Architectural Design, Construction and Remodeling of Self-Sufficient Residences and High Security Retreats

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The Secure Home

Third Edition

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Preface to the Third Edition

This new edition represents the first major update I have done since the 2nd edition of 1982. With this edition, the original *Survival Home Manual* has a new title: *The Secure Home*. The title was changed due to the increasing hostility of the mainstream media to the word "survival" and its continuing insistence that a "survivalist" mentality equates to some form of right-wing terrorism. It has somehow become the popular pastime of those in power to denigrate and vilify any person who distrusts the ability of those in power to manage and control the world in our behalf. I frankly admit to being one of those who distrusts government. Not only do I believe the "powers that be" lack the wisdom, the constitutional authority, and the moral character to guide others' lives against their will; I believe there is ample evidence to demonstrate that the top leaders are joined in a conspiracy of power, intent upon destroying the vestiges of liberty that remain from our once constitutional republic. They clearly desire to implant a world government upon all nations, stripping us of effective national sovereignty in the process.

Of course, they will never stoop so far as to admit that our sovereignty will be removed. But in fact, nations will exist in the future only as "nation states" of a larger global combine, not as sovereign nations with the inherent power to withdraw from participation in this global power structure, in which no true individual liberties will exist. If you are skeptical and feel no sense of danger in your soul, then probably nothing I present will convince you otherwise. But if you are interested in seeing the evidence, read my book *Strategic Relocation*. In any case, this book is not the forum for a detailed exposition of this ultimate threat. For whatever reason you have chosen to survive (and in the end, we will all be proud to say we are "survivors"), I hope this updated work will be helpful to you.

This book differs from the other preparedness books on the market in several ways. First and foremost it is the only book that, to my knowledge, covers this subject within the context of the *conventional home*. I cover all aspects of making a conventional-looking home into a fully secured and self-sufficient residence. It has always been my belief that most people would rather survive hard times within their existing home than camp out in some make-shift habitat. Most other books on shelters, for example, deal with rudimentary structures or separate, buried shelters out in the backyard. While these have their place for people who haven't fully prepared beforehand, it has been my experience

after working in the field of security design for almost 30 years, that if you integrate a shelter and most security features into a conventional-looking home, you make those expenditures much more useful and convenient.

There are several advantages to this strategy:

- Access to your high security facilities is convenient and private. You avoid the danger of trying to get into a separate shelter by first crossing open terrain or trying to open a secret hatch in the ground.
- You can stockpile in the privacy of your own home, so that it remains private.
- Your facilities are easier to conceal when integral to your home.
- You can access all normal household facilities and stockpiles within the same structural system.
- A lower overall profile is maintained, both in construction and operation.

Second, I have the advantage of having designed hundreds of secure homes and having consulted in the design process of hundreds of other homes around North America, and thus have a feeling for what is practical and what is not. My specialty has become the ability to adapt off-the-shelf equipment to a better purpose, rather than make my clients purchase the super expensive, military-rated piece of equipment which may well exhaust the entire budget. Shelter filters are one such example. To buy the Swiss unit which meets all military specs, you'll pay over $6,000. To get a US medical version that performs 95% as well costs about $200. The purist would object to the slightly less effective version, but for most people, this compromise will make the difference between having a filter and having none at all. In reality even the best production filters cannot guarantee 100% protection against all potential biological, viral, and chemical threats. So there are tradeoffs in every decision.

During the intervening years since publishing the 2nd Edition of this book, I have been busy helping people relocate to safer areas, and designing high security and self-sufficient housing for them. As I write this during 1999 while the world prepares for the potential problems of Y2K, I am swamped with work. Part of my previous reluctance to update this book was the apparent futility of it all. The self-sufficiency market has always been a fragile one due to people's inability to see through the illusions of life and prepare for the inevitable economic and lifestyle ups and downs. People are naturally short-sighted. When a crisis arises, there is a temporary boom in survival products. When the crisis goes away, the suppliers dwindle from lack of customers and eventually go out of business. It has always been a terrible roller coaster for those who have stuck with preparedness out of a long-term ideological commitment. This fluctuating market is difficult to track, which makes keeping the technical and equipment recommendations updated in this book nearly impossible. Any up-to-date designer in this field would have to hire a full-time employee working just to keep track of available suppliers and new innovations.

But all that has changed in the past few years due to the advent of the Internet. Not only is it much easier to research what is still on the market and what is new, it is easier for you to check out my recommendations and get literature. In the Recommended

Equipment and Sources section, I give the URL (Internet address) of most products that are on the Web. With a click of your computer mouse, you can download literature and information. One of the biggest problems in writing a book on technical innovations with commentary on products and services is the problem of things becoming out-of-date. So with this new edition, I am taking advantage of the Internet resources to keep this latest edition up-to-date.

Here is how it will work. Instead of mentioning brand name suppliers within the text of this manual, I will (with a few exceptions) refer you instead to the Recommended Equipment and Sources section for specific recommendations. Thus, when I publish a new edition, I will often only have to change the Recommended Equipment and Sources section. In going through the old 2nd edition, I often found that most of the principles and ideas I developed in 1982 were still valid; only the technology and sources had become out-of-date. But how will that help you when your existing copy of *The Secure Home* is out-of-date?

To assist my current book buyers, I am providing the entire Recommended Equipment and Sources section as an **Online Update** on my Internet website. Any time you want to have the latest findings from my equipment and resource recommendation, log on to my website, download the latest version to your printer, and put the printout in the back of your book. My website URL is **http://www.joelskousen.com**. If that address ever changes, you can still find me somewhere on the net by doing an Internet search for my name using one of the many search engines.

Also, I want to encourage all my readers to send me feedback. I try to be accessible and appreciate any corrections you may suggest for this work. Due to the volume of work that I do, it is most convenient for me if you communicate with me via *Email*. My Email address is **joels@joelskousen.com**.

The ultimate motivation to do this update has been that I have more people asking for my design help than I can possibly handle as a one-man design shop. I gave up having employees years ago due to the high cost and hassle of dealing with government-mandated programs and employee regulations. My main purpose in publishing this latest edition is to help people help themselves. I have included as many drawings and details as I can to help you design and build things yourself. If you do use another professional to help you, you can loan him this book for guidance.

Obviously, I can't include enough details to cover every custom situation you may encounter. But at least you should have enough so that I can fill in the gaps on a brief consultation basis at my hourly rate. Someday in the future, when things change, I may be able to return to design work, but somehow I don't think my work load on my newsleter (the World Affairs Brief) will allow that. The world isn't getting any better. It may be progressing technologically, but its moral foundations will not long support increased progress. I don't look forward to hard times any more than you do, but I sense they are coming. Let's get prepared so that we can live to do our part in building a better and freer world when and if the opportunity comes.

Introduction: Philosophy of Self-Sufficiency

This introduction and the following three chapters will deal with the human factors involved in preparedness: important lifestyle changes and preparations that I consider every bit as essential as the physical preparations. If you are only interested in the design and implementation aspects of security and self-sufficiency, go directly to sections II, III, and IV. If you have the time and interest, perhaps you will feel impressed to return to this first section at a later time.

I assume, by your purchase of this manual, that you have at least recognized a basic need for increased security and self-sufficiency. The more important questions, however, are:

- What threats are we preparing against?
- How self-sufficient can I realistically become?
- Is it enough to prepare to survive?

THREATS

Specific threat analysis is covered extensively in my book *Strategic Relocation.* That book provides a starting point for your analysis of your personal location and situation. What I will address briefly here is a synopsis of the basic threats so that you will have an idea of the breadth of the preparedness task.

- Natural Disasters: location-specific disasters such as storms (tornadoes, and hurricanes), earthquakes, floods, earth changes, etc.
- Health Threats: air pollution, water quality, disease, bad nutrition, establishment medical control and/or suppression of natural health solutions.
- Economic Collapse: depression, speculation, market manipulation, wage/price controls, shortages, excessive regulation, unnatural growth, subsequent collapse.
- Crime/Social Unrest: riot, criminal activity, racial/class conflict.
- War: nuclear, biological, chemical warfare, terrorism, invasion.

- Government Tyranny: conspiracy for power and control, destruction of constitutional protections of life, liberty, and property.

THE PROBLEM OF HIGH POPULATION DENSITIES

All of these threats have direct consequences, and they all have one indirect consequence: social unrest and panic in large cities due to excess population densities in large cities. This long-term problem of ever-increasing population *densities* of the world – not increasing population, per se, but the conglomeration of problem people into mega-metropolitan areas – is what threatens a society's ability to survive. These millions of people cannot hope to support themselves without a constant flow of water, food, energy, commerce, and police protection. Many of these critical services will evaporate or become ineffective in any major crisis. The only alternative to organized society – everyone fending for himself by growing a meager portion of his own food, or providing even minimal water supplies for basic needs – becomes a near impossibility in large cities with little or no arable land and no internal water supplies suitable for drinking. A large metro operating near the limits of its infrastructure is a recipe for disaster during even minor disruptions.

High metropolitan densities are a problem even if the people are moral and hard working. But in today's culture they are even more dangerous because of the potential for conflict among corrupt and problematic people. We face a downward spiral of moral values, rampant permissiveness in parenting, and the contagion of bad attitudes spawned through excessive youth interaction in a public school system that has all but outlawed discipline and hard work. Adding to this downward trend is a systematic corruption of human incentives through increasing government regulation, controls, and welfare.

The increased dependency in our job markets upon a highly specialized and sophisticated set of products and services is both a necessity for increased efficiency and a threat to one's ability to revert to self-sufficiency. These highly complex interrelationships simply cannot function fully or effectively in a crisis when a certain percentage of key products or labor elements are removed from the marketplace, either through shortages or through preoccupation with surviving the physical crisis at hand.

The Year 2000 computer bug was a good test of society's ability to fix a major problem that threatens the highly computerized interaction of goods and services. But even after the Y2K qualified success, our society is still very vulnerable to many other potential strategic threats that loom ahead – any one of which could fracture the complex infrastructure that binds high density population centers together. In summary, it is this ever-increasing fragility and complexity of high density habitation that presents the most pervasive threat to your ability to react and survive a future crisis.

THE CORRUPTION OF PEOPLE FACTOR

The most deceptive factor in our society's false sense of well-being is the people factor. On the surface most people appear fairly nice. What we don't notice is that people are

getting softer in their social, emotional, and moral habit patterns, making them poor candidates for surviving hard times. Often people fail to see that materialism, false security, and the corruption of the welfare society has destroyed a lot of moral character among the majority of people. The personal self-control which is necessary to react peacefully and productively in a major crisis will disappear quickly in those who are used to pampering themselves. Even those who now, in relative times of plenty, would denounce violent action will become rather panic-stricken in the face of starvation and mob action. Our society clearly does not have the slightest idea of how much character has been lost in the past 20 years of permissiveness and false social philosophies. Only time and trouble will tell.

When specialization ties expand too far beyond the local community, a basic fear of crisis arises in the wake of increased dependency upon people and upon fragile supply lines that cannot be effectively controlled. The overall trade-off is that increased wealth and comfort during peaceful periods is always at the expense of sovereignty, independence, and self-reliance in a crisis – unless specific, conscious efforts are taken to practice skills that retain at least some independence from others. A dependency syndrome may even develop in the presence of a small crisis if government always steps in to absorb the burden. Eventually, a populace willingly trades any amount of independence to have the government restore them to their former comforts. For this reason, government tyranny is an ever-present threat in any crisis.

HOW MUCH SELF-SUFFICIENCY?

The following list summarizes what I consider to be the essentials of self-sufficiency and basic security that all my readers ought to be actively pursuing. Obviously, few achieve 100% of these factors, but hopefully this manual will help you in prioritizing and selecting those factors which you can implement.

Self-Sufficiency Options:

- Water: Internal home storage tanks plus some independent water supply (well or spring, or even a filtered rain water cistern).
- Food: Storage and ability to grow your own essential foods.
- Alternate electrical power: A modestly sized back-up generator, solar modules charging a battery bank tied to a 110 volt inverter, 110 volt and DC lighting (12/24 volts).
- Fuel: Wood, propane, diesel fuel, gasoline, kerosene, and electricity in battery banks.
- Alternate Forms of Heat: Solar, wood, propane, or oil.
- Multi-source water heating: Solar/wood, LP, or natural gas.
- Multi-fuel cooking capacity: Electric, LP or natural gas, kerosene, or wood.
- Multiple communication options: Telephone (conventional and cellular), radio.

- Ample storage facilities: Water cisterns, internal tanks, and/or pressure tank with a well.
- Equipment, tools, spare parts, and supplies.
- Energy-efficient construction and appliances (to reduce energy outlays).

Security Options:

- Low profile setting and design.
- Fire Resistance and Fire Fighting: Internal fire hose system, all levels.
- Security Lighting: Interior/exterior.
- Intrusion detection/monitoring.
- Communication (security).
- Multi-purpose high security shelter.
- Above-normal Fortified Construction: Walls, windows, doors, roofs.

In the ultimate sense, *self-sufficiency* implies completeness in an environment of total isolation from assistance. Philosophically and realistically, this is neither possible nor desirable for any length of time. Thus, all references to self-sufficiency in this work will involve various degrees of partial self-sufficiency. Apart from the ultimate implications, it is useful to set up a specific type of self-sufficiency wherein the terms "total" and "partial" can both be applied. While acknowledging the historical benefits of increased specialization of the economy, I feel this is only beneficial as long as all the necessary skills for sustaining life are *maintained by each individual*.

However, this ideal (that everyone maintain some broad-based diversity in their skills) is very difficult for people to do in practice. As year after year passes without any apparent need to revert to savings, storage, or alternate skills, few people have the foresight to continue to prepare for trouble. It is no wonder that the savings rate, level of food and water reserves, and broadening of job skills of each individual continues to plummet worldwide. The illusions of continual prosperity have anaesthetized people's sense of caution and concern. Even the occasional natural disasters don't seem to have much effect on changing people's habit patterns. People continue to rebuild on the same old earthquake faults, in flood plains, at the base of volcanoes, and on hurricane-battered coastlines. They stockpile batteries and candles for a while and then lapse back into their old habits. It is as if human beings (in the absence of effective and enlightened leaders) cannot seem to keep a sense of vigilance over any length of time. I'm certainly not suggesting that government mandate personal preparedness. People should be free to cast a blind eye to the future – a kind of foolhardy risk-taking. They should not be continually bailed out by government disaster aid every time the predicted disasters return. Consequences for willful blindness or wishful, rosy thinking need to be harsh to be remembered.

BALANCING THE ART OF LIVING IN THE WORLD WHILE PREPARING FOR DISASTER

I do not advocate that people become hermit-like in their attempt to be independent – only that they practice the arts and acquire the skills, equipment, and facilities to revert to a generalist society when needed. As to our specific alternatives, I am somewhat pragmatic in view, rather than idealistic. I believe a highly paid professional man or technician ought to maximize his high-priced time in his professional area, so as to have the financial ability to purchase the expensive self-sufficient facilities and equipment necessary to deal with a crisis. However, his free time should be spent in maximizing his self-sufficiency skills and preparing his family. So, when temporary reversion to home production is required, he can perform various tasks with the greatest leverage over the crisis.

The idealistic alternative of retreating immediately to a totally rural area, where one is cut off from his ability to maintain a viable financial lifeline, is for the most part, a short-sighted strategy (at least for now). Most back-to-the-land people will take more years than we peacefully have to acquire the expensive equipment and facilities to survive in all but the most rudimentary conditions. I admit there are those who desire nothing else, and I do not disparage them in the least. These families who have a strong ideological commitment to a lifestyle somewhat isolated from the evils of our present society may be the only ones capable of enduring what others would consider severe sacrifices. But the majority of people now looking toward self-sufficiency preparation desire a higher technological and commodious lifestyle, almost identical to the present. Most of my readers cannot and perhaps should not leave their positions in society. However, each family should make significant changes to their existing way of life, and provide contingency plans for retreat and survival in a future crises.

Maintaining some degree of proficiency in basic skills (gardening, home repairs, auto mechanics, etc.) does somewhat inhibit total dedication to a specialized profession, but this is more than compensated for when such skills are needed later on. Normally, life has enough ups and downs to frequently remind us that we must maintain our flexibility and not put all our "eggs in one basket." However, the increasing intervention of government to shield people from the natural consequences of bad decisions, coupled with the proliferation of insurance, has given most people a decidedly false sense of security. This illusion of being able to buy our way out of trouble is not true security in light of the potential for a crisis which would destroy the economy (along with our income) and take away our home's ability to shelter us. This book is all about preparing a home to fulfill its role both in hard times and in good times. But **each person must learn the skills** necessary to provide the operational and maintenance functions of preparedness facilities, since we will not likely have any other recourse.

In this book, I propose a somewhat limited degree of self-sufficiency: limited on the lower end, so you will not be ill-prepared, and limited on the top end so your preparedness home will not be so dependent upon sophisticated technology as to be "out of business" when a single computer part fails. (The Y2K problem has clearly demonstrated the short-sightedness of eliminating all manual back-up systems and

relying solely on computers.) Expensive, automated systems are not necessarily the ultimate answer to self-sufficiency unless the owner is completely competent in maintenance, adjustment, and repair. Then too, there is always the problem of parts availability. That's one of the reasons why I have not been a great advocate of "home automation" systems. These systems are so sophisticated that home owners become hostages to a delicate system of maintenance and repair beyond their capabilities.

I hope it is obvious that wealth alone cannot provide the optimum solution. The necessary lifestyle adjustments usually involve some re-education of the professional man and his family toward the manual trades, home gardening, and home production skills. I have designed full self-sufficiency systems for clients who can afford them, but who have never taken sufficient time to learn to operate and maintain such systems. Those who can troubleshoot these systems may not be available when trouble comes. Even if repairmen are available, the necessary repair parts may not be. I admit, it is like "pulling teeth" for some highly paid professionals to stop spending so much of their time making money and revert to learning basic skills. But it must be done. There is no other alternative when it is just you and your family against the elements.

DEVELOPING A SOUND STRATEGY FOR ACTION

The ultimate success of the survival plan depends as much upon correct foresight of the future threat and correct strategies for handling each part of the crisis as it does upon a general knowledge of self-sufficient facilities, equipment, and skills. There are many excellent and skilled workers, but few can see what is coming. Thus, they are not prepared with the parts and supplies they need to exercise their skill. We must be as firmly rooted in political, financial, and social foresight as in mechanical skills, so as to correctly foresee what type of systems and equipment will be necessary to cover future shortages or threats. Even in self-defense preparations, too many have only concentrated on buying "firepower" and have not done enough to develop the mental preparations in tactics and proper reaction to a threat when it comes.

For proper survival design, we must avoid being reactionary to whatever current shortages there are, at the expense of accurately forecasting future conditions. Social awareness of the moral climate is also essential so as to properly assess the potential breakdown of the social order in the future. Thus, true survival preparation could be defined as: **Combining (in the proper proportions) the facilities, people, materials, supplies, equipment, knowledge, character, and skills sufficient to match a correct analysis of the shortages and crises we will face in the future**. I hope this rather esoteric definition helps to impress upon you the magnitude of the task, if you have set a goal to become "totally" self-sufficient for every possible circumstance. But of more practical help, we can derive from this definition the following general survival principles:

1. Diversification of supply and energy sources

These may include raw energy in the form of electricity and fuel, as well as financial supplies that are the intermediate trade sources for future end products. We should seek

multiple sources of supply for our essential energy fuels and other end needs. Never forget that money, even in the form of hard currency, is still only an intermediate trade item. It is not enough to have a diversified source of money if you do not convert that money into real worth commodities (equipment, facilities, and supplies) which satisfy your end needs and *eliminate* (partially) your future need for money.

2. Access to good intelligence sources

Knowledge is essential to your survival, whether financial or physical. Books set down the firm principles and fixed forms of present technology. But you must receive timely and accurate intelligence reports, updates, and analyses on the rapidly changing times and threats that are present. The INTERNET is now the best and most current source of information. If you are not now computer literate, you must become so. With today's user-friendly computers, this is within everyone's capability and can be done for less than $1500. Trustworthy, specialty news sources on the Internet and in private newsletters are another key to avoiding the filtered and distorted news from the controlled public media. See www.worldaffairsbrief.com for daily news stories and my weekly analysis of those stories. Other recommendations are in the Recommended Equipment and Sources section.

3. Proper preparedness priorities

One of the prime errors of hard-core survivalists is they get excited about one or two aspects of preparedness (such as solar energy or food storage) to the exclusion of other important areas. While food and water are definite firsts on every human's list, there are other important considerations that are sometimes unique to your location and circumstances. For example, a person who must live in a high risk area may well have a more critical need for self-defense measures or a quick getaway vehicle than for long-term storage of food or water. He or she may even have to provide for long-term stockpiles at some way station or retreat. These will be covered in detail as we go along.

4. Building a close-knit support group

Whether formally or informally organized, your ability to fall back on people you can intrinsically trust in a crisis will be indispensable. The hermit approach is not desirable, nor feasible, except for a very few. On the other hand, there are some real cautions to be considered concerning excessive entanglement in survivalist or even religious groups. I never recommend communal organizations. One has to be very careful to avoid being targeted for infiltration by government agents looking for ways to foment illegal actions in order to prosecute anti-government groups (who have legitimate fears of government usurpation of liberty). Most conventional groups lack the proper idealistic commitment to principles to hold together in a crisis. Remember too, that survival-oriented people are individualists, no matter how much they talk about "joining" and "working together." Make sure your arrangements allow for maximum personal independence in both living and work regimes.

Cooperative groups should be interested in seeking a diversity of specialization among their members, in addition to encouraging everyone to be fairly well-rounded.

Networking with others who have expertise in alternative medicine, dentistry, electronics, communications, metal working, construction, engineering, and farming will be of great benefit. But make sure everything is done on a fair and honest free market basis. Voluntary charity is fine, but people always need to be prepared to trade value for value.

I do not recommend that groups go around searching for a person to represent every specific trade or profession. You may get a doctor all right, but he may be so arrogant and intolerable that he will factionalize your entire group. Above all, look first toward finding really good people with personalities you can live with. Invite people to join with you who have the ability to learn new things – these will be more valuable in the long-term than a small group of highly specialized but prima-donna types. Even when you have strong religious feelings, be careful about only searching out those with a narrow range of theology. Usually there are various levels of discrepancy between what people profess and how they live. Learn to look more at how they live and what kind of character they possess, than at what they openly profess. Listen to your conscience when making these judgments. The conscience that God gives every man and woman in the world gives us little warning signals when something is going to be a future problem. Don't let positive thinking talk you out of those warning signals. Your ultimate survival depends upon being sensitive to these divine promptings.

I recommend that you seek out and become associated with one of the less compromising of the national movements that fight against the growing threat of government tyranny in our nation. The most effective groups don't have regular meetings, but they do provide good, early warning information and the makings of a network of reliable people to fall back on in a crisis wherever you may be in the nation. See the Recommended Equipment and Sources section.

5. Cost-effective use of present time and prosperity

While products and equipment are still readily available in a specialized economy, maximize income earning time now, so as to increase your ability to purchase essential supplies and equipment. Work the greatest leverage of monetary gain over time while the economy is still good. Preparedness projects, that offer marginal or no gain over the purchase alternative, should be done for experience sake only with minimal time investment, unless family training is involved (such as in growing a garden). Gardens simply don't pay in terms of economics, but you can't afford to be an amateur the first planting after a famine begins. There are some things you must practice before trouble arrives. One final caution: Be careful not to construe this advice as an excuse to work right up to the last moment before a crisis hits. In some future time, in order to survive, you will want to avoid living so close to the edge that you are forced to try and get "the last train out of town."

6. Flexibility

Don't put all your eggs in one basket or location. Develop your options to the maximum. If you can afford to have a second home or buy a small place in the country, do so. If you cannot, do your best to prepare your existing home and then establish some formal

contingency arrangements with friends or relatives who may have a safer place in the country. If your finances are somewhere in between these two options, consider simply buying a rural piece of land. Establish a water source, put in a septic system, build a small underground storage chamber. Then you have a place to go in a crisis, even if it is only a prepared campsite. Some who have travel trailers or RVs can drive out to their rural land and hook up to their existing arrangements and voila! – a modest retreat. Make sure you allow for flexibility in your present schedule so as to avoid getting caught in irreversible commitments that don't allow you time to learn and practice the essential preparedness skills. During good times, when you are working hard to maximize your income, learn to enjoy preparedness chores as a portion of your relaxation.

7. Development of good judgment and wisdom

Develop a critical mind by looking deep into the motives and intents of people. Learn to judge properly, fairly, and incisively – even if you don't like what you find out. Learn to live with knowledge that isn't pleasant. People who can't stand to think and see anything but positive thoughts and outlooks are not only foolish, but also fail to understand that false positive attitudes are really harmful and negative in their ultimate results. Be realistic and you will always possess much more stability in any given situation. Avoid excessive or unrealistic negativism as well. Sometimes all of us must defer in judgment to those whom we trust and who may have access to more knowledge in a certain area. In the final analysis, learn to develop reliable interaction with your conscience so that you become sensitive to those "nervous feelings" which are always present to signal when something is not quite right. This is a prerequisite to developing a close relationship with Deity, the ultimate source of knowledge needed to navigate through life's uncertain paths. He may not give you a clear dictation, but when you do your part to think things through, He is more than willing to give you warning feelings when you are off base and calm feelings when headed in the right direction (assuming you haven't skewed your spiritual sensitivity by chronic bad judgment and rationalizations).

IS IT ENOUGH JUST TO SURVIVE?

One of the implicit assumptions of the survival movement is that the ultimate threat is physical destruction or social unrest stemming from the fragility of life in a high density metropolis; that ultimate safety can be found in full self-sufficiency in a rural environment, far removed from the threat. Notice that this assumption is only possible because we still have a lot of wide open spaces in North America. Europe or Japan does not have this luxury. The more densely populated the country, the more people realize the difficulty of avoiding conflict with others in a crisis.

The following paragraph was written in 1982, and is from the 2nd Edition of this book. The examples are now somewhat out-of-date, but the principles are not – nor the pain we should feel at what has happened to liberty in the world.

> In my opinion, the ultimate threat is not from physical destruction or even the social unrest that may accompany it. The main threat is the all-encompassing, future control system that is being planned and implemented by conspiring elements in world affairs. This is the threat of

> the Gulag. The Gulag is the vast system of concentration camps in Russia and China which are filled with people who resisted such control. They are thrust in with the most rabid criminals and treated with far more contempt. You see, criminals are not a direct threat to tyranny, but freedom fighters are. The "powers that be" hunt down dissidents with a passion. Here in America, as in other countries where Socialism is growing more powerful, the courts and legislatures (being part of the establishment "system") view with increasing hostility those who come before them pleading for freedom from onerous laws and demanding real justice. They systematically deny justice to libertarian court challenges on licensing and victimless crime issues, and then refuse to write a legal opinion justifying their decisions (to avoid the obvious lack of constitutional support of their position). Some cases they simply refuse to hear, on appeal, and with others they simply affirm the government's case "without comment." Such legal maneuvers that avoid confrontation with truth are a sign of lack of personal integrity within much of our legal structure – if not conspiracy and collusion to tear down liberty itself. Every year more liberal and leftist federal judges rise within the politically appointed system – and they are there for life. Many of them are part of a larger conspiracy to undermine true constitutional law. Most of these judges are appointed because they have the required leftist agenda necessary to further the cause of undermining individual and family liberty.
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> There are women today who are in jail for refusing to send their children to public schools, and fundamentalist Christian ministers who are arrested for refusing to hire State-certified teachers in their church schools. What kind of society do we live in which holds such allegiance to the god of public-credentialed education where it is deemed better for a child to be taken from a sincere mother than to be educated at home? Of course, the legal "Pharisees" of today will never admit that *that* is the reason (the ultimate right of a parent to determine the child's education) these women are in jail. They are in jail for being in "contempt of court" or defying an arresting officer, who was "only doing his job" enforcing an evil law. How convenient to separate the reason for resistance from the actual act so they can be prosecuted under the sacrosanct principle of "obedience to law." Never mind that the law is amoral, unjust, and unconstitutional. Yes, I am deeply pained inside, and you should be too. You need to read Solzhenitsyn's *Gulag Archipelago*. You need to suffer in spirit with the freedom fighters who are languishing by the millions in the filth and grime of the Soviet concentration camps. Despite public utterances to the contrary, these gulags still exist. Our sterile and controlled media effectively shields most Americans from that which may awake feelings of serious indignation. Worse yet, you need to feel a sense of disgrace at a United States President and government who haven't got the integrity to rescue American hostages in a timely manner without negotiating away the rights of free contract for those Americans who still have legal claims on Iran. We should feel disgust at a subsequent President who could only bring himself and the nation to light candles for the oppression in Poland while bailing out the Soviet-controlled regime with monetary loans. There isn't a single group of true freedom fighters in the world receiving any American support, while almost all leftist nations receive millions in foreign aid. In my vocabulary, this isn't simple stupidity, it is treason.

I feel the same futility you must when we seem so powerless to change the affairs of a corrupt and controlled government. The world is full of slick talk and excuses of why we must "act with restraint" in the defense of liberty. But it all boils down to moral weakness and lack of character. The West has lost its courage. So in answer to my question, is it enough to "*just survive?*" I would say to America an emphatic NO!

In the first place, I think few people will escape the sophisticated, bureaucratic tracking mechanisms of the future (electronic money, national ID, smart cards, and government surveillance of all communications). If you have any principles to stand on, I guarantee you will run afoul of the new breed of amoral and unconstitutional regulations and laws – and you will have no effective recourse to an impartial court, because the courts are already fully controlled by judges allied with the dark side of government – at least at all

the higher levels, where it counts. If you doubt my word, take the time to read some of the resources I have cited in the bibliography.

This, then, is the lesson you should have learned from my analysis of our present situation. Once the majority becomes benefit-corrupted in a nation where the courts have removed any constitutional barriers to theft by taxation and regulation, we cannot redeem our country politically. Those who are in the majority control democracy and its representatives, and democracy becomes an evil when the majority supports evil (in the absence of constitutional restrictions on majority rule).

Of greatest importance, whether or not we win this battle in the absolute sense, is that we learn to distinguish what constitutes good civil law from evil civil law and that we develop the fortitude and courage to then fight for the principles of right. There will surely come a time when we must fight again for liberty. There exists no historical precedent for a corrupt majority, in combination with corrupt government, to voluntarily repent and give up the reins of power (notwithstanding the illusion of the fall of communism in the Soviet Empire). We need to develop in our children a spiritual will to fight for what is right, rather than just "get along" in the world. We need to resist the "all is well" philosophy of the world which keeps normal people in a state of contented apathy. Those who are aware must resist the temptation to convince others of the futility of resisting government encroachments upon liberty. True, some things are futile, but we must know where we can still be effective.

Yes, be prepared to survive, but not with the hermit motive. Prepare to survive so you can fight again in the aftermath of coming judgments. Everything in the world is always in a state of flux. Even though the waves of tyranny sweep over the world from time to time, we must always remember that there will always be counter-cyclical moments when liberty can arise anew. When we get another chance to re-establish liberty, let us be prepared to tighten up the language of the Constitution and prepare against the inevitable corruption of men and majorities seeking to get more out of government power than is proper.

Section

I

Philosophy of Security and Self-Sufficiency

3rd Edition

Chapter

1

Lifestyle Changes Under Self-Sufficiency

While it is only natural to attempt to avail oneself of as many labor-saving conveniences as possible, the exigencies of a survival situation will demand a more Spartan lifestyle. The transition to survival living can be made somewhat smoother by making some lifestyle changes now. First, by occasionally making temporary changes in lifestyle to simulate certain survival conditions. Second, by making some permanent changes in personal habits and lifestyle that will ease the transition to hard times.

Recommended Temporary Lifestyle Modifications

1. I recommend that once a year each family live off their supplies for one week to test their completeness and palatability. Ideally, this test should be a surprise to all except the parents (in order to minimize the temptation to "stock up" just prior to the test.) If you are part of an organization that shares common preparedness goals, it is fun to do this at the same time as others, and to compare results, or even practice bartering for various items.

2. Go camping regularly and allow all family members to practice cooking without electricity. This should include one winter camp out to test the effectiveness of your clothing and shelters. Some family members may object on the grounds that they don't like the outdoors, but having to fend for oneself in the outdoors may not be an option someday. It would be well for all family members to learn to enjoy the outdoors now, while time and weather are at your choosing. It is amazing what an increased appreciation children have for running water from the tap after spending a few days hauling water from a stream or campground faucet – not to mention going without toilet and bathing facilities, if in a primitive camp. I would caution survival enthused fathers not to thrust their families into such uncomfortable camping circumstances that they lose their desire to practice. Even primitive survival techniques (living off the land) can and should be practiced first under optimum conditions, including goo food provisions. Only when the difficult skills of snaring, trapping, and scrounging are developed should one attempt an actual survival trek.

3. Plan vacations to include a wide variety of geography (not necessarily in the same vacation). Family members should get a feeling for the various types of terrain and climate in this country. The type of equipment and effort necessary to cope with them varies greatly.

Recommended Permanent Lifestyle Modifications

I suggest that each person implement certain lifestyle changes now, so as to lessen the shock of transition to the harsh realities of a long-term crisis. No one can totally prepare for such an eventuality since we cannot create a real crisis just for practice.

The changes I will outline involve learning new skills, improving eating habits, increasing physical fitness, and developing family leadership. I hope that you will not pass lightly over this section. I realize that it will be uncomfortable for many to consider changing less-than-efficient habits that have been nurtured for half a life-time. But these suggestions are far more important in a real crisis than any of the material preparations I recommend.

I consider your receptivity to these principles as the *primary* indication of your success or failure in a long-term survival environment. First, it represents your willingness to adapt to more stringent requirements in life *before* such changes are forced upon you. Second, it is an indication of your willingness to accept change based solely upon enlightenment and conviction rather than waiting (like everyone else) until force of circumstance demands the change – perhaps too late. This second aspect is actually the single most distinguishing characteristic between those who have the foresight to prepare and those who refuse to prepare until forced into the actual survival climate.

Consider the following suggestions for permanent implementation into one's daily habit patterns:

1. Raise a garden each year. Whether you have a large backyard, fifty acres of farmland, or just some planter boxes, families should begin to develop some gardening skills.
2. Begin conditioning your physical body for the stress and changes in diet and physical activity that accompany a crisis. This requires changing your eating habits to include unprocessed foods instead of ready-made and junk foods, exercising regularly and vigorously, controlling weight, and learning to use natural and alternative remedies to cure disease.
3. Develop a system of family leadership that will provide the foundation necessary for each family member to develop the necessary characteristics for surviving a crisis. This includes child discipline, education, resolving conflict between family members, etc.
4. Begin a comprehensive study plan of the various skills and equipment that you will need to become self-sufficient. While knowledge is cheap, its acquisition is very time consuming. Time will certainly be lacking when you most need the knowledge. Books and references may be unobtainable as well. I would emphasize the following areas:

Technical Skills

- Appliance and electronics repair
- Electrical house wiring

- Auto mechanics
- Metal working
- Home construction (framing, plumbing, masonry)

Outdoor Skills

- Camping
- Hunting, fishing, trapping
- Arms, munitions
- Mountaineering
- Primitive survival skills
- Canoeing, rowing, sailing
- Skiing, snowshoeing

Homemaking Skills

- Gardening, farming
- Canning, dehydrating, freezing, preserving
- Sewing
- Weaving, crocheting, knitting
- Leather tanning
- Cooking (buttermaking, cheeses, yogurts, breads, etc.)
- Candlemaking

Medical Skills

- First Aid
- Nutrition (diet and vitamin supplements)
- Holistic healing (herbs, homeopathy, cleanses, and other therapies)
- Natural childbirth

A list of my favorite books and reference material for developing these skills is included in the Recommended Equipment and Sources section. The remainder of this chapter goes into detail about physical health and family leadership. In the area of health, I have yet to find one good book that comprehensively covers the field without some major errors, so you will have to do some sifting with all the books I list. In this chapter, I combine the most important facts that I have gleaned from my own reading and experience. The information about family leadership is my own and is not available anywhere else.

CONDITIONING THE PHYSICAL BODY

Since we cannot believe everything we read in the health field (due to the marketing hype for selling products) it is important to be sensitive to our feelings. I believe that we can develop the sensitivity to conscience that would allow us to receive small warnings about improper or unsafe practices.

Changing and Improving Eating Habits

There are several survival goals we are trying to accomplish by improving eating habits:

- Increased health
- Increased resistance to disease
- Controlled weight
- Sharpened senses to internal body indicators of health

If you are an average American, these general recommendations will involve some distinct changes. The purpose of this discussion is two fold. First, to assist the average consumer in transitioning to a more basic diet so as to lessen any food aversion problems during a crisis. Second, to improve a person's health and resistance to disease by eliminating most of the “junk food” now consumed. Besides the inconvenience and expense of waiting in doctors' offices and hospitals to get treatments for occasional ill health, poor preventative habits usually lead to various chronic disabilities in the middle years of life where one's personal effectiveness and leadership potential are highest. This is not intended to be a comprehensive guide to natural health and nutrition – only a general guideline. The following are a few recommended eating habits based upon good general health principles and do not involve any special diets.

Eat a Balanced Diet from Unprocessed and Raw Foods

Specific recommendations here are a lot different than what school nutritionists teach. Forget about the famous food groups. The real balance that is important in any meal is to achieve the proper percentages of carbohydrates, proteins, and fats. This doesn’t need to be exactly precise, but should be around 40% carbohydrates, 30% proteins, and 20% fats. If you vary, you can go to 40% protein and 10% fat, but you should try not to go over 50% carbohydrates any time you sit down to eat. Most people eat far too many simple carbohydrates (starches and sugars). These create certain chemical reactions with the body that are damaging to long-term health. Proteins create a whole different set of chemical triggers that tend to balance and keep the carbohydrates under control, thus the need for balance. The science behind this balance is found in the book *The Zone* by Barry Sears. I don’t agree with all of his conclusions (I think there is more leeway in the percentages than he claims), but the basic science is sound.

By unprocessed foods, I mean two things. First, that you cook most of your foods from initial raw ingredients rather than refined, packaged products. Grind your own flour, cook your own rice, cook up fresh vegetables. Second, eat at least a fourth of your meal as raw food. When you use canned vegetables, always serve something raw with them –

whether it be a tossed salad, fresh fruit, or celery and carrot sticks. Cooking destroys all the digestive enzymes that are built into foods. If your diet consists solely of cooked foods, you will be overworking your digestive organs, specifically the pancreas as it tries to make up the difference. One of the reasons why eating a fresh apple in the morning has always been so healthful is that it puts some fresh vitamins and enzymes in your stomach before breakfast. Try it and see if you don't feel better over time.

Dairy Products

Be aware that foods processed by high temperature often undergo fundamental changes in protein structure that alter their ability to be digested. Pasteurized and homogenized milk is a prime example. The extremely high temperatures at which milk is heated to kill bacteria changes the protein structure and destroys all enzymes that help with digestion. Humans do not have significant quantities of lactase, the necessary enzyme to digest milk. In its pasteurized form, milk is fairly indigestible. It is the leading cause, after antibiotics, for intestinal and colon problems. Powdered milk is even worse since it is made by spraying milk against the superheated walls of a room, instantly drying it. Instant powdered milk does this twice – don't consume these products. Most humans have allergenic reactions to milk caused by pasteurization and homogenization. Homogenization makes the fat globules small enough to sometimes pass directly into the blood stream, causing an allergic reaction. The most noticeable reaction is the immediate buildup of mucous down the back of the throat. This same excretion of mucous occurs in the lining of the digestive tract as well. This mucous builds up over time, coating the intestines and colon, making digestion very difficult. Unfortunately, unpasteurized milk is now almost universally illegal to sell. On the bright side, however, fermented milk products (yogurt, cheese, cottage cheese) are very good for you and can be legally produced in some states without pasteurization. Look for some of the best cheeses (Alta Dena and Tillamook brands) in your local health food store. These unpasteurized products are perfectly safe due to the fermentation process used to make them. If the label on the back lacks the word "pasteurized," then it is not. No label will specifically state that a product is unpasteurized.

Hormone-Free Meat and Dairy Products

Watch out for all the hormones and medicines that are pumped into commercial meat and dairy products. Over time, these will be shown to have bad health consequences. Fortunately there is a growing organic farm industry that produces everything from eggs and meats to produce without commercial fertilizers, chemicals, or hormones. They are higher priced, but are becoming more competitive all the time.

Fats

Don't eat phony fats. The heart-cholesterol theory has been seriously challenged in the scientific world – even though those with heavy financial interests in promoting it are not yet letting go. It is true that you should avoid eating too much fat, but you do need some. Hydrogenated vegetable oils (also known as trans-fatty acids) as a substitute for animal fats are not only dangerous to your health, but rob you of the high nutritional value found only in saturated fats. Don't replace saturated fat with anything that says "hydrogenated" (margarine, shortening, and most crackers and cookies). Even the mainstream scientific

community has proven, and made public, that the change in molecular structure of hydrogenated oils is very damaging to cells. If you ever saw the process whereby they make this gray plastic goo and then bleach it and colorize it to look like butter, you would never touch it. Avoid fried foods, not only because of the use of hydrogenated oils, but because once again the high cooking temperatures alter certain factors in oils which cause problems in assimilation.

Stay hydrated with lots of water

It is essential to keep the body hydrated by drinking 6 to 8 glasses of water daily. This means making a conscious effort to drink, even if not thirsty. The thirst mechanism ceases to give accurate signals to the body as it ages. Many people after age 30 stop feeling thirsty and the body begins to subtly withdraw moisture from critical areas (joints, stomach lining, saliva, lymph, etc.). This is a significant cause of degenerative maladies like ulcers, deterioration of the joint lining, and low immunal activity). Make sure you have a good, clean, non-chlorinated source of water. Never drink public treated water. Get a good filter (see Recommended Equipment and Sources section) or get your water from a pure spring water source, even if you have to buy it.

I also recommend that you avoid or eliminate habit-forming drinks like coffee, caffeinated tea (vs. herbal tea), and soft drinks of all kinds. Drink real fruit juice, especially the kind without a lot of corn syrup added for sweetness.

Cut the sugar way down

The body does not need to take in sugar directly. It converts carbohydrates into sugars as needed. Naturally, sugar makes many foods tolerable to eat, so most people won't want to eliminate it entirely. Certain sugars are better than others. The refined and processed white and brown sugars are the most dangerous. Fructose, the naturally occurring form of sugar in most fruits, is more complex than sucrose or glucose and takes longer to assimilate. Slow uptake of sugar is important so that the body can adjust to the sugar level. Nevertheless too much fructose, like any sugar, will unbalance your system and over time begin to overwork your glandular digestive functions. Here are the major problems with regular sugar consumption in the quantities typical in Western culture:

- Direct intake of sweets makes it difficult for the body to maintain the proper blood sugar level (the amount of glucose in the blood must balance the amount of blood oxygen). Overdoses of sugar stimulate large insulin reactions (insulin works to hold down the glucose level), which depletes blood sugar causing that "let down" feeling after a candy bar is digested, for example. This roller coaster in blood sugar levels will eventually wear out the pancreas resulting in hypoglycemia or diabetes.
- Permanent damage to cells can occur after long periods of excessively high or low sugar levels. These abnormal levels can also affect vulnerable cells of the brain (causing hyperactivity followed by depression). The adrenal glands, whose job it is to react to the "crisis" of a blood sugar imbalance, can be overtaxed in producing hormones to correct this balance. This in turn can lead to an unhealthy endocrine system which may inhibit your ability to cope with stress. Most often it causes long-term fatigue problems, as well. A

wholesome, balanced, unsweetened breakfast provides a more constant blood sugar level for a longer period than the same amount of calories consumed in a highly sweetened breakfast.

- Sugar is harmful to the teeth, even with brushing and flossing. Sugar contributes to an altered pH in the saliva which makes it less effective in naturally controlling bacteria damage.
- Excess sugars are stored as fat, leading to weight problems.
- Sugar can become mentally habit-forming, causing a self-control problem associated with excessive cravings.
- Metabolism of sugars uses up a significant portion of the body's B vitamins.
- High intake of sweets is the largest contributing factor to the dulling of the appetite's sensitivity.
- There is a strong correlation between high sugar intake and disease. Viruses and bacteria feed on sugar, altering the correct pH necessary to deter disease.
- Sugar bogs down the rejuvenating process of cells, causing them to function below par or cease functioning altogether

Obviously, there are occasions when sugars are needed to increase the real palatability of certain foods so that children do not develop a serious food aversion to grain foods, cereals, etc. In all such cases, I recommend you use a complex sugar such as fructose found in fruits, fruit juices, and unprocessed honey. Because honey is sweeter than the simple sugars, one tends to consume less. You only need half the amount called for in recipes where you substitute it for sucrose. Molasses and maple syrup are good substitutions also. In your canning, try cutting the sugar down to about half the recipe requirement. Shelf life is a little shorter, but that can be offset by storing bottles in a cool place. You will gradually get used to the less sweet, more natural flavor of canned goods. Soon you will actually dislike the heavy syrup taste.

Stop eating junk food

I define junk foods as those foods that are over-sweetened, overprocessed, and prepared with cheap food fillers and chemical preservatives. Almost every type of commercial dessert fits in this category as do cold cereals, sweet rolls, candy bars, soft drinks, cookies, and other pre-cooked foods packaged for anything but immediate use. People intuitively know these things are not good but are slaves to their sweet tooth. Children who are raised on sweets and cold cereal find it more difficult to learn to develop a taste for good, wholesome food.

Don’t overeat

Being overweight it destroys your ability and motivation to exercise rigorously, which will lead to long-term health problems. In addition, overeating is directly related to your propensity to get diabetes, cancer, and heart disease. The major problem with heavy consumption of food is that over time you wear out your glands. This is one of the points most often overlooked by physicians. It is not sufficient to test someone’s glands for

normal output. When we overeat in general or specifically (by eating excessive quantities of protein, carbohydrates, sugars, or fats), our glands – especially the pancreas – are overworked. They wear out, especially if you have one or more genetic weaknesses in your glandular system. Some people can eat a lot of junk food and not seem to be bothered, especially when young. But slowly they are drawing upon limited body reserves and later on, just like a ticking clock, their organs will begin to falter and disease will set in.

The pancreas has many more functions than just digestion. The production of ***excess*** pancreatic enzymes is the main way the body has of keeping cancer cells in check. When your pancreas is still in the "normal" range, but has lost its ability to put out excess enzymes, you are starting to be at risk for cancer. No person has cancer without some decrease of pancreatic enzyme output. Overeating also keeps the blood stream loaded with food which inhibits the immune system's ability to react quickly to disease. Blood loaded with sugars is a massive breeding ground for bacteria and virus.

Internal body indicators – the appetite

My purpose in stressing proper utilization of the appetite is to promote and enhance survival preventive medicine through allowing your body to tell you what you need to take in at any given time. In our discussion of the appetite, I want to stress that it can be developed so as to correctly monitor your food and liquid needs not only in health, but also in sickness, except where special medicines or herbs may be needed. There are certain prerequisites for training a sensitive appetite:

1. One must gain a broad experience in all different types of foods and eat them enough to learn to like them. (I am not referring to gourmet, specialty foods necessarily.)
2. You must avoid the "junk" foods most of the time.
3. Sugar intake must be greatly reduced on a permanent basis. The old adage that "sweets will ruin your appetite" is true over the long run.
4. It is best to avoid snacking, which is a deterrent to a good appetite. Raw foods like carrots, celery, or apples do not deter the appetite. Learn to recognize the foods which enhance appetite. True "appetizers" do precisely that. Raw vegetables and tart or sour foods (e.g. grapefruit, apples, dill pickles, sauerkraut) are very good.
5. Always satisfy thirst with the proper amount of water prior to eating. If the body lacks sufficient water reserved to digest food quickly (digestion and chewing require a lot of water), it will lessen the appetite, reducing both the quantity and variety of foods eaten.
6. Learn to recognize the relationship between fatigue and lack of appetite. This is more applicable to mental fatigue than physical except in the case of trying to eat immediately after strenuous exercise.

Take health supplements properly

While a diet of unprocessed and raw foods will provide almost all needed nutrition, there are a few key vitamins and minerals that are sometimes necessary to take as supplements.

All synthetic vitamins and minerals are less effective than those derived from natural, whole-food substances. Vitamins and minerals in their natural state are usually combined in a balance of other complementary elements. Individual vitamins and minerals are less effective than vitamins and minerals that come from whole-food sources that have never been isolated. The body never uses vitamins and minerals separately, but in complex formulas with other essential elements, in the proper proportions. Thus vitamins and minerals derived from plant based sources (which retain their original combinations) are much more effective than chemical separations. Herbs are carefully-measured creations of complex products. This balance of effective ingredients is one of the reasons why there are few side affects when herbs are used appropriately. In contrast, the isolated chemical nature of drugs (even those based upon herbs) produces many side-effects. Drug companies isolate the effective ingredients, concentrate the dosages, and often make the ingredients artificially.

Dietary Guidelines: A Summary

I owe much of this to Dr. Albert Rose of Mountainside, NJ

1. Drink 6-8 glasses a day of non-chlorinated water.
2. For optimal health or if fighting illness, eat 60% of your food as healthy, raw fruits and vegetables. People who are otherwise healthy and not subject to pollution or heavy stress can do well with only a 30% raw diet. Try to eat at least two different raw fruits a day, one being citrus. The raw diet is primarily important for enzyme and vitamin and mineral content.
3. A maximum of 40% of your diet should be cooked carbohydrates (vegetables, whole grains, and whole wheat bread). We eat cooked carbohydrates for bulk supply of energy. If you aren't working hard, cut back in this area.
4. A maximum of 15% should be protein from nuts, beans, fish, poultry, eggs, or fermented milk products (unpasteurized cheeses, yogurts, etc.). Make sure you include this percentage of protein each time you eat to balance out the carbohydrates.
5. Eat only natural, unprocessed fats and oils. Never use hydrogenated oils like vegetable shortening, margarine, synthetic whipped cream, or coffee creamer.
6. Daily consume products that have live, friendly bacteria to keep your intestinal flora in good shape. Such foods are raw sauerkraut, unpasteurized cheeses, and natural yogurts. Do not drink cow's milk in any form if you are a nursing mother. Cow's whey has been proven in double blind studies to produce colic in babies. Fermented dairy products like cheeses are OK because the whey has been removed.
7. JUNK FOODS TO NEVER USE: Cola drinks, candy bars, alcohol, caffeinated teas, soda pop, diet drinks (aspartame has been proven to have very damaging side effects).
8. JUNK FOODS TO AVOID: Icing on cakes (mostly shortening and sugar), white bread, commercial ice cream (too many chemicals), packaged lunch meats and hot dogs (too many nitrates and preservatives), cold cereals (especially the sugar-coated variety), commercial cookies, cakes, and pastry treats. Whenever you get invited out

and can't avoid certain poor quality foods, eat very small quantities of it and your body will be better able to cope with the junk.

9. AVOID PREPARED MIXES like "Hamburger Helper," ready made-meals, etc. (The materials are poor quality, over-processed, and contain preservatives).

10. Buy ORGANIC MEATS AND PRODUCE that do not have added growth hormones or antibiotic treatments. None of the name brand meats qualify. If possible, find products butchered locally. Eat meat sparingly – never in large servings. Meat (especially red meat) increases the acidity in the body's pH levels.

11. Always chew your food thoroughly until liquid. Never overeat. If you do, don't eat again until you are both hungry and weak – that shows that you have used up all that excess food. Do not eat meals closer than 4 hours apart. Never eat late at night.

12. Season only with herbs and CELTIC or REAL SALT brand salt. Commercial salts have dangerous additives in them.

13. Never cook with aluminum cookware. The aluminum oxides are dangerous to your health.

14. Avoid all products with refined sugars (white sugar, corn syrup, sucrose, glucose). Use raw honey or maple syrup instead. Cut the amount of sugar in recipes by half.

15. Bake wheat and flour products with your own freshly ground flour. Whole grain flours cannot be stored at room temperatures without going rancid and losing their nutritional value, so it is best to use freshly-ground flour and store leftovers in the freezer.

16. Because of nutrient depletion in farm soils, supplement your diet with sea-based minerals such as kelp. Be careful of colloidal mineral supplements that contain aluminum, arsenic, and other harmful metals.

Summary

These changes, you will note, all involve some self-sufficiency from the over-specialized and regulated food industry. If a family cannot achieve, through the application of good leadership techniques, these beneficial minor changes (the children will feel they are major), it will hardly be able to overcome the severe food aversion problems that will set in when switching to a rudimentary food supply diet in a long-term period of stress.

Historical examples have shown that food aversion is a serious problem in the first year of a famine for children who have become hooked on an isolated range of processed, smoothed, and sweetened foods. Some have died rather than eat perfectly edible wild foods available to them. Many adults have not been able to overcome food aversion as well. Remember that overcoming food aversion is not simply a matter of self-control. It can become a reflex rejection where nausea sets in and people vomit food that they are forcing themselves to eat. If you begin to transition self and family to a more basic and natural diet now, your survival potential will be greatly enhanced.

Daily Physical Fitness

To adapt well to a life possibly involving many physical and manual endeavors, it is not enough to simply be at an acceptable weight. It is essential for men, women, and children to develop both physical strength and endurance. Rather than dictate a specific exercise program, I simply desire to emphasize five different body areas that need constant attention and several exercises that will do the job.

1. **HEART and LUNGS**: Cardiovascular exercise can only be achieved through vigorous activity leading to deep, rapid breathing. Running is perhaps the finest way to achieve this state in the shortest amount of time. Bicycling, long-distance swimming, and other heavily aerobic exercises are good when running is not an option. You don't need to join an an expensive health spa to exercise. If you need such a crutch to keep going, you are not practicing self-control or self-sufficiency. On the other hand, if you are confident in your ability to exercise alone with motivation, and you need the facilities of a club, by all means join. But for most, in thirty minutes a day, at little or no cost you can achieve most of your endurance needs. When I mention running, I am not referring to "jogging," which is merely plodding along. Running involves a lengthened stride and proper use of all leg muscles. It is far better to stop when you get tired of running and walk fast, rather than to slow down and plod along. In deference to other areas of the body that need strengthening, I recommend running every other day, on a six day exercise schedule. The alternate days are used for strengthening the upper body.

2. **MUSCLES**: There are several main actions of the body that should be strengthened. Three of those involve the torso of the body, which should give you a key as to why round, overweight people can't move very well. The six key actions areas are:

- PULLING of the body up with the arms
- PUSHING the body away with the arms
- TWISTING of the body with the torso
- SITTING UP with the torso
- LIFTING with the back
- JUMPING, CLIMBING, or RUNNING with the legs

The effects of regular, rigorous exercise go far beyond strengthening the heart, lungs, and muscles of the body. Exercise also greatly benefits the following body systems.

3. **INTESTINAL TRACT**: While not strictly a function of exercise, proper and frequent aerobic exercises somewhat guarantee that you will use the food placed in your colon. This helps to avoid stagnation and putrefaction of the colon. Persons who have sluggish intestinal tracts are never completely healthy. It is also difficult to exercise if your torso area is enlarged, bloated, or surrounded by too much fat. Even those who have the muscle power to run with all that extra weight experience side aches and other problems associated with intestinal gas.

4. **GLANDS**: Not counting poisoning by heavy metals, overeating is the single most significant cause of weakened glandular function. People who rarely overeat usually

have strong glands. Exercise is also believed to be one of the primary ways of ensuring that your glands will stay strong and in good production. Hard cardiovascular exercises will stimulate certain glands to function properly. Strong exercise also helps eliminate toxins and poisons through profuse sweating and heavy circulation of the blood. Be sure to work up gradually, in accordance with your abilities, but don't baby yourself too much.

5. **MIND**: Mental abilities are enhanced by hearty exercise also. Not only does exercise protect against the results of long-term stress, but in pushing the body to your fatigue limit your mind gains strength and drive which helps in other areas. Do not forget what I just mentioned about stress. I know from personal experience, as well as from the experience of every other person who has tried rigorous and regular exercise, that it almost always eliminates the harmful physical effects of stress. But it must occur at least every other day to be effective; and it must be rigorous. Those who frequently suffer from depression will find that depression cannot tolerate vigorous activity. If you force yourself to run when depressed, relief is forthcoming almost immediately.

Eliminating Excess Weight

There are numerous justifications for this suggestion, and due to people's difficulty in overcoming this weakness, I will review them. First, with rare exception, being overweight is an indication of some lack of self-control. Even if you have a so-called "thyroid" excuse, most people got to that point by poor eating habits. Genetic weakness in a gland certainly contributes to the problem, but parents should make children practice the self-control necessary to make sure that family proclivities toward obesity are not reinforced early in life. Conversely, the process of eliminating all excess weight will vastly increase self-control. I refer to the elimination of excess weight rather than the reduction of excess weight to avoid passive approval of the bad habit of feeling self-satisfied because a few pounds were lost. I hope that all will develop sufficient personal pride to feel uncomfortable until they achieve their best, which is my second point.

An interesting phenomenon occurs with the overweight person who remains in a heavy condition for a long period of time. He experiences a type of self-justification of his condition. As with most people who have a great deal of partial pride, this justification takes the form of transferring pride to his positive talents and accomplishments in order to compensate for his weight control problem. This misconception allows a person to believe that his weight problem is "insignificant in comparison to my greatness" as a lawyer, contractor, teacher, etc. Although there is some truth to this thought, it is of no positive value as long as it is used to justify a problem or weakness. Others who may not be able to transfer pride to another great ability or talent simply experience an embarrassed resignation syndrome – always apologizing for their condition but never quite caring enough to overcome it. In each case the person is to some degree satisfied with less than his best.

Some may protest, "I really want to lose weight, but I can't." Because of the dynamic state of the human body (cells constantly dying and rejuvenating), the inability to lose weight is vary rarely related to a *physical* barrier to change. Therefore, this protest becomes a lack of sufficient desire *compared to* the price that must be paid (usually pain

and mental anguish). The simple presence of *some* desire is often consoling to people with a weight problem, but it is essential to realize that the desire must exceed whatever is holding you back from success – the price, if you will. If you are not moving ahead with something within your power, it is because you haven't enough desire and control to put your available power into the action required. This will be explained more fully in the section on motivation.

The No Nonsense Way to Get Fit and Stay That Way

There are two main reasons people gain and retain weight. When you gain weight, you do so because you eat more than your body burns, and you eat an unbalanced combination of poor quality foods – usually too many carbohydrates or fats. Don't blame your problem on the thyroid alone. The laws of energy cannot be subverted. You cannot gain weight (short of using chemical gimmicks) unless you take in more calories than you burn, period. In the same way, you cannot lose weight (short of using problematic drugs) without burning up more energy than you consume. There are other factors related to the balance and quality of food you eat that affect this process – so it isn't a matter of simply starving yourself.

The Keys to Weight Loss

1. Stop eating more than your body needs to fuel your daily activities. That means quit eating before you feel full, and don't eat again until you are empty (really hungry).
2. Change the type and quality of the foods you eat as outlined in the section. This includes drinking lots of water and other liquids that are not heavily sweetened (real fresh juices and herb teas). This will help you retrain your appetite and cleanse your system.
3. Exercise daily for 30 to 45 minutes six days a week. This will burn the stored fat and increase your metabolism. Exercise on an empty stomach (usually first thing in the morning or at other times in the day when you are the weakest and out of energy).
4. Cleanse your colon. Overweight people almost always have a fair amount of toxins in their intestinal tract, which lead to migraine headaches and worse ailments. You'll feel better if you get on a natural cleansing herbal formulation before and during your weight loss period. Occasional juice fasts and use of colonic enemas are also very helpful for cleansing and for overcoming weight loss plateaus.
5. Do not take thyroid or adrenal pills, or any other false hormones. You must eliminate these completely. But you can replace them with raw glandular extracts, homeopathic remedies, and herbs to help restimulate the glands that are weak. I suggest you see a good naturopathic doctor to help you diagnose and rebuild weakened glands.
6. Exercise self-control when eating out or at social gatherings. Again, this includes not eating until you are full, substituting salads or vegetables for fried food or white bread, and limiting desserts.

Remember, the working principle is to change your *lifestyle* from one that fosters extra weight and poor health to one that maintains a thin, healthy body. This isn't a short-term diet or weight loss program. This is a new way of life.

I don't believe in losing weight by using diet pills and programs. Diet clubs and special programs are a form of crutch which is often substituted for self-control. Besides, they don't work in the long-term because you are not *permanently* eliminating the cause of the problem. If you can't get up and exercise in the morning without a group of people to motivate you, then you haven't developed enough self-control. This is important to realize even if you think your present peer-oriented regime is working for you. There will come a time in some future crisis when you will have to act solely on your own motivation, in circumstances far more difficult than losing weight. I don't object to people starting out with support groups or clubs, but ultimately they need to be able to manage and maintain their weight on their own.

The Principles Behind the Method

This method is not easy. It promises to make you come alive again, but only through your own will power and effort. There are no short-cuts. With this method you will not only be healthy, you will also be able to maintain that health longer, even under a lot of stress. Best of all, you will have a new strength of character. While you may think you have strong character now, you really don't know until it has been tried in the fire of adversity and self-control.

This method is designed to train the body and appetite to heal themselves and to once again respond properly to natural stimuli. It will do more than just help you lose weight. It will heal and strengthen your body and will even reactivate the thyroid gland in most cases (if done with a combination of herbal and homeopathic remedies which trigger stimulus to the dormant glands). The basic principles involved in what I am recommending are these:

- Eat proper foods in moderate amounts
- Rekindle the fat retrieval mechanism of the body
- Regenerate dormant or worn-out glands

Eat proper foods in moderate amounts

Overeating creates a state of overload within the body. The extra calories must either be burned or stored. The body's first choice is to burn the extra calories, but usually another meal comes along before it has a chance to use the calories/energy from the previous meal. This essentially forces the body to store the extra in order to make room for the new.

Note on appetite: Have you ever eaten a moderately large meal and have not felt really full (uncomfortably so) until *after* you stopped eating and relaxed for a few minutes? Sometimes it takes the brain 5-10 minutes to register the "full" or "stuffed" feeling. Take this into account in your new eating habits. Stop eating *before* you feel satisfied (and definitely before feeling full), and then wait a few minutes for the "satisfied" signal to kick in. When you don't stuff your stomach to capacity, it is normal to feel hungry again

sooner than you would otherwise. This is a good time to drink some water. That will likely satisfy the "hunger" until you are really ready to eat again. If you eat the proper foods in moderate amounts, and do not eat again until all of that food is used up in energy, you will not gain weight.

Eating quality foods is one of the most important factors to consider when trying to lose and maintain weight (and overall health) over the long run. As discussed earlier, eating a diet of highly processed or concentrated proteins and carbohydrates (including sugars) is the fastest way to wear out your adrenal glands, thyroid, pancreas, and colon. It depletes the body of nutrients, which increases the appetite, creating an overfed and undernourished body. Without the fiber and digestive enzymes provided by an abundance of raw fruits and vegetables, the colon becomes sluggish, clogged, and lined with goo. That alone will create a "gut" and add 5-10 pounds to your overall body weight. In this state, the body is unable to absorb the full range of whatever nutrients are available from foods and even from vitamin supplements. This creates a heavy strain on the other organs (liver, kidney, heart, etc.) that rely on the availability of those nutrients.

A brief word on fats. Again, quality and quantity are the keys here. With nine calories per gram (compared to 4 for protein and 7 for carbohydrates), fat will definitely add more calories to your diet. But remember, calories aren't a problem unless your body doesn't have a chance to burn them. Burning fat calories can be easier than you might think. The right kinds of fats are highly nutritious and easily utilized by the body. They are essential for absorbing fat-soluble vitamins like A, E, and D, and are the main building blocks for hormones and brain tissue. But remember, this is only true for fats occurring in their natural form. You must absolutely avoid all fats that have been highly processed and heated at high temperatures (hydrogenated). That includes all margarine, shortening, processed cheeses, all fried food, and most packages labeled "low fat." Do enjoy – in limited quantities – butter, natural cheeses and yogurts, and extra virgin olive oil.

Rekindle the fat retrieval mechanism of the body

After you have corrected your nutrition problems, the secret to losing weight is to rekindle the fat retrieval mechanism of the body – which in most people hasn't been used for years. Why? Simply because people eat *before* they really get hungry. The body begins calling for more food (often because of habit more than actual need) long before it starts metabolizing fat. This resistance to using up storage is related to your normal hunger pangs. One of the keys to health is to train yourself never to eat at the first onset of hunger. Exercise the fat burning process of your body each day. The thyroid gets atrophied through disuse when you overeat and never burn up any fat. When you finally do decide to lose weight, the essential hormones are not there to assist you. But don't blame the thyroid. You are to blame for not using it for long periods of time, in addition to engaging in other eating disorders that lead to glandular exhaustion.

If you use up the energy from the previous meal and then exercise on an empty stomach, the body will be forced to energize its metabolic process of pulling from fat reserves. Exercising on an empty stomach helps you do two essential things. First, it forces the body to go into reverse and retrieve some fat to operate on. You aren't going to run far without drawing some reserves from somewhere. Make sure you don't do this on a weak

heart, for the demands on a recalcitrant system will really put some pressure on your body as it fights against change. As you start to run in a weakened condition, your body will complain a lot. You have low blood sugar and technically not much to run on. You need to look for that second wind that indicates your reserves have kicked in. Don't quit without feeling it. Forcing yourself into gear will give maximum signals to that old fat retrieval system. If your system is so dead that you can't feel any second wind, slow down and walk; then run and walk some more to make your body find some energy. Even a state of rest requires getting more energy out of fat cells after you have exercised with cardiovascular rigor.

Second, regular exercise helps ensure that your body will go after your fat cells and not your muscles for burning material. It is true that on some types of diets if you don't use your muscles, the body will burn protein rather than fat. Certain urine test can tell you the percentage of protein that is being metabolized by your body. By working your muscles, you will send signals to the fat metabolization process: The muscles send an "I'm being used, go get your energy somewhere else" signal. Naturally, you need to be careful of the foregoing regimen if you are in poor health. While I wouldn't be as cautious as a doctor would be, I would say push yourself hard but don't get close to faint. Build up slowly, but don't baby yourself. You can do much more than your body thinks it can. When you run, run – don't plod along at a fraction of a run (what others call "jogging"). That is bad on your feet, joints, and everything else. Run at a brisk pace and then walk, but don't jog. Keep up a good stride so that your heels hit first. If you are running flat footed, you are jogging. Be sure and get a good heart physical before undertaking any serious and strenuous running. If your heart is not in good shape, start walking fast and build up your heart with good nutrition. There are nutritional and herbal-enzyme treatments to undo everything from cancer to clogged arteries, but you must also give the body signals of real change – and exercise is the key to helping the body make permanent repairs.

Summary

Once you have lost the excess weight, a few modifications of the weight program will serve you as good habits for the rest of your life:

1. Establish permanent eating habits that include eating unprocessed and raw foods in their natural form. Eliminate junk food, and drink plenty of water.
2. Don't overeat. If you do, make the next meal some light fresh fruit or juice so that you burn up the excess calories before another meal. Note, that even though an apple may violate the carbohydrate/protein percentage guidelines, it is such a small, raw quantity that the body will not take adverse affects.
3. Exercise regularly and when empty. Push yourself hard in heart and lungs.
4. Work with a good naturopath or other holistic doctor (homeopath, iridologist, etc.) to rebuild weak and degenerating tissues and organs.

Learning to Transition to Natural Remedies

Because we may not be able to depend upon a highly sophisticated medical establishment in a crisis, and because dependence on and use of most medical drugs is discouraged if you want permanent remedies to your health problems, each of my readers should become knowledgeable in competent alternative practices in medicine that offer a better hope for prevention and true healing. In general, I have found herbs to be more effective and less prone to side effects than modern medical remedies. They also have the added value of being storable for long-term future use. Many herbs can also be grown in your own garden so as to offer you a constant, fresh supply.

As an introductory statement, may I say that I have the highest and most profound respect for the professional medical establishment in the area of technological surgical techniques, though I would challenge the need for so much of that surgery if doctors really cared to use the alternative practitioner's philosophy of prevention. The establishment has linked itself so inexorably with commercial drug companies that there is a systematic rejection of research not related to the pharmaceutical, profit-motivated industries.

Additionally, it is my opinion that the medical profession has exercised a decided lack of professionalism and good judgment in its flimsy and cursory evaluations of natural and herbal remedies. I am fully in agreement that the field of natural remedies has had its shysters and scoundrels, but then so has the medical profession with all its credentials, protection, and liability insurance. The near complete rejection of natural and herbal remedies by the medical profession stems from several sources and intents, not all of which are represented in every medical study:

- Improper and false parameters in the testing of natural remedies.
- Test subjects who are not following a regiment conducive to the success of natural remedies.
- An internal conflict of financial interest in refusing to acknowledge remedies that would eliminate the need for some medical specialties. (Allergists are the prime example.)
- An inordinate amount of "professional pride" in refusing to review work by uncredentialed persons. There seems to be a stigma that none but the accredited research organizations can discover superior techniques.

The example of the testing of vitamin C as an anti-viral remedy is a perfect example. Research at the Linus Pauling Institute indicated clearly that measurable results in a test of vitamin C's effectiveness came with large dosages in excess of 5,000 to 6,000 mg per day. Yet the test conducted by the medical establishment purposely used dosages of 140 mg, and on test subjects that ate the normal American junk food diet. Even then, the test group using the small dose of vitamin C did show a *slight* edge over the other group. Naturally, the testers chose to discount it as statistically insignificant. This test points out a few interesting points that I have personally discovered about natural remedies which are essential to their success.

1. Natural remedies must be taken in the proper combination and dosage with other whole food vitamins and herbs to be effective. Simply popping vitamin pills as "insurance" is not necessarily beneficial, and may be harmful.

2. Since natural remedies are not as powerful or as concentrated (and for good reason) as commercial drugs, the body must be free from heavy or sugary foods for the remedies to work most effectively. Vitamin C, cayenne pepper, and garlic have been shown to be excellent anti-bacterial and anti-viral remedies, but only if your blood stream is not loaded with sugars and starches. If a person is not feeling well, her appetite naturally diminishes as a signal to "unload" the bloodstream and allow the natural antibodies to more effectively fight the infection or virus. If this cleansing is supported by modified eating habits, the natural remedies can give slow but lasting relief.

3. The quality of the natural remedy is also critical. Vitamin C does work better when taken in combination with fruits or vegetables also containing vitamin C. This works even better than vitamin C enriched with bioflavonoids or rose hips, though these are better than straight ascorbic acid. Fresh garlic pressed from cloves is more effective than the oil and extract diluted and deodorized in capsules.

4. Natural herbs have demonstrated the ability to be highly selective in their interactions with the body. Generally, when taken orally, they do not disturb the natural balance of beneficial bacteria in the intestinal tract, as opposed to antibiotics which will destroy the good with the bad. Sometimes this broad range of killing power is beneficial, but generally it is not. The destruction of the intestinal flora by broad spectrum antibiotics is not easily remedied.

Use Sound Diagnostics

There are a lot of mystical techniques parading as honest diagnostics in natural medicine. Don't be fooled because they work – often they do, but it's not real science. It's like water witching. It works most of the time (only for witchers that are "in tune") but it is not in accordance with true physics. Spiritual forces on the dark side of the spectrum control this medium, in my opinion. The fact that the diagnostic method seems to be innocuous enough doesn't mean there isn't a trap somewhere down the road. It is the same with other mystical methods that claim to tap into your spiritual sensors, like arm testing or reading spiritual auras. I'm convinced that some people really can see auras, but it is induced by spiritualism and not a reliable science. Arm testing has some basis in reality (your spirit can sense weakness when you know something isn't right) but to start asking it detailed questions that go beyond the conscious mind is making it act more like a Ouiji board. The Lord never intended the spirit to act as a yes-no answer board for every little detail.

In any case, there are only three natural diagnostic tools used in alternative medicine that I trust (as of this writing):

1. **Dark Field Microscopic** viewing of the blood. This test shows a myriad of blood conditions, from free radical damage to uric acid crystal formation (leads to gouty arthritis and bursitis). It also shows yeast and fungi in the

blood, slow white blood cell activity, and improper protein digestion – leading to sticky blood cells that clump together and inhibit oxygen uptake.

2. **pH testing** of the saliva. This simple test, using standard pH testing paper, available at any drug store, can immediately give you an overall reading on your state of health. If the paper is anything but blue or dark blue after soaking it under your tongue, you are not well. Your body fluids must be alkaline (showing dark blue on the pH paper) in order to be healthy. I have never seen anyone sick who has the proper pH. pH can be corrected with calcium, sodium phosphate (found in celery and goat whey), and other treatments.

3. **Iridology**. This is the science of reading the micro nerve endings that terminate in the eye, from all parts of the body. It is fascinating to see that any damaged or weakened systems in the body show up as lesions and color stains in the iris of the eye. It takes a magnified photograph to see enough detail to make an accurate diagnosis, but it really works – no bogus science here. This is the only broad-based diagnostic tool that, in my opinion, is capable of giving a reading on each individual body part and gland without invasive or costly testing.

Tried and Proven Natural Remedies

In general, I have found that there are a few natural remedies that cover most situations. They are:

Vitamin C

This vitamin used in doses of 1000 mg or more is very effective for general cleansing of the blood stream (being an anti-oxidant). Along with calcium, it helps maintains the proper body pH, which should be alkaline. Vitamin C, though acidic, produces an alkaline reaction in the blood. It has definite anti-bacterial and anti-viral properties and is effective against a cold in doses exceeding 1000 mg per hour, in combination with "unloading" the body from food intake. This vitamin should be stockpiled in large quantities (in sealed bottles protected from the sunlight), and should be of a brand that includes bioflavonoids or rose hips. There are other new and more powerful anti-oxidants on the market today, but this one is cheap, readily available, and should be taken regularly throughout your life.

Garlic

This is one of the most powerful anti-bacterial and anti-viral remedies I have found. It also controls and lowers blood pressure to some degree. Used directly from the clove, not in capsules, it will work on everything from pneumonia to strep throat. The worst drawback from its use is bad breath, (but that can be offset if everyone in the family eats it). It is effective on intestinal problems and warts as well. The easiest and most palatable way to use it is crushed fresh in a glass of tomato juice or in a light broth or soup like Lipton brand. Do not cook it with a soup. If the sting is gone out of the garlic, it is not effective. Cooking will destroy the effective ingredients. For sore throats,

placing a slice of garlic toward the back of the mouth or cheek and occasionally crushing a little juice out so that it bathes the throat with stinging liquid will solve your problem in a few short hours. Don't take my recommendations about garlic lightly. They could save your life someday. Garlic saved the lives of many who took it during the black plague in Europe many centuries ago.

Cayenne Pepper

Also known as capsicum or Mexican Red Pepper, this pepper is very hot but will not burn the body in the damaging sense. Mix it with herb tea or tomato juice or just sprinkle it on food (which is a very common practice in many parts of Africa). Remember, a little goes a long way. For a gargle (great for sore throats), sprinkle a little in a small glass with water and honey (just a tiny bit) and gargle with the head tilted back. Another potent use of cayenne is as a blood clotter. If you or your child ever scraps off a large patch of skin, sprinkle on cayenne (only burns slightly). It will immediately clot the blood and purify the wound. In more serious wounds, especially gunshot wounds or gut wounds, you can stuff the puncture with cayenne and it will stop venal bleeding and keep infection down until you can get medical assistance. Use it also as a temporary internal stimulant (instead of caffeine) to ward off drowsiness.

Echinacea

Echinacea is another of the powerful anti-bacterial herbs that is most often used in combinations of other herbs. You can't have too many of the natural antibiotics as we enter a period when new drug-resistant varieties are threatening. Echinacea is particularly beneficial with glandular and organ purification as well as blood problems.

Slippery Elm Bark

Among the hundreds of uses claimed for this herb, I have found it is the most effective herb to stop diarrhea from water contaminated with bacteria or parasites, either domestic or foreign. In general, it is the herb for treatment of most intestinal disorders and is probably most effective in combination with other herbs as outlined in most herb books.

Calcium/Magnesium

Calcium is the most essential mega-mineral in the body and controls many complex functions. One of the prime factors it controls is body pH. No one gets ill unless the body pH turns acidic. To counteract, the body attempts to grab all the calcium it can (sometimes taking it from bones) to cure the acidic levels. Vitamin C, even though an acid, causes an alkaline reaction in body fluids by enhancing the body's use of calcium.

You must have the right kind of calcium or the body doesn't absorb it well. Calcium needs to be accompanied by magnesium and zinc in the body in order to be assimilated and function properly (though don't take zinc at the same time you take calcium). Milk as a source of calcium is an unfortunate piece of commercial advertising. Yes, it has calcium, but not in an absorbable form, due to lack of other co-factors. Capra Mineral Whey is the best way to get a dairy source of calcium and minerals, all in a perfectly

absorbable form – great to mix with hot natural beverages like Postum. The whey is also very high in sodium phosphate which is an essential "helper" to calcium. Found in many fruits and vegetables (especially in celery), sodium phosphate lines the stomach and helps produce the right amount of stomach acid for digestion. It is also an essential element in the synovial fluid which carries calcium from the bones to the tissues that need it. Without sodium phosphate, the synovial fluid drops the calcium in the veins and arteries, contributing to heart disease, arthritis, PMS, and other problems.

Bone meal (from bones of organically raised cows) is an excellent source of calcium, but mineral calcium from commercial sources is almost useless. For non-bone sources, I use calcium citrate with magnesium, boron, and vitamin D co-factors. Stockpile proper calcium – and take your calcium with Capra Mineral Whey to ensure proper absorption.

Digestive Enzymes

One of the most important types of supplements is enzymes – especially after age 30 when few people's glands are operating up to par. Lack of proper and complete assimilation of nutrients leads to many different anomalies in the blood. For example, when proteins are not digested properly, the red blood cells get sticky and group together in long chains. Less than 1/3 the normal blood cell surface is available for oxygen absorption in this condition. A majority of people suffer from this weakening condition which leads to gout, arthritis, fatigue, anemia, and lack of mental acuity.

Tea Tree Oil (or Maleleuca)

Tea Tree oil is the best of the natural topical antiseptics and anti-fungal agents. It works on all cuts and abrasions, cold sores, athlete's foot and other fungal infections, and rashes.

Sprouts and Wheat Grass

I include in this category all the natural greens from early growth plants – chlorophyll, wheat grass sprouts, alfalfa and other seed sprouts, and algae (kelp). Chlorophyll (extracted from plants) and these early growth plants have a full range of vitamins, minerals, and digestive enzymes – all in the right natural combinations to have great nutritional value. These are absolutely indispensable if you don't have any more supplements, and are better than supplements for everyday use. Learning to sprout wheat and other seeds (alfalfa, radish, even lentils) is an essential part of your survival preparation. They could make the difference between health and mal-nourishment if growing a garden is just not an option.

Baby Food

Research continues to prove that breastfeeding is the only suitable way to feed a baby. Babies should be nursed for a year and a half minimum and never supplemented with formula or cow's milk. Solid foods should not be given earlier than nine months. Grind your own with a baby food grinder – do not buy commercial baby food products. This

may seem radical but even the best conventional medical research confirms this. Obviously the Creator knows best.

As an aside, it is best to prepare to give birth with the assistance of certified lay midwives, rather than going to the hospital (except in an emergency). Not only do you avoid the problems associated with birth pain drugs and invasive standard OB birth practices (which result in excessively high C-section rates), but you avoid the ever increasing controls and medical demands upon your baby. Increasingly, hospitals are becoming more and more demanding that children born at hospitals have dangerous inoculations. Even the vitamin K shots mandated for newborns are now under dispute. It seems there is an increasing occurrence of heart failure with too much vitamin K in the first few days of life. It looks like the naturally low level of vitamin K in babies is divinely designed. Breastfeeding overcomes this early deficiency just when the milk starts to come in.

Stabilized Oxygen

This unique product provides two fundamental services. First it is a very powerful killer of bacteria, viruses, and other parasites. It is the water purifier of choice. Second, it is one of the easiest and safest ways to get a large dose of oxygen into your blood stream for all the remedial purposes that oxygen plays. It is the only water purifier that will work in your intestines even *after* you have a dysentery condition.

This is marketed under a variety of brands (Aerobic 07 or K07, Aerobic Oxygen, Liquid Oxygen, etc.). These products are non-toxic, stabilized electrolyte solutions containing oxygen attached to naturally occurring chlorine salts (sodium content is minimal, with no salty taste). When the oxygen is buffered and stabilized, it remains firmly attached to the electrolyte molecule waiting to be released when exposed to a biologically active environment. The storage shelf life, away from excessive heat, is indefinite.

Aerobic oxygen kills harmful microbes, parasites, and anaerobic bacteria (the harmful type that cannot withstand exposure to oxygen). It is effective against E. coli, salmonella, cholera, streptococcus, and the dreaded giardia lamblia. It is also effective against the most common type of fungi.

Aerobic oxygen works by releasing its oxygen molecules as it comes into contact with harmful microbes and bacteria present in the treated water or stomach acid. The oxygen oxidizes sensitive membranes of the bacteria or in other ways interferes with vital life functions, which causes the death of these harmful microbes. There are three factors that affect how fast an oxy-purifier works: concentration of the solution, time, and the presence of citric or hydrochloric acid. The more drops of Aerobic oxygen you add, the less time until purification takes place. Conversely, to economize on the dosage (especially useful if you are running low on stabilized oxygen), you can reduce the dosage and allow more time.

The most effective way to release its power as a water purifier is to add a teaspoon of lemon juice to a glass of water, then add 10-20 drops of stabilized oxygen. This immediately releases the oxygen. Now, pour this solution into the gallon you want to purify and it will go to work almost instantly. If you want to get oxygen into your blood

stream, however, DO NOT add the lemon juice activator – you want it to come out of solution more slowly in your stomach.

The best version of stabilized oxygen is manufactured by Aerobic Life Industries, the makers of Aerobic 07 (chlorine salts-based). They have perfected a new product based on potassium salts, which is healthier all around. It is called Potassium 07 or K07 for short. I use the cheaper Aerobic 07 for water purification, and K07 when I want to take oxygen into my system for health reasons.

Summary

I consider the items I have mentioned to be essential for survival. They are all life savers. But there are hundreds of other herbs and vitamins that are good and beneficial. However, it is beyond the scope of this book to go into them in any further detail. Let me say that it takes years of wisdom and savvy to know how to use herbs and vitamins wisely without wasting your money. Find a good naturopath to consult with, but avoid the types that deal in a lot of spiritualistic-based diagnostic means (hands sensing auras, arm testing, pendulums, etc.). I wish there was a book on natural medicine that I could wholeheartedly recommend. There are many good ones but they all have one or more flaws.

Avoid anything "herbal" or "natural" that comes from the major drug companies. They have decided they can't squash this movement so they are joining in just for the money. But you can never trust the multinational companies to put out truly natural products – especially in vitamins and minerals. Every company in the world is starting to play the game of isolating one or more "essential micro-elements" in the microbiological processes of the body and then marketing it as a supplement. If you took all the thousands of micro elements, proteins, and enzymes as supplements you would be broke for life. Try to get the micro elements of life in sprouts and whole foods – organically grown, and fresh. Eat lots of raw foods to ensure the nutrients are still there.

FAMILY MOTIVATIONAL LEADERSHIP

Most families today are a wreck. Husbands and wives have wide differences in perception and children are weak and undisciplined. Most families have become immune to the whisperings of conscience and as a result have chronic bad judgment in many areas. Even those that appear normal have fragile emotional and spiritual connections that will fail when real hard times come. This section is meant to help you prepare by remedying these family weaknesses before the crisis.

Human Assets

Let us start at the very beginning. Streamlining and organizing your life's assets into a condition that will survive future problems will depend far more upon your personal character assets and those of your family than on the physical suggestions I make about money, land, and facilities. Ask yourself the following questions and be prepared to make some hard changes if your answers are not what they should be.

These are danger areas of personal problems that mean guaranteed failure of the family unit (or at least part of it) during a severe crisis.

1. Do you really LIKE your spouse? If you don't, down deep inside, remember that each person in a family relationship has an ultimate responsibility to *change* those habits and personality characteristics that are out of harmony with goodness and truth. Looks are relatively irrelevant, except as a person's face reflects years of bad living. You can become a person that is loved by all other good people if you act and become aligned with goodness and truth (don't expect evil people to love you because you are good). That may sound simplistic, but it is true. If your spouse is a really good person and you don't like him or her, you had better look inside yourself for the problem. That doesn't mean you have to like eccentricities that bother you. Even good people can annoy others and should make personality adjustments, difficult as that is.

Don't kid yourself about "loving" your spouse. Playing games with words and using communication gimmicks to imitate a successful relationship is not the same as real love. Now, this is not to say that everyone needs to feel some deep passion or constant longing for one's spouse to qualify as love. Relationships that have become common and comfortable are not often filled with the highs and lows of exhilaration and passion. There is a peace and serenity about life together that is the hallmark of the most stable relationships. There is also a place for dutiful regard and general kindliness toward the spouse – even when you don't feel anything special. This kindliness bridges the gap until the time when love returns. All this is part of life. I don't want to project any unreal expectations here. What I'm interested in suggesting, is that changing things that are both wrong and irritating to the other person is the key to real unity and the return of legitimate affection.

If there are problems, resolve them. Be willing to change yourself and expect change in your spouse. There is even room for legitimate feelings of irritation and impatience when one or the other is simply not putting out any significant effort to change. I believe it is important to show righteous anger when necessary. It lets the other person know how big a problem is and how serious the inaction has become.

Pressure is necessary to change the most persistent problems in a marriage. Contrary to popular psychology, all things cannot be accomplished by soft love, acceptance, and kind words. Innate problems (part of the person's root personality that have always been with him or her) take many years and a lot of heavy, internal pressure to overcome. But examine your motives when angry and make sure you are really trying to help the person and not simply trying to drive them away.

Expect to see movement in the marriage if you want to see happiness return. You should expect constant improvement and progress from both yourself and your spouse. There are no gimmicks that work for anything but the short term. The worst lie is the false social philosophy that "I'm OK, you're OK." This popular, but relativistic piece of trash teaches people to demand that others accept them as they are, and subtly gives signals that there should be no expectations of change. While that is true about some things physical that really can't be changed, when applied to character flaws, it allows people to put up a defensive shield to excuse their lack of change. You can lie to the world, and even to your spouse, but you can't ultimately believe inside that you are "OK" when *you*

are not. Remember that it is never too late to improve or change – it just takes more effort the more ingrained our habits and personality become.

Sadly, many marriages that began from bad judgment and persist in chronic bad habits cannot be saved by an appeal to truth. They are destined to fail when real change is refused over a long period of time, or where one or the other is fully unrepentant and abusing the relationship.

2. Do you TRUST your spouse and children implicitly? This question is another indication of your confidence in your family's allegiance to principles of truth. If you have doubts about what choices they will make when under pressure (especially peer pressure), then you have a long-term liability problem for tough times. Don't be duped into excusing a certain family member's lack of trust in matters of fashion or small things with the excuse that "when the chips are down, he (or she) will make the right decision." While that does occasionally happen, the odds are at least 3 to 1 against a positive outcome when a person shows weakness in easy times. More importantly, when a person only makes the right decision when *compelled* to do so by the force of circumstance, it usually means they lack insight, vision, and/or self-control. All of these liabilities will continue to plague this person's trustworthiness until he learns to do the right thing by will power or desire, not compulsion. With your own children, watch them carefully after disciplining or correcting them to see what they do on their own volition (as a test of how well they have absorbed the lesson internally). That's one of the reasons why I emphasize disciplining people's chronic violations of conscience, rather than by fixed rules. If you can reawaken a person's sensitivity to the warning voices of conscience, he will be more likely to make better decisions the next time, and at least he won't be able to say, "I didn't know."

3. Are you or your children PERMISSIVE in self discipline or in the discipline of others? This one characteristic is perhaps the foremost character killer of all times. A permissive philosophy of discipline makes people soft in mind and body. It reflects in the spirit of a person a certain lack of a sense of urgency, lack of attention to detail, and perhaps even a lack of feeling for the warnings of conscience. Ultimately this leads to chronic bad judgment in personal affairs and the lack of a fighting spirit. People who have no stomach for resistance will always delay strong action until it is too late to win. The permissive spirit is born out of laziness and is nurtured by the slick media and the voices of credentialed educators. The new intellectual sophistication of today promotes the idea that issues are too complex to have "easy answers;" that we must always give the "benefit of the doubt" to the individual or "let him do his own thing" and find out for himself so that we don't stifle his creativity with absolutes.

I believe that all truth is ultimately absolute for every given circumstance, and sometimes absolute across all circumstances. This qualification is at odds with the typical liberal intellectual's objection to absolutes (that the notion of absolute truth forces over-generalized solutions to apply to masses of individual people). In fact, it is the liberal tendency toward relativity that applies glossed-over generalities to individual circumstances – specifically to avoid dealing with the specific and detailed violations of truth that are involved. Real absolutes apply a variety of universal truths, but do so in a manner perfectly matching the particulars of each individual situation. This means that

for *every given situation*, there is an ***absolute best answer or way to proceed***, and that even though we may, in some instances, be personally incapable of finding it (or lack the time to find the ultimate answer), we never ought to drop the searching process even though we have to act upon interim or incomplete conclusions.

Permissive attitudes are harbingers of personal corrosion in judgment and in sensitivity to certain critical details in life. People with such attitudes tend to feel that nothing is worth fighting over; that pleasant human relations are almost always more important than principles. In the training of a child, they destroy his or her ability to develop the normal benchmarks of conscience. This happens all the time when a child gets nervous feelings about some errant behavior and a permissive parents fails to correct the child, or even worse, says "That's all right, don't worry about it." When that happens often enough at home and in school, a child begins to actively discount those warning signals from conscience, assuming his own feelings must be wrong since none of the adults are bothered by his behavior. Decision making becomes fuzzy as a rebellious person cuts off those internal spiritual indicators that are meant to guide the child when acting outside the limited rules he has been given in life. On the other hand, when parents are active in correcting children according to conscience, each correction reinforces the child's remembrance that he or she was warned by a tiny little internal voice beforehand. In order to avoid future trouble, the child is motivated to listen more closely to that warning voice. This process is enhanced even further when parents and teachers correct by making direct reference to conscience, rather than turning every infraction into a corresponding rule. A simple sentence like, "I think you knew that was wrong, before you did it. Why didn't you restrain yourself earlier?" or perhaps "Didn't you feel nervous inside before you started doing that? If you didn't then you're not listening well enough. You have to slow down your mind and stop and check frequently for nervous feelings, to see if what you are doing is all right." These kinds of corrections help more in the long term than any other methods of discipline.

Non-permissive discipline is the application of controlled and well thought out consequences in proportion to the intent and foreknowledge of the person who makes the mistake. I believe some physical punishment and a show of anger at severe rebelliousness are an essential part of discipline (they reflect the seriousness of the infraction). Although these methods might be called harsh or even abusive by present-day child psychologists, they are effective when well thought out and not based upon erratic expressions anger. The entire philosophy of non-permissive discipline is that we provide correction and consequences to a person's acts so that he learns to avoid bad judgment *before* entering real life where the consequences can be fatal. Remember to correct attitudes and chronic violations of conscience before they breed bad actions. This is a truly preventative philosophy of discipline. In contrast, always giving mercy instead of a strong correction is not only unmerciful, but deceiving to the learning perceptions of a child. Permissively reared children are denied the close linkages between fairness and right and wrong. The institutions of the world have become permissive and will be further pressured by government to shield people from the consequences of their low true worth. You can at least see that this doesn't happen in your home. Remember that if you raise a family correctly, they, along with your spouse can be your finest assets in a crisis situation. Don't neglect this vital area of your preparations.

Establishing a Correct Philosophy for Change and Progress

In light of the major lifestyle changes required in a crisis environment and the changes in family life recommended in the foregoing pages, I have included some new material on correct motivational techniques to help parents and individuals understand how to correctly affect changes in themselves and other people.

In matters of self-motivation, one must first realize that *within areas of our own capabilities* we are totally responsible for our success or failure. There is no such thing as "I *wanted* to, but I *couldn't*." Correctly translated, using weight control as an example, it means, "I wanted to lose weight, but not as much as I wanted to be sociable at the party (through eating), or wanted to avoid the pain of going without." We see that within the realm of our capabilities, all things that we do are things we want to do *most* among the total list of all things we desire in one way or another. There is a trade-off in everything we decide to do or not do.

Consider the example of the little boy who responds to the foregoing statements as follows: "What about all the things we have to do that we don't want to do?" I respond, that according to the laws of motivation in humans, no one does anything they don't *want* to do, in the context of their limited choices at the time. Shocked, as we all are upon first hearing this, the boy responds, "But last night I didn't want to do my homework, but *my father made me do it*." Well, yes, and no. In reality, the father simply reduced the boy's choices to two things – doing homework or being punished. The boy *chose* to do his homework. As proof that this was perceived as the more desirable choice, had the father just punished him and not given him both choices, the boy would have pleaded to be allowed to do his homework. Simply put, the boy wanted to do his homework *more* than experience the pain of a spanking, or the pain of being put on restriction, etc. So we see that as long as we still have life, everything we do, no matter how poor a choice, is something we chose over all other available alternatives (which are always limited). The misconception is that, since there are other alternative choices we desire (even though they are not available to us), our ultimate choice is not what we want to do. In terms of ideals, that may be true, but every choice we make is perceived (at least at that very moment) to be the best of all *available* alternatives. Let us never forget this key point.

The lesson to be learned herein is that just having desires is fairly meaningless in-and-of-itself. The road to failure is paved with good desires. In fact, just because a certain desire is our long-term desire does not mean it directly leads to success or change. All desires, no matter what quantity or quality, must be weighed against the *price* that success or change is going to require. This then brings us to the *law of change*, as I define it.

My LAW OF CHANGE states that, before any change can occur, the *desire* to change must *exceed the price* that must be paid to *accomplish that change*. The price that must be paid for success is sometimes set by society, sometimes by the laws of the universe, and sometimes it is determined by our previous successes or failures. Thus, the secret of motivation is to elevate our desires above whatever price is required in order to achieve what we set out to do. Sometimes failures to achieve certain goals are good. Often people set out to achieve a goal that requires as a price the sacrifice of things more dear

to them than the goal itself (family is a frequent casualty). It is beneficial if people can learn to recognize when the price is unjustifiably high. Too often men sacrifice the more meaningful things in life for power, position in business, or to keep up on a favorite sport. But perhaps the more obvious problem with most people is their failure to raise their level of desire. To achieve their goals, they attempt to *lower the price*.

As I obviously don't recommend the reduction of price of success (where personal progress is concerned), the task at hand is, *how do we raise desire*? It is first essential to understand why some people stay where they are in obviously unhappy and uncomfortable conditions, and why others keep progressing. From the motivational principles previously presented, we can derive the following truths:

1. Within our capabilities, everything that we do is something we most wanted to do among our given alternatives at that moment.

2. The alternatives are not only determined by what we perceive as possible. They are also evaluated according to their *price*, compared with our *ability or willingness to pay*.

3. Anyone who is not changing or progressing, in one way or another, has reached a level of satisfaction in the balance of his desires for improvement versus his willingness to pay the price for further change.

4. Anyone who moves upward does so because, for some reason, he no longer was satisfied with his previous state and his desire exceeded the price to move upward. There are two basic ways to break loose from a state of satisfaction. Note that no change takes place without one or the other occurring.

    a) Some person or thing applies some negative consequence to our situation which does not fit within our concept of satisfaction, forcing us to move up or learn to accept the existence of those consequences.

    b) A new and more beneficial situation is described, shown, or experienced, and we can no longer view our present realm with the same level of satisfaction. We must either discredit the new experience and stay stagnant, or move upward to seek the new level of choice.

New experiences or desires are commonly discredited when we consider the price and find that it exceeds our willingness or ability to pay. Sometimes this is the correct choice, as often is the case when a person would have to go into debt to finance some new perceived pleasure.

Based upon this basic understanding of why people change, let's discuss some recommendations for implementing an environment conducive change within the family. The purpose is to achieve all of our preparedness goals (within our means) without being hindered by family apathy.

Establish a Learning Relationship with Your Children

If the only contact you have with your children is of a disciplinary sort, you are at best reacting to their mistakes, instead of actively guiding their attitudes prior to the error. I

don’t want to denigrate your efforts to discipline, for I believe it is essential. But it doesn't seem to be enough to say, “When they want to talk, I'm available.” Even when young people are willing to talk, they usually don't approach a parent until a problem arises – so you're already halfway too late and back in the reacting ring. There are ways to get parents and children together on a regular basis in a listening and teaching situation so that decisions are made prior to the appearance of a potential problem.

The most successful families always seem to have a few things in common in this area. They all find time to get together frequently as a group. Many schedule a regular night each week to have a family council and enjoy activities. The parents can take a few moments when the opportunity arises to instruct the family as a whole on rising trends within the society which they desire to avoid as a family. Group teaching situations of this type are very favorable in the sense that they avoid embarrassment or confrontation with any particular member who may have a problem in that area. In addition, most successful families have firmly established a system allowing each child personal, regular access to each parent. Some achieve this by establishing regular times to help their children with their homework. Other successful parents set aside a certain hour each night (from 9:00 to 10:00 p.m., for example) when the children know their parents are available to “chat.”

But no systematic way of running a family substitutes for parental watchfulness. Most parents frankly don’t have a clue about what is really going on inside their children’s mind. They have trained themselves to be “non-judgmental” which, in my opinion, is suicidal to the thinking process. When a parent regularly practices disregarding his or her suspicions or hunches in the “hopes” that everything is all right, that parent loses critical timing in the resolution of problems when they may still be small. Waiting till the evidence is out in the open is sometimes too late. I believe in getting children to overcome innate weaknesses early in life. I never accepted problem attitudes or behavior as “normal” in my family – no matter what other families did. When you correct attitudes, rarely do bad actions show up. But you can’t simply ask children to improve an attitude. You must demand they get over improper attitudes and then follow up with physical punishment if they don’t. This only works, however, if you teach a child how to listen to his conscience. When you take time to discuss what you really know inside from conscience, there will be a solid basis for discipline. Otherwise, the child simply has an excuse to blame the parent for being “oppressive.” The nice thing about conscience is that as a parent, your own conscience can help perceive when your child also knows what is right – so don’t let them play like they don’t know when you perceive they do. How can parents know? Well, first they must live by the promptings of conscience themselves so as not to be hypocrites. A parent’s sensitivity to conscience improves the more he or she follows the dictates of conscience – the very same lesson you are trying to teach your children. Because conscience comes from a divine source, honest and sensitive parents not only hear signals directed at them, but they can also sense what signals are being sent to their child.

There are two basic rules of conscience that we employed in our family. These two rules will cover almost 90% of all family problems, for both parents and children.

1. **Never do anything you feel nervous about, as to the correctness.**

2. **Always force yourself to do the things you know you should do – especially when you don't feel like it.**

The first rule sensitizes everyone in the family to the basic signals of conscience – those little nervous feelings that tell you that what you are planning to do is either wrong or not quite right. Everybody knows this feeling (after about 4 or 5 years of age). You do have to teach children and adults how to distinguish between nervousness because something is new and difficult, and nervousness because it is wrong – there is a difference that takes practice and discussion to learn.

The second rule covers all those little promptings we get from conscience to do things we know we should do, but don't feel like doing – to do our homework when we would rather play; to do housework rather than to watch TV; to help the wife fix something when we would rather read the paper. These are not rules, per se, but rather common examples that all of us should relate to. Sometimes conscience does allow us to relax before doing something hard, but usually it's the other way around.

The Twelve Principles of Child Discipline

Here are a dozen principles of discipline that should help you get your family straightened out quickly. This is simplified and could merit a book by itself, but you will get the general idea.

1. Learn to possess a higher **allegiance to what is true and right** in any given situation than to the desire to maintain good feelings with others.
    - A person who acts with excessive deference to people's feelings will never be capable of effective discipline – especially with the persistent cases.
    - This principle does not promote insensitivity since a proper understanding of the truth surrounding each circumstance includes a correct analysis of how to treat the people involved fairly.
2. Become sensitive and loyal to the **tough promptings of conscience**, as they apply to both parents and children.
    - Most people are innately predisposed to dealing softly with people and are rarely willing to accept the tough signals from conscience – to discipline and to give strong consequences when necessary.
    - Practice <u>being tough on yourself</u> and you will get better at hearing the proper balance of signals.
3. Require that **all actions** (even in play) **be controlled**, thoughtful, and productive so that children can hear the voice of conscience when it prompts.
    - Teach and expect children to <u>mentally slow down</u> and <u>check regularly</u> for "nervous feelings" about the correctness of what they are doing or intend to do.
    - Help them learn how to hear the promptings of conscience reminding them of things they "should be doing" as opposed to what they "want" to do. When you find them wasting time or sitting around not doing anything productive,

make them check their conscience for a list of several better things they should be doing – then pick the one they feel they should be doing. Correct them if wrong.

4. Require **total compliance with what is right** from everyone in the household, in all circumstances, without exception.
    - Children (who are not innately predisposed to peaceful, controlled behavior) never learn to love doing what is right unless they do it all the time, so that they can feel the inner peace of doing what is right.
    - An innately rebellious child will never learn to love the truth, but he or she will at least comply while in the home – if you enforce these principles. Your only consolation will be that none of the child's willful rebelliousness will have been due to parental permissiveness – and that is very important.
    - Allowing children to be good "some of the time" and mess around freely at other times foments a resentment for the restrictions of good actions, and never leads to the child's learning to love truth.
    - Allowing regular contact with children having bad habits will severely undermine your child's willingness to do the right things. Children don't need a lot of social contact with other kids, despite what all the experts say.
5. Require the **regular use of self-control** and willpower enhancing exercises to ensure parents and children can muster the strength to comply with what they know is right.
    - Rigorous cardio-vascular endurance exercises (running, strenuous biking, etc.) are the best way to instill stronger willpower over things of the body.
    - Regular restraint of both overeating and the eating of junk food/drinks is also very effective.
    - Listening carefully to the numerous daily promptings toward self-denial of bad habits and desires that come to each person's mind (via conscience). Expect everyone in the family to listen and comply with these self-denial promptings and will power will increase dramatically.
    - Control exercises for young children and babies: here is the principle that underlies the proper use of spanking for young children. **External,** physical discipline forces children to use **internal** self-control to suppress their own errant wants in order to avoid the pain. Never let a child throw a tantrum at any age – spank immediately to give a strong signal that tantrums are always unacceptable. Never allow children to yammer and complain. Ascertain immediately if the need is legitimate or not. If not, demand immediate silence; spank if they don't comply. Expect children to stop crying after allowing sufficient time to get over their pain. Expect them to respond the first time to one word commands: No, Stop, Wait, Quiet, Relax. Respond quickly to children's true needs. When they begin to interrupt unnecessarily, demand that they wait until you can get to them. Don't allow them to continue to harp at you after you have told them to wait. Be very strict about this, and they will learn to suppress the need for instant answers. Correct their

judgment when they talk too much, or ask too many questions, or make too many interruptions. Often, it is more important for some children to learn to control their excess mental activity than be given answers on demand. When they are too tired to control themselves, make them go to sleep. It does little good to reason with children who are out of control through fatigue. In short, never allow misbehavior, tantrums, or uncontrolled crying or complaining and these behaviors will disappear quickly (unless the child senses you really lack resolve).

6. Discipline according to **violations of conscience** rather than rules.
    - Set down general rules only as an ultimate safeguard when there is a high probability that conscience may fail to get through or be disregarded, but discipline the violation of conscience, **not the rule**.
    - This includes avoiding the tendency to create rules based on promptings of conscience. "My conscience told me this was wrong, so I'll make it a rule." This leads to discipline based on rule breaking, rather than listening to conscience.
7. **Discipline bad attitudes** before they turn into bad actions.
    - Children and adults can and should be expected to recognize bad attitudes (depression, sulkiness, cockiness, light-mindedness, etc.) and use mental self control to control it and change their attitudes.
    - Teach and expect all to check their conscience for things they should be doing when depressed. Getting up and doing what one knows he should do is the first and most effective defense against allowing minor depression to turn into chronic depression.
8. **Match the intensity of discipline** to the degree of the rebellion when the correction is right and proper.
    - Don't talk too much. Short commands are better than many words toward instilling a sense of urgency in compliance. Save the explanations till after compliance comes.
9. Parents must **discipline with sufficient strength** so that the problem is solved quickly and does not happen again.
    - Vary the forcefulness of the discipline according to the willfulness and/or sensitivity of the child, but always use enough power to achieve a quick cessation of the action and instill a sense of deterrence.
    - If the problem persists, you didn't do it right or strong enough the first time.
    - Physical discipline is far more effective than repeated words when dealing with children who are prone to sloppy habits and lack of attention to detail. Painful discipline makes the memory sharper.
10. **Never repeat a command** or correction (when heard and understood) – discipline immediately if they willfully disregard.

- Once children learn that physical discipline always follows any purposeful disregard to a verbal correction or a call to present themselves, they will never delay or snub a parent's call again.
- This process ensures that the efficacy of your verbal commands will be maintained and that they will be useful when they really count (like in an emergency).

11. **Don't stop the discipline process until both compliance and humility is achieved** – then sit down and talk it over so that feelings are healed.

    - Don't ever discipline half-heartedly (when correct) and then allow a child to scream and yell back in your face, or talk back to you – knowing that he or she is in the wrong. The object of discipline is to achieve compliance and humility in the face of error. You only breed long-term disrespect when you accept a conciliatory position short of complete humility on the part of the offender.
    - Strong-willed children do not respect you when you apologize or try to give them acceptance love when they are still in rebellion to what is right. First discipline hard enough to gain true submission. Then and only then is acceptance-type love appropriate.

12. Parents must be willing to **apply the ultimate consequence**, when discipline fails.

    - Let all the children know at the onset that when the severity of the discipline required to obtain compliance from them exceeds your ability or willingness to apply it (because it borders upon physical harm), the child will be removed from the home. That is the absolute, bottom line rule: *No one will be allowed to live in this home who is in open rebellion to anything he or she knows is true*. Sounds harsh, but if you start compromising on a "little" rebellion, where does it end?
    - If you draw this line early and they know you mean it, most children will not even get close to testing it. If you wait to implement these principles until they already love their bad attitudes and habits, then you will almost assuredly have to use this recourse at least once.
    - Your chances of getting a real change in behavior with a rebellious child are greater when you use this early, than if you keep compromising and use it too late. Otherwise such children can become so hardened that even the hard knocks of life outside the home won't bring them back – and that's your fault as well as theirs.

Notice that in successful families, unity doesn't just happen. Just like any form of preparedness, family unity is achieved by those parents willing to pay the price, which always involves a significant portion of ***time***—not just "together time" but time spent teaching and influencing the children on specific issues. Take time to discuss your children's habitual weaknesses so that they become cognizant of those weaknesses and recognize when they are succumbing to them. May I emphasize again, that maximizing time in the development of human bonds will pay more dividends in a long-term crisis than the material storage items, which are essentially short-term commodities.

Develop Informal Analytical Habits

Once an atmosphere conducive to teaching and mutual communication is established in the home, watch for opportunities to analyze the relationship between principles taught and actual present-day problems. The television can be of some limited, positive value in the home if time is taken to analyze with children why problem people act the way they do under certain situations. Analysis sessions can be informally developed after the evening news. Casual discussions around the dinner table are especially enjoyable. In-depth analysis of any problem, person, or situation takes a lot of careful observation, questioning, and research. The development of these habits early in children will help them to see what goes on around them. However, one must exercise caution to make sure that children don't transform analysis into the destructive form of criticism and the negative, cynical habits or attitudes which sometimes follow. Young people need to be taught realism – not undue optimism or pessimism. With the development of analytical habits, family conversations become less shallow or superficial and starts focusing on the "real reasons" why people do the things they do.

Help Children Develop Proper Priorities and Desires

One of the signs of the declining moral character of the nation and its people is the feeling that if you avoid that which is illegal or criminal, you are okay, and that everything above that illegal base line is a matter of personal choice, not subject to judgment of right or wrong. The natural outgrowth of such a philosophy is the tendency to push the limits to the maximum; to walk as close to the border line as possible so as to maximize your opportunities ("What can I get away with?"). The secondary result is the slow erosion of the border line until more and more things become legal and therefore "good." The obvious error in analysis is that the absence of illegality does not equate to goodness. Without delving into a list of right and wrongs, parents can utilize an effective procedure to assist their children in avoiding the "what's wrong with it" syndrome.

In dealing with any child's desire or request, it is beneficial to establish the understanding that the child is expected to explain what's good and beneficial about what he wants to do or buy. Expecting the young person to explain how this desire or action is going to assist him in developing his character, channels his thinking toward positive priorities all the time. Of course, this does not preclude wholesome recreation, which is very much a part of character building. It effectively removes the burden of proof of "what's wrong with it" from the parents and forces the child to start thinking about choosing the best, not just avoiding the wrong. Naturally, if the child really doesn't know what's wrong with a certain action, you should help him or her understand the dangers. Further development of this technique allows for the increased expectation that a portion of a young person's endeavors should be involved in being of service to other people – not as a rule of life, but as a response to the promptings from conscience to help someone else, even when it may be a sacrifice. This further expands his priorities to include unselfish endeavors. The most beneficial result of this method is the elimination of most arguments and wasting time in legalistic but worthless pastimes.

Review the concepts involved in the "Law of Change" as you discuss a young person's desires. Come to an understanding together on what the price is to achieve what he

wants. Many people switch aimlessly from one interest to another because they don't realize what the price is that they will have to pay to be successful in any one endeavor. A child learns early in life that all worthwhile and lasting endeavors have fairly high prices. This realization helps a child accept the fact early enough to overcome laziness and learn to enjoy honest effort.

For example, if he wants to go to the beach all weekend, have him point out what other desires and responsibilities he will have to sacrifice for this one desire. Is it worth it? And if so, what plans have been made to compensate for lost time to ensure the accomplishment of other responsibilities (e.g. homework, chores, etc.). This guided discussion should not be a negative experience. Child should learn to see it as an assistance to their ability to order set priorities successfully and, ultimately, to be happier individuals.

Learn to Match the Correct Leadership Technique with the Person's Receptiveness and the Situation

I recommend, when time permits, that parents begin exercising the type of leadership that allows for the greatest amount of freedom for the child given his attitude or behavior. In the following discussion on several types of leadership, watch for the various factors which determine the type of leadership that should be used. These factors include:

- Whether the change is urgent, needful, or just nice to have
- Time frame required to achieve the change
- Receptiveness of the person needing change
- Results of previous efforts and the potential future consequences

Permissive Leadership

This should only be used for non critical situations where it's simply nice to have something done your way, or where you lack any authority over the person. This is basically just an invitation since there are no consequences for refusal to act or change. If there are dire consequences to the person in his current state, you are doing him a disservice by being permissive and should switch to a more persuasive type of leadership.

Leadership by Active Example

This is one of the highest forms of leadership and is seldom used due to the time and effort required of the leader and the receptiveness required of the person being led. I am not referring to being just a *passive* example, hoping that the person sees and likes what he sees. Here, refer to areas in which the parent or leader has first become successful himself, and second, has learned to enjoy the effort required for success. You serve as an active example when you take the person with you as you go through the action or procedure, and you share with him your enthusiasm and enjoyment as you work. This is the finest way to elevate someone's desires and to let them feel your success and enjoyment. Many children and women never learn to enjoy camping because they had no one to make sure they had a smooth, enjoyable, and successful experience when they first began.

Persuasive Leadership

This type of leadership should be used when change is very important, but where the person's freedom to fail must be maintained. There are always consequences for failure, under persuasive leadership. Sometimes the consequence only amounts to the denial of certain desired benefits linked to successful completion of the task. In persuasive leadership, you employ verbal reasoning incentives and consequences to either pull from above the person's level of satisfaction, or push from below, or both. Verbal attempts to draw a person upward take the form of relating your own similar personal experiences or those of others, describing the benefits involved in the change. Many leaders effectively portray the person as if he were changed already; they graphically describe his increased happiness and potential. A skilled speaker can often paint a verbal picture which is better than the real life situation would be. Care must be taken to stay within the bounds of realism. Too much positive motivation is a real "downer" when it proves totally unrealistic.

When a person fails to respond to positive pull from above his level of satisfaction, it is usually beneficial to attempt some push from below – especially when the consequences of inaction are rapidly approaching. Many people reject this very useful aspect of persuasive leadership under the blanket condemnation that it is using "force." Not really. There is a distinct difference between heavy pressure (where the person is still free to fail) and force (where the only other choice is death, injury, or total loss of freedom). Pressure from below can take the form of verbally discrediting his present level of satisfaction (with the danger of defensive entrenchment occurring on the part of the individual), applying personal negative consequences to his inaction (restriction, loss of privileges), or simply pulling out any support from his current state so that the full impact of his poor position can be felt. This leadership technique is most appropriate for those people who, through a long history of rebelliousness and failure, only respond to physical discomfort. That is, they only move ahead enough to avoid pain and then they stop. Thus, you have to open their eyes to the uncomfortable and insecure position they are really in. When they still refuse to see, one must allow them to feel the discomfort, through either natural or man-made consequences. The least offensive type of consequence is to allow the person to fail while still giving him the normal amount of support after the warning. When or if he fails, hopefully he will appreciate your wisdom and support shown by giving him the "benefit of the doubt." This must only be used once per type of problem and only when you are assured that the consequence is not permanently disabling.

Authoritarian Leadership

Contrary to popular belief, there is a place for authoritarian leadership – but only under careful and important circumstances. The first instance is when time is of the essence, leaving no room for persuasion or explanation (such as in an emergency or life or death situation). The second reason is when the person needing change has become so rebellious or willfully malicious that only the threat of physical force will motivate him to change. By definition and by title, this type of leadership must only be used when proper authority is vested in the person providing leadership. That doesn't mean you have to be a person of official authority. Sometimes, in defending your own fundamental

rights, or those of your family, you have the right to enforce your demands for compliance upon those over whom you would not normally have authority.

It is important that parents and children understand the strict conditions surrounding the justification for use of force. This alleviates the misconception that spanking is a perpetration of violence upon a child. The child learns to understand that the parents are consistent and that physical discipline is only used when the violation is severe and when other persuasive efforts have failed, due to rebelliousness, not ignorance. It is always important, prior to physical discipline, that the parent sees that the child is aware of his mistake and the parents' previous efforts to correct the child have failed. Afterward, an increase in affection and respect should be shown (but only after a change of attitude is manifested) so that the child will not feel like the parent dislikes him personally.

Conclusions

I know these changes may seem overwhelming, if not impossible for you – especially if bad habit patterns have already developed within the home. Your children may already be grown. In any case, all successful and happy adults have to someday learn to abide by the principles of conscience and self-discipline that I have described here. This process obviously works best if practiced from the beginning. But it is never too late to start living these principles. It is just more difficult and requires more pressure to encourage the change. But having lived these myself and successfully helped my own family (and a few other families) to live them, let me pass on a few observations:

- First, remember to expect full compliance with truth when you make the change. Letting yourself or your children get away with halfway compliance never leads to a love of living the right way. Your only hope of converting your family is to make sure peace and good judgment are always present in your home. Bear down on the bad attitudes and nearly everything else will take care of itself. Don't think you can do this and still send your kids to public schools (or even private schools that act like public schools). Bad attitudes picked up by peers are very hard to undo when kids come home.
- Second, while you can demand and enforce compliance only when your children live at home, you can still influence your children once they have moved on. Keep trying to influence your children even though they may be resistant at first. Hopefully, life will eventually make a believer out of them.
- Last, as you try to influence family and friends, remember to be perceptive of what kind of innate spirit each person has. Search out the ones who are naturally in tune with truth. If you are having to push too hard to convince, they are probably not receptive. Remember that this earth life is a test of our sensitivity to truth and our willingness to obey it. Let the Lord take the burden of the sadness of people's rejection. We have to move on and work with those who are willing to be led.

Chapter

2

Strategy and Training for Quick Reaction to a Crisis

There are many people who have accumulated survival equipment, as well as defensive arms, who are totally unprepared to use them. While in certain crises there is sufficient time to get out the manual and learn how to use a piece of equipment, there are many other situations in which you must act instantaneously, and how you act will be a matter of life or death, safety or injury. The purpose of this chapter is to offer you some concrete guidelines on ways to precondition your mind to react quickly and firmly in a crisis without panic. The degree of calmness you possess will depend upon many factors, but primarily upon the following:

- Whether you have rehearsed the procedures enough times in your mind to react without undue hesitation when needed.
- Whether you have the training to use a skill confidently.
- Whether the other family members know what they should do, and whether each is aware of what the other knows.
- Whether you have the response equipment readily at hand, available for use.
- Whether you have the mental and physical well being to handle the threat and survive the stress.
- Whether you have any faith in your personal worthiness to merit some divine protection or intervention (no guarantees, naturally).

In general, I am convinced that preparation in sound tactics and having a confident mind (born out of regular practice) are far more significant than the actual sophistication of the equipment. In self-defense a lot of people talk about the stopping power of a .45 caliber weapon. While true, I believe that the most important part of dealing with a threat involves an accurate and timely reaction to the intrusion with sufficient tactical savvy to get the proper defensive weapon into use without any hesitation or delay. The actual pulling of the trigger and the aiming of the pistol, while very important in the final results, represents less than 5% of the decision-making process that leads up to a proper defense. Your chance of making a wrong decision in that early reaction phase is far greater than the chance of being defeated because of insufficient caliber or expense in the purchase of the weapon. There are exceptions, to be sure, but the general rule stands. A

tenacious and prepared mind will prevail with a .22 caliber weapon over a timid and indecisive person with a .45 who has never practiced and who can't get to the weapon quickly.

SPECIFIC TACTICAL CONTINGENCIES

In developing security procedures, you must analyze as completely as possible all of the factors that will influence your actions. The better you prognosticate where and how the threat will come, the better you can precondition your mind to react without hesitation. When the factors are too complex, you work at eliminating some of the possible threats so that you only have to worry about a few. Some threats are so random and so indefensible that it doesn't pay to worry about them – like a direct nuclear strike over your home from a missile gone astray, or a catastrophic, worldwide earthquake that destroys everything. If it comes, it comes. Don't waste mental energy worrying about the extreme cases that you cannot prepare against. Consider the following general procedures in developing your protection plans:

1. Select a specific threat and break it down into the various sub-threats which may need a slightly different manner of defense.
2. Determine the most likely direction in which the threat may arrive. If there are too many alternatives, consider any remodeling or situational changes that will narrow the alternatives and force the threat to come through a more defined area (which can be better defended). If you cannot narrow the direction from which the threat comes, you must either defend against all possible directions or prognosticate the most likely direction and hope you are right.
3. Determine the persons who would most likely be the target of each threat and when and where they would be most vulnerable (kidnapping of children, for example, walking home from school alone).
4. Select a defensive strategy for both the potential target and the person providing defense. It's not enough to blindly defend a family member if you can't survive yourself.
5. Select the location of equipment that must be strategically located in order to be useful at the time of crisis.
6. Identify people who can be called upon for assistance and make a list of how and where to reach them.
7. Plan at least one other contingency for each plan, including alternate escape routes.
8. Discuss false alarms and the safety of innocent people who may accidentally intrude upon a danger zone.
9. Determine a fixed safety limit at which you will make a go-no-go decision and stick with it.

SUGGESTED SECURITY PROCEDURES

Practice developing procedures to safeguard against the following:

- ARMED INTRUSION at home, at night
- ARMED INTRUSION during the day
- SEXUAL ASSAULT
- KIDNAPPING
- MOBS and SOCIAL UNREST
- UNJUSTIFIED OR ILLEGAL ATTACK BY GOVERNMENT AGENTS
- FIRE
- NUCLEAR WAR (Nuclear, Biological Or Chemical Attack)
- EARTHQUAKES, TORNADOES, and STORMS

Armed Intrusion at Home, at Night

If the intruder comes at night, he will most likely attempt to enter secretly. Ruses, or the use of deception to set you off guard, are usually reserved for daytime intrusions. At night, the direction of intrusion will usually be through the most easily accessible way that offers the intruder some degree of privacy and silence. That will not usually be the front door unless it is secluded, unlocked, or easily picked. Sliding glass doors, back doors, and windows are always a prime target due to their ease of access and non-secure construction.

As in all security situations where human intrusion is concerned, it is desirable to have an early warning system, preferably around the outside perimeter of the home, so as to detect the intrusion prior to the breach of the exterior wall. Where this is not practical, all potential entrances can be monitored by sensors, and/or the interior spaces can be monitored. If perimeter warning is not available, it is nearly mandatory that bedrooms be secured with a separate lock and a strong door to provide an inner ring of security. In this way, the initial intrusion into the house serves as the perimeter alarm. The difficulty here is that, if you have children to protect, you must mentally account for several inner security areas which may not be defensible without going outside of the security of the master bedroom. Specific equipment and electronic strategy will be covered in the Security chapter.

When a potential intruder is detected, it is essential to make some type of identification to ensure it isn't one of your own family members. Obscure lighting is important so that you can make the detection and identification without exposing your position and means of protection. I prefer some exterior night lighting around the outside of the home so that diffused light enters the windows. This is usually sufficient to see the size and shape of forms well enough to make an exclusionary identification. In other words, your primary interest is to ensure it is ***not*** one of your children or a good friend or neighbor. Make sure your adult friends and neighbors never establish the habit of entering your home unannounced – especially at night – since you want to completely preclude the chance of accidental defensive harm to a friend. Locking all doors each night is essential to your

determination that someone isn't going to wander into your home using one of many phony excuses like, “I had a flat tire and came in through the open door to use the telephone.”

If you hear sounds at night or get a signal from your alarm system and desire to make a positive identification, first stop and listen to the nature of the sounds. If you have a listen-in intercom, use that as well, but some of your best indications come from your knowledge of which creaks and sounds within your home are “normal” and which are not. If the security door on your bedroom has a peep hole (a good idea), always check it before opening the door. Don’t turn on lights that illuminate you. If you use a flashlight, never hold the light in front of you, but rather out to the side. If an intruder lunges or shoots at the light, you will not be in the line of fire.

Once you decide you definitely have an intrusion, make your telephone call to the police or security central station (you may have an alarm system that does this automatically). Hopefully, you have a phone in your bedroom which only requires that you punch one button to dial 911 for police or fire. Take charge when you make a call. Do not let the dispatcher at the police desk take his or her time going through the list of required questions. As soon as the phone is answered say, “I have an intrusion at (your address). My name is (state your name). Hurry!” Then leave the phone off the hook, so the 911 recording can pick up what happens. Do not wait for them to respond or ask you to spell your name, etc. Every second you get distracted by the police bureaucratic procedure is another second you are exposed to the approaching threat. You must continue to monitor the progress of the intruder by sound or electronics to know if you have to take immediate action to protect yourself or the children before the police arrive.

If you have to take immediate action, you have to decide upon two choices – to use either lethal or non-lethal weapons. Do not consider talking as an option. An intrusion into your home at night, when the doors and windows are all closed and locked should always be considered a life-threatening situation. You must never, under any circumstances, get yourself into a talking and negotiating position. You must always assume that there are others on the premises who you do not see. I would only recommend non-lethal weapons like liquid tear gas canisters (CS) or pepper spray if the threat is already upon you physically and you have to grab for something quick to disarm the person. Since guns must usually be kept in safer and harder to get at positions than chemical weapons, I would grab for the chemical weapon close at hand rather than search further away for the firearm. If there is no immediate threat to you personally, but there is to the family, grab the lethal weapon.

It is important to plan several “go-no-go” decisions before engaging the intruder. If you find someone unauthorized in your home at night, where you are sure he had to break in to be there, and he is making no obvious attempts to awake you by calling out, then you may assume he is an intruder. All intruders have ready-made excuses in case they are caught. Do not let them start explaining away their presence or work on your sense of pity. You must add up the evidence before you make your single clinching question or statement to the intruder, which will determine his relative innocence or guilt. Check to make sure the sounds are that of an adult (or at least totally different than your children). You should know where your spouse is already. Check the shadows to make sure it is

adult size and totally unfamiliar. Get ready to ask your one and only command/question. State in loud, forceful words:

"STOP (or FREEZE), WHO'S THERE?"

If he runs, let him go. Do not pursue him unless he is stealing something you want to retrieve at high risk. If he doesn't say anything, do not repeat anything immediately. Let him make the next move. Many armed professionals are good enough to shoot you by sound. If there is no answer or movement within 4 or 5 seconds, or if the intruder makes any move except toward the door, SHOOT. If he answers and the voice is unfamiliar, let him finish his explanation (as long as he is not moving), then command him to put his hands behind his head and sit down on the floor. Tell him you won't hurt him if he complies quickly. Be very firm. If he refuses and continues to talk, there may be another criminal in the house maneuvering to get you. You have no choice but to shoot if there is any movement toward you. In the dark you cannot make a clear determination if he has a lethal weapon, but you must assume he does. To do otherwise is to allow him to approach so close as to preclude any defensive response. Unfortunately, if you have to shoot, you must shoot to kill, or prepare to face our unfortunate system of "justice" that will allow the criminal to sue you and make you his debtor for the rest of your life. Any other procedure is stupid and suicidal. If he complies with your request, simply hold him for the police. Be watchful while you are waiting in case a second person attempts to come to his rescue.

If you live alone and are somewhat timid about the foregoing procedure, there is nothing wrong with waiting it out in the locked bedroom until the police arrive. Even if your phone lines have been cut, you can still wait it out since the intruder is extremely vulnerable in having to come to you through your door or window. As long as you are armed and intend to use your weapon, you will come out ahead. If your door or window is penetrated with force, shoot without asking any questions. Don't worry about the fear of shooting a fireman by mistake who is trying to save you from your house being on fire. They would have been yelling to wake you up far before they started breaking down doors. In Chapter four of my book *How to Implement a High Security Shelter in the Home*, I detail how to make your master bedroom closet bulletproof with special gravel-filled walls. This also works very well on your master bedroom walls to further protect you in the above situation.

Armed Intrusion During the Day

Daylight intrusions will most likely be accompanied by a ruse or deception designed to allow the intruder to get close enough to you to overpower you. Someone comes to the door or walks in pretending to be someone he is not. If it is an intrusion at a place of business, the problems of differentiating customer from foe are almost impossible until it is too late. However, in a residence, if he is inside unannounced, you may be fairly sure something is amiss. However, since during the day you may not have your doors locked, a door may have been left open in warm weather, or someone may be coming in to report an emergency out in the street with your child, so you cannot use the same intruder-danger identification criteria that you can at night in a secured house. In this case the threat criteria is complex and it becomes difficult to make a quick decision. Fortunately,

you have the advantage of daylight to make a more positive identification and to detect bad intentions.

Certain common security features can place a safety buffer between you and a potential ruse at the door. Peep holes for visual ID and external speaker/intercoms are the most common. These are effective unless his sales pitch or reason for coming is convincing enough that you open the door. Obviously, the better your sensitivity to nervous feelings the better your judgment will be in avoiding marginal situations. If in doubt, have a non-lethal chemical unit in your hand, ready to use. This should be standard procedure anytime an unfamiliar service man comes to work on an appliance. Always ask to see someone's badge or identification, even with police or other “official” persons in uniform. Uniforms can be stolen or rented, so never assume a uniform is the same as identification. Identification badges can also be faked, so look closely at the badge to make sure it isn’t some generic mail-order version. When calling for an appliance repairman always ask who will be coming and get a general description.

Let us suppose the worst. Someone barges in your door and starts to tell you something. If it sounds the least bit suspicious tell him “STOP RIGHT THERE – JUST WAIT!” and move immediately toward your nearest canister of pepper spray. If your judgment of the person is extremely suspect, get your lethal weapon. If he follows you instead of waiting, run to your weapon. If he doesn’t follow, call 911 for safety and then return to the confrontation with the canister or weapon hidden behind your back and your body. Be determined that the intruder stays at least 10 feet away from you.

Remember, the weapon behind your back is never to be used to argue or negotiate with. Use it only to disable the person if you determine that the intruder fully intends to do you harm, or refuses to stop and penetrates your “safe zone.” The first thing you say is, “PLEASE GO BACK OUTSIDE IMMEDIATELY AND I WILL TALK TO YOU THERE!" If it is a bona fide emergency, he will tell you in the next breath, regardless. At least you have made a first statement that is going to give you an indication of his intentions. This is essential to your decision. If he hesitates or starts to make an excuse about something that is not an extreme emergency, say, pointing to the door, “MOVE...NOW! I’LL ONLY TALK TO YOU OUTSIDE!” If he doesn't respond and doesn’t move any closer to you, keep listening but look around quickly for anyone else. Within one sentence you should be able to determine if you are in danger or not. If he begins to move any closer after having stopped previously, yell, “STOP...NOW!” One more step closer and you use your weapon.

If using a non-lethal weapon, make sure that you get the eyes and that he is incapacitated before going for help. If a lethal weapon, shoot to kill. Never stop at wounding a person once you are sure the intruder is aggressively out to harm you. You can never imagine how crafty, in combination with an amoral defense attorney, an wounded intruder can be at concocting a story of sympathy and tear jerking potential. He can even get his buddies to testify on his behalf. You, the innocent victim, will end up paying him money for the rest of your life. How can you prove the feelings you felt and were sure of before you acted in self defense? You can't, but he can sure prove that he has been harmed. He becomes the invalid to pull upon the mercy of the jury and you become the bad guy who hurt him. Once again, never shoot until you are sure of his aggressive intentions to

toward you – and then shoot to kill. Lastly, don't be a Pollyanna who keeps trying to convince herself that there is no need to shoot as the person keeps advancing. Be tough.

Remember, just because he doesn't have a gun in his hand doesn't mean you can't use lethal force. Assault, rape, and murder can be accomplished without lethal weapons and you have every right to defend yourself with lethal force if the person threatening you can reasonably be perceived as larger, stronger, or more aggressive than you. The important thing in establishing your defense is to have these clear procedures in your mind so that you can establish in any court that you have definitive mental and verbal barriers established for your safety, which the criminal breached. I repeat, you do not have to wait until you are actually victimized to use deadly force. Threatening movements toward you in opposition to demands to stop and leave are sufficient to justify such a response within your own home. You cannot use deadly force on fleeing persons, however.

The essential tactical procedure is to make a firm determination that 1, he doesn't have a bona fide excuse to have barged into your home; 2, that he demonstrates at least two times that he is not going to obey you; and 3, that he is moving toward you without obeying your emphatic demand to stop. You now must act or you may not have another chance to act under your own volition. Keep in mind the importance of having a mental picture of what you will do and the firm limits of your protective "safety zone." Never let anyone dangerous penetrate that zone (an 8-10 ft circle) without your taking action.

Sexual Assault

This type of assault is usually done with the maximum amount of stalking and surprise. Rapists know that victims get strong warnings from conscience (extreme nervous feelings) prior to the assault. Expect the use of a variety of soothing words on the part of the potential attacker in an attempt to disarm your nervous feelings. This is a prime example of how dangerous it is to get into a habit of disregarding nervous feelings from conscience in your daily affairs. Such rationalizations keep you from reacting quickly when you need to. Even the criminal usually experiences considerable nervousness leading up to the commission of a crime. He knows it is a crime and he has a plan with his own contingencies. He has a certain fixed set of images in his mind of how a person is going to react when they realize they are threatened. If he has any experience at all, he realizes that most people are going to fall apart with fear. They freeze, get timid, start to talk a blue streak for mercy and pity, and in short give the criminal all the information he needs to type them as predictable and weak. So, you must prepare yourself mentally to blast him with an emotional image that he is not prepared for and cannot cope with effectively.

The SCREAM Maneuver

This technique I call the "S.C.R.E.A.M." maneuver. It looks like it only involves screaming, but it actually stands for Scream, Explode, And Move. This maneuver is guaranteed to give you the maximum advantage in a situation where you are already in direct physical contact or seconds from it. It will even help if the primary motive of the intruder is murder. Take the example of a person in bed who is the object of an intrusion.

If you awake and sense that someone is in your room approaching you, take no more than a second to get your bearings and then explode with a scream as loud as you can, at the same time flailing the covers upward and outward as you leap out of bed, screaming like a madman. Even if the covers don't hit the intruder, he will certainly be thrown off guard. In most cases he will be shocked enough to back off. Even if he still intends to strike out, he now has a dark, moving, flailing target. Before the intruder gains his composure, you seize your pepper spray and spray in the direction of the intruder. As soon as he is incapacitated, call the police while watching for other intruders.

Notice that this technique is suitable for almost any situation. Remember to ***scream***, and ***explode with movement***. The criminal cannot talk to you or issue his planned threat because you are "monopolizing the conversation." He cannot act until he first gets over the shock that just bought you a few seconds. You act crazy, and he may even begin to fear dealing with you. Since most criminals want to accomplish their crime without killing the victim, you destroy his ability to direct you and coerce you verbally. Even if he grabs one of your children, when you go mad and run away the child may be viewed as an encumbrance to him now that he has no parent to coerce, and he may let go. Remember, you never gain anything by talking – you always lose. Deny him time, deny him talk, and thus you deny him the offensive. If he is a real killer, then you would most likely get killed whether you cooperated or not. Better to move with wild surprise, giving yourself a chance to escape and call for help, than to try and negotiate with an armed killer. Even if he doesn't have a weapon, if you submit and he grabs hold of you, he can grab any number of potentially lethal objects to inflict harm.

If, after your SCREAM maneuver, you are cornered and cannot escape, fight and keep on fighting. Never give up. While that may sound rather futile, it will help impress upon you the need to always carry with you some better protection than your fists. Use your teeth and your fingernails, and hit for vulnerable places like the eyes.

I am a real believer in the potent versions of pepper spray, *if* you develop a mental habit of pre-conditioned use. I don't mean just carrying pepper spray somewhere in your purse or pocket. Develop a defensive habit of carrying the pepper spray within your closed fist anytime you are transitioning from a building to your car at night. Holding the unit in your hand every time you go out the door toward your car puts you in a good mental framework to be cautious and observant. You don't have to be paranoid – just careful and sensitive to danger. The time in transit between car and house or car and business is when women are most vulnerable. Always check the rear seat of your car, visually before you enter, especially at night. Always drive with your doors locked when downtown. Avoid situations where you are alone with persons who may become tempted. Always dress modestly in public.

Lastly, do not allow a person threatening harm to your child to deter you from the SCREAM maneuver. With sexual assault, the child threatener is almost always bluffing. Besides, remember that you aren't going to give him any time to even tell you his threat. Your only response is the SCREAM maneuver. For it to be effective, it must be done instantaneously and without hesitation. Teach your children to scream and kick as well. Every "wild man" helps when you need chaos and the intruder wants silence. As in all defensive tactics against potential threats, physical and mental preparedness is not a sign

of being paranoid. On the contrary, being prepared actually helps you to sleep better and not worry excessively about a threat. Learn to control idle thoughts, and do not let imaginative episodes of tragedy rule your life. You cannot prepare for everything, but you can prepare for the majority of threats. Do so and then you can truly relax about life – well....don't get too relaxed. Always keep your senses alert.

Kidnapping

Whether an adult or a child is kidnapped, you must mentally prepare yourself to act with principle, not emotion. Except in instances of terrorism, your chances for the safe return of a kidnapping victim are fairly good, so don't lose your character in the process or the criminal has effectively hurt both the kidnapped person and you.

Your first line of defense is to take precautions against the kidnapping. While this is a threat extremely hard to defend against, you can concentrate on denying a kidnapper an easy target.

The following are sensible guidelines to follow for the average family:

1. Never take your eyes off of a child who is in a stroller or cart when out in public, especially in large amusement parks (like Disneyland) or supermarkets. Baby-napping is big business now and almost impossible to trace since the child quickly adapts to his new set of "parents" and forgets his real family. Don't let this all-too-frequent tragedy happen to you out of carelessness.

2. Don't let children under 12 go unaccompanied anywhere, period. They are prime targets even just walking home from school. Make sure they always develop the habit of walking with one or preferably two other children. Train them not to talk to strangers in cars who may approach them, and to run away and scream if anyone starts to open a car door after approaching them. Some children have to be taught to be cautious. They are usually too trusting.

3. Don't let girls over twelve go anywhere unaccompanied, especially out walking, without carrying some form of self-defense. Don't let teenage daughters take jobs as delivery girls of any sort, or as the sole employee of a laundromat or other shop where night work is common. In some cases, if they are provided with a security system and a weapon and know how to use it, you may wish to make an exception. Watch out for unsafe employment in amusement parks or bad sections of town. The money just isn't worth the risk. Check for nervous feelings when your children present work-related proposals to you. Teach them to watch for nervous feelings themselves.

4. Train all teenagers to carry and use mini canisters of pepper spray or other non-lethal weapons. If your family is a target for a political or terrorist kidnapping, you should also go to the additional expense of purchasing small, mini transmitters available for tracking an individual if kidnapped. It enhances the ability of law enforcement to find someone. Transmitters are worn in a small pouch under the clothing and are actuated with a small pressure switch by the victim when necessary. Further precautions such as bodyguards and armored cars are reserved for severe threat

situations where terrorism is common, and if you have lots of money to throw at security (which also increases the risk of being held for big dollar ransoms).

5. Never take a taxi in a foreign country that actively solicits your business. Since most taxi drivers are hungry for fares, this advise is sometimes hard to follow, but you must try. In many countries criminal thugs use taxis as the main way of kidnapping and robbing rich-looking tourists. Always find your taxis at major hotels where the taxis have to line up at random for fares. Always carry pepper spray when traveling. In most cases, airlines don't let you take it as a carry-on, so check it with your luggage.
6. Always carry portable door alarms or locking devices when staying in hotels or motels, either foreign or domestic. These devices will provide you with enough advanced warning of intrusion to prepare yourself for defense. If these precautions are taken, you will lessen your chance of a being a random victim of crime.

Never Pay a Ransom

With the exception of certain political kidnappings, almost all abductions are done for the purpose of demanding a ransom to further the monetary means of either criminal or terrorist activities. For this reason, it is absolutely amoral and without justification of principles for any good person to pay a ransom. Whenever the loved ones of the victim only concentrate on the hope of securing the safe return of a family member or friend, they fail to see that any money they give would promotes more damage to others. First, it gives a tempting message to all other would-be kidnappers that they also can and will succeed. Second, it gives criminals and terrorists money to buy explosives, rockets, and other weapons that allow them to kill, maim, and destroy many others. Third, it nearly guarantees that the successful kidnapper will strike again when he needs more money. There is no way that good men can justify trading even a valuable person for the lives of countless other innocent people. Since Italy implemented the law prohibiting persons from paying ransoms, terrorist kidnappings for ransom purposes have almost completely disappeared.

What then is your alternative? First, you must realize that once the loved one is taken, you have failed to act preventively and your remaining alternatives are very limited. Essentially, you need some time to let the police do some investigation and tracking. Their main lead will be to try and trace the source of the ransom call or note. Police authorities will differ with my assessment and may encourage you to think about paying a ransom just to lead the kidnappers on, or worse yet, to pay the ransom. It would be permissible to fake a ransom payment if the police have a competent plan to trap the kidnappers in the process. But if this trap fails, you run the risk of making the kidnappers angry and in possibly feeling justified in "wasting" your child or spouse.

So, let's first concentrate on catching them early on. As soon as you suspect a kidnapping or disappearance, notify the police so they can order a quick tap of your phone by the telephone company to trace any ransom call. Usually the first notice a parent has about the kidnapping is by the telephone call demanding ransom. You want to try to get ahead of the kidnappers on the very first phone call if you can. The basic tactic here is to play like you can't hear what is being said, as soon as they begin telling you

they have your child or spouse. Even if you have said hello, or have already answered an identifying question like, “Is this Mrs. Jones?” you must train yourself never to say anything further after hearing the words, “We have your child.” Simply hang up and simulate being disconnected.

This is important to do BEFORE they get their full message out. When you simulate being cut off, they are forced to try to call back. If you are really cool and calm, you can even play act the words, “Hello, Hello....I can’t hear you – must have a bad connection.” Then quickly hang up. All this must be done the instant someone starts to tell you they have your child or other family member (you must pre-condition your mind **not** to do the natural thing – ask questions about the welfare of the person). By disconnecting immediately, it will force them to try to call back. Call the police immediately to arrange the call trace. Remember, do not let the ransom messenger complete his message. If you do, then the onus is on you to respond to their demands.

Once the tap is established, don't answer any more phone calls personally. Have a friend come over to do so. Have them take all messages, acting the part of a baby-sitter. This increases the chance that the kidnappers will keep calling and give the police more than one opportunity to trace the call. Also, they don't have any assurance the message has gotten through to you personally on any deadline they may have set. Make sure the friend plays dumb about when to expect you. Keep those delays coming and don’t let them speak to you directly.

Mobs and Social Unrest

This is a broad topic which could involve a myriad of different threatening situations and an equal number of possible responses. I will try to emphasize some essential and key points. The most common threat of social unrest you will face is a group of malicious vandals or looters, taking advantage of a breakdown in the ability of police to respond during a major crisis. The primary targets of their destruction will be the windows and the interior of the house if they break in to steal or pillage. Security shutters on windows are only helpful if they are in place and closed, which is rarely the case when you are at home during the day and get attacked without warning. Roll-down shutters are also very expensive – over $1000 per window installed.

Acrylic plastic storm windows are, therefore, the preferred alternative for several reasons. With a 3/8” thickness, they are impenetrable except by a bullet or chain saw. You don’t have to take them down – they can stay up all year long. They provide storm proofing and added insulation, and are less than $500 a window when installed by others. If you install them yourself, you can do it for half that price.

Several types of people will become targets of discrimination or persecution in the future. The foremost targets will *not* be Jews as in the previous holocaust. The new targets will be the so-called “right wing” conservative Christians, survivalists, and people who have become vocal about government conspiracy (conservatives of liberty, if you will). All of these groups are resented by benefit-corrupted majorities as well as New World Order leaders who conspire to eliminate constitutional restrictions to government power. The US government has been successful at inducing various fringe elements of the American

right to commit acts that allow the media to portray the entire movement fomenters of hate crimes and domestic terrorism. Within the dark side of government there is a movement to create a new class of enemy in the US that will need to be eliminated someday, just like the Jews. When the ignorant public is convinced by politicians and bureaucrats to look for a scapegoat for their problems, they will most likely go out searching for those who can be accused of being "hostile" and "negative" toward democracy.

Fundamentalist Christians and survivalists fall within this category. You would do well to consider how you will respond to a mob outside your front door, or worse, to a government swat team descending upon your home falsifying some excuse to arrest you and take you away. Actually, I doubt if the "mob at the front door" will be your first indication that someone has targeted you. You and your family will become targets of verbal and other minor abuse prior to serious threats, generally. I recommend several things:

1. Don't try to defend your house as if it were a fortress. It should be strong enough as to its fencing, gates, exterior shell, windows, and doors to withstand general vandalism and typical rock-throwing. Only a very few people can justify the expense of bullet-proof structures. Remember that normal walls are not suitable protection against firearms, so you should never attempt holding off an armed group by hiding behind your walls. You should always keep in mind that if you are targeted by a group and you drive them off with weapons, you can bet that the next time they will be back with something bigger and more devastating.

2. Prepare an alternate concealed exit from the home. It is very important that you are not trapped in a situation which leaves you no alternatives except a life or death confrontation.

3. Prepare your home with a tape recorder or even a hidden mini video camera which can be activated in a crisis. This will faithfully record the intrusion, the foul language of federal agents, their refusal to properly present a warrant, or even the false planting of drugs that federal agents have been known to do in order to justify arresting innocent gun dealers or patriots.

4. Keep most of your essential and valuable storage items in concealed and hardened secret storage so that there is little to pillage if you are a random target of social unrest.

5. If you see social unrest or persecution coming, make sure you prepare an alternate place of residence – even if only temporarily with another family. I would be prepared to send off the family *before* a life threatening situation develops. Often inflamed attitudes will calm down and your family can return. Better to be a month early in escaping than a minute too late. If the father needs to stay for a job-related activity, he may want to consider an apartment somewhere else, or rooming with a friend to avoid being targeted living alone in a house where he is watched. Too many Jews in Germany and Poland lived in denial right up to the time they were taken away. Some refused to believe they were close to being killed, even as they were herded into the sealed rail cars.

6. If long-term persecution is expected, sell your home early and rent it back. Don't be left with a home that a hostile neighborhood prohibits you from selling, waiting to cash in on a “freebie” when you have to flee for your life.

7. Teach your children to become watchful of trouble and not to give anyone an excuse to persecute them. Don't encourage them to compromise principles, however, just for peace. Just encourage them not to antagonize other hostile people. Join with any other local families who are sympathetic with your plight and ask them to warn you if they hear anything coming.

In general social unrest, many of the same principles apply, except that you can usually count on a mob going down a street and indiscriminately hitting all the houses. In such a case, the neighborhood will probably be in a state of panic unless previously organized. If your house has some maximum security design features, it will generally be bypassed by a mob since they won't spend time on one tough house when there are “easier nuts to crack” next door. In such situations, it is best to batten down the hatches, or make your house unlivable with pepper spray or CS gas, and go sit it out in your security shelter. Don't bother calling the police for a huge mob (such as the one that went through the Watts district of LA). They will be too overwhelmed to respond anyway.

Threat of False or Unjustified Federal Arrest

As I outlined extensively in the Government Threat section of my book *Strategic Relocation*, there is a growing threat that the dark side of government is turning its attention to creating a “domestic enemy” within the United States. The new enemy is to be any person or group that espouses any philosophy, religion, or political belief of liberty that runs counter to their eventual plans to take down American constitutional sovereignty and replace it with an all-powerful world government. Already, virtually every well known survivalist or militia group has been infiltrated with government-hired “agent provocateurs” offering and encouraging illegal weapons, explosives, and other provocative material in the attempt to induce a criminal offense. And not just any common criminal offense. They prefer attacks like the Oklahoma City bombing that can be paraded before the world as another example of “right-wing, domestic terrorism.” Special snipers have, I believe, been tasked to shoot at abortion doctors so that the blame can be placed on anti-abortion Christians. These people are without moral conscience, and will stop at nothing to blacken the name of any potential target group before the public. Their ultimate purpose is to so raise the specter of danger from so-called “negative” elements or “extremist” elements within society that it will justify the incarceration of millions. Those of you who don’t think it can happen in America suffer from the illusion that American liberty is somehow “permanent.” It is not, and is slipping through our fingers daily. What freedoms they allow us to enjoy are merely to keep the majority from becoming aroused about the present danger.

Don’t think you are safe just because you don’t belong to any of these groups. More and more we see examples where innocent conservatives are targeted for accusation and their home is invaded on trumped up charges, with no warrant. Evidence of drug dealing is planted, or simply assumed because they have an “unnamed” source who has testified that some crime is going on in the home. Your neighbors see you dragged from your

home in handcuffs and immediately assume you must have been hiding some dark secret – why else would the FBI be treating you like a criminal? You see, all the mechanisms exist for the public to become passive bystanders to tyranny:

- Excess confidence in the "rule of law" (which is becoming more unjust by the day).
- Excess confidence in titles of authority (especially federal authority).
- Partially true propaganda images of our noble FBI and CIA agents "defending our liberties" against criminals (which they do often using fine patriotic agents so as to maintain a benign image, while deflecting attention from the many illegal acts done by other agents on the dark side).
- Secrecy laws which prohibit good agents, who witness these dirty tricks, from speaking out.
- Classifying illegal acts as matters of "national security" to silence any honest attempts to investigate.
- Those who persist in questioning the authorities are threatened with arrest for "interfering with the law." Anyone who even stands by as a witness to an illegal search or arrest is threatened if they don't leave immediately.

The dark side of government needs unprincipled agents to do their dirty work, and every federal law enforcement agency has its "good ol' boy" network of underground agent thugs. They work with "black" budget money (often coming from government drug deals), and their existence is not known even by legitimate good agents within the FBI, CIA, DEA, or Secret Service. These dark agents, often trained as special SWAT teams, engage in assassinations, intimidation of witnesses, frame-ups of innocent people, and any other assignment given by higher command. More and more, state police agencies are being brought into this conspiracy of power, and they work along with these federal agents in order to take down troublesome individuals in communities.

Civil forfeitures are increasingly used to take property from people, without even filing charges. It sends a ripple of fear through everyone when this happens. Since police departments get to keep most of this property or sell it at auction, there is a perverse incentive to plant drugs on property or in vehicles in order to justify seizing them. Police in some southern states have a notorious reputation for doing this on the Interstate highways.

The FBI domestic terrorism branch is dedicated exclusively to keeping track of all potential threats to dark side of government. Its main targets are fundamentalist Christians or other conservatives who are suspicious of government motives. If a person is also a defender of Second Amendment gun rights, home schooling, or constitutional limitations on government, they are even more highly targeted. The FBI lab regularly falsifies evidence in order to convict those who might get in the way of illicit government operations. Often they "take down" their own agents when they sense such agents are getting tired of illegal work. More often, illegal means are used to cover-up crimes,

silence witnesses or in other ways exonerate political collaborators or agents who have been charged justly by aggrieved citizens.

Your greatest defense against being arrested unjustly is to prepare in advance to document the injustice. Alert your neighbors that if any SWAT team should arrive at your home, they should immediately come over to act as witnesses to any wrongdoing. The Feds will try to threaten them off the property, but they must stand their ground, take pictures, use video cameras, and take names if possible. Each person must first try to help your neighbors understand the nature of this threat to liberty. Pick only the best to try and convince. Problem or pro-establishment neighbors will probably turn you in for even believing there is a dark side of government.

These "dirty tricks" teams can't tolerate open scrutiny since their actions against innocent people are always illegal. Demand that they show their search warrants, and be sure to read it thoroughly to ensure it actually names the specific person and address being intruded upon. Make a record of any officers who refuse to show legal identification. Remember what they look like and write down a description.

As part of your security system, it may pay to have a surveillance camera in the house which you can activate with a remote panic button – this will record any illegal invasion of your home. If you can't afford that, buy an inexpensive hand-held cassette recorder with a one-button record feature. Keep it by your bed and turn it on any time you experience a search or arrest by any of these agents. Be sure to keep asking them questions such as, "What am I charged with?" Demand numerous times to see the warrant. If they have one, read it out loud so the recorder will pick up the language – Often these warrants are non-specific or falsified and will not stand up in court (or the one they present later at your trial will be changed). Ask every agent his name and badge number. Bad agents will always refuse to give you that information since their acts are illegal. Talk to the recorder about what they are doing by protesting every action. "Stop going through my drawers. You have no right to take my computer," etc., etc. All this will be very embarrassing for them later in court – especially their harsh tactics, and the filthy language and cursing they use. None of these agents expect to be recorded, so they are often not very careful. Even judges who are bought and paid for by the dark side of government sometimes have to rule against them in order to maintain some semblance of justice on appeal.

Fire Prevention and Escape Procedures

Most fires in residences are preventable and rarely happen in a home that is carefully maintained, and where the electrical wiring is not misused. Wood burning stoves are becoming a major factor in fires. Pay close attention to the section on creosote buildup (Solid Fuel Combustion section, page 498) which, along with improper chimney installation, is a prime cause of stove related fires.

While I am a strong believer in fire safety, I do not believe we are wards of the State and that fire chiefs or building code authorities have a right to infringe upon our personal decision-making in the home as to what is safe and what is not. That represents an unlimited intrusion of lawmaking into our lives. If they can judge any one thing unsafe,

they have the power to judge any other thing as unsafe – their only limit is the discretion of the "experts" and the rule-makers perception of how much the people will tolerate. Please be safe, if for no other reason than to deny the "ought-to-be-a-law" fire brigade any further excuses to restrict our personal freedoms.

Remember that smoke is the real, quick killer of children and older persons in residential fires. Teach children some basic rules to follow if they smell smoke:

- Always feel a bedroom door before opening. If it is hot, it means there is fire on the other side. Do not open the door. Use the window.
- If they must move through the smoke, they should crawl flat on the floor and breathe through any available cloth wadded up. If the cloth is damp, all the better. The best thing is to use a gas mask. Buy a smoke hood or gas mask for each person in the family and have it near the bed. These are wonderful for escaping out of a smoke-filled house. I also keep one in the garage and in the trunk of my car in case I have to rescue someone. Remember, however, that these masks do not filter out carbon monoxide, so your time in a smoke filled house is still limited.
- Teach them to think of waking up others and helping them out. Many times children have saved other children, and even some adults.
- Close all doors to all rooms to keep drafts and fires from spreading.
- Practice escape tactics including the use of multiple exits and rope ladders from second story windows. Show kids how to hang their head low outside of a window even when smoke is billowing out so as to avoid breathing the fumes. Teach them how to use a fire hose or extinguisher, how to recognize the smoke alarm sound, and how to protect themselves from flames with wet clothes or blankets.

If your house has a small fire-fighting apparatus, you should attempt to use it first, but only if another adult is able to handle evacuation of children and if the fire is small enough where immediate action will mean the difference in calling the fire department or not. Credentialed firemen may cringe at any suggestion of homeowners fighting fires, but properly equipped homeowners can usually handle many fires which would normally become uncontrolled within the 5 to 30 minutes it may take the fire department to arrive.

Nuclear Radiation Protection Procedures

Contrary to popular media misrepresentations, the chances of surviving a nuclear explosion are very good if you are not within the actual blast zone. Your greater threat after surviving the fallout will actually come from the accompanying social unrest and the tyranny Federal Emergency Management Agency (FEMA) personnel who will attempt to force rural residents to provide shelter for city evacuees as a last ditch "civil defense" maneuver. Supposing that you have prepared yourself for fallout protection with a suitable security shelter (see the High Security Shelter chapter), there are certain basic training procedures that you should implement in order to ensure that the family will be able to use that shelter and its equipment when needed.

1. Develop a plan for getting the family back together if separated when the blast occurs. This should involve designating alternative locations for shelter in every part of the normal vicinity of their everyday activities. This may include other homes (with basements) of friends and acquaintances, and even businesses that may have basement space for temporary shelter. If you live in a high risk military target area, additional warning and communications equipment should include a home pager system for each member of the family. These are very inexpensive.

2. Some basic training should be given in the short term use of expedient shelters. See the Bibliography for sources. These are very difficult for anyone to accomplish who is not an adult or who does not have tools for digging, but the knowledge of their construction and use may buy a little time until a child can be picked up and brought to a better shelter.

3. First aid and fallout decontamination procedures should be part of every family member's training. See the High Security Shelter chapter for more details.

4. Training should encompass operating and living in your security shelter. This should include operation of ventilation, lighting and generating systems, security and communications equipment, food preparation, sanitation, and monitoring of fallout levels with the radiation meters

5. Teach family members about certain warning signals which may allow them to prepare in advance of a nuclear threat – such as signs of a fireball in the distance, giving advance warning of approaching radiation fallout.

6. Prepare a multiple contingency evacuation plan from your city if it is a primary target area (for use when you have advance warning). You should have as many alternatives as possible which allow you to go around or over the massive traffic jams that may result. Only off-road vehicles, bicycles, and motorcycles will get through on the ground. Those who are pilots may even wish to provide an airlift contingency plan out of the area. Nothing beats having your own private airstrip on your property. Others may have access to some resort communities that have their own airstrips. Whatever you do, don't keep your plane at a highly regulated major airport – they may well prohibit you from taking off or from even getting to your plane.

General Precautions If You are Near a Blast Area

Never look out a window at an explosion; the oncoming shock wave will burst the window into your face. Never look at the light of a blast as it is full of instantaneous radiation energy. Move quickly into a hall of room without windows. Wait two minutes for a blast wave to arrive before trying to go outdoors to enter an exterior shelter. The initial blast wave travels about one mile in the first five seconds before it begins slowing down. If no blast wave reaches you within two minutes, the blast is over 25 miles away and you will not be hurt by direct blast effects. Persons 100 miles away may have to wait as long as 7-10 minutes before hearing the blast.

Children who are away from home when a blast occurs must try to get home if at all possible before the fallout comes raining down – especially if they have no place to find expedient shelter (heavily reinforced concrete buildings, especially those with

basements). Teach them that it makes no difference if they have to stay in a place without food and water, it is suicide to go outside and be exposed to fallout. You must be very strict about these instructions, for children don't usually do well when everyone around them is panicking. They must be especially warned about blindly following the instructions of teachers or other leaders who have no idea what to do in a nuclear situation. Teach them to sense which way and how strong the wind is blowing. This is their main way of telling how long they have till fallout reaches them.

If you are driving in a car when you see the flash of a nuclear weapon, you must stop immediately and get out of the direct view of the blast. The direct radiation from the blast is very strong and can put you over the limit of radiation exposure in a very few seconds. Even stopping and ducking down under the dash board is helpful. When you try to make it home, train yourself to avoid getting stuck in the massive traffic jams that surely will happen. Stick to the side streets and residential streets rather than the major thoroughfares. If you see a jam up ahead, turn off onto another street before you get trapped in the jam. If you have to stop, leave more space than usual to your front so you can turn your car around if necessary.

Have a checklist ready of last minute things you need to gather and take down to your shelter. In my case, I try to have duplicates of all essentials inside the shelter so I don't have to do this. I know everything I need is already there. I even have a tool bench there with a full set of tools. More on this later.

Avoiding EMP (Electro-Magnetic Pulse) Damage

Nuclear EMP is a threat to all electrical lines and electrical equipment A nuclear explosion detonated in space causes a powerful electromagnetic wave to enter all electrical conductors. The induced voltages cause severe damage to sensitive circuits. Actual documentation of the severity of the problem is still not fully documented, but it will range from major power outages to destruction of almost every microelectronic circuit. The threat is not particularly easy to protect against since the electromagnetic pulses are so quick and have such high frequencies that they can be picked up by any length of wire that is not shielded and heavily grounded. I will cover EMP protection in more detail later. But the important family strategies here involve keeping sensitive equipment unplugged from the wall outlets, and even placing things like short-wave radios into fully enclosed metal boxes to keep EMP waves from damaging them. Disconnect all antennas as well, if you have any advance warning. Unfortunately, one of the sure advance warnings of a Russian first strike is that they will set off a series of high altitude nuclear explosions to take down the electrical power grid. So if there is a massive power outage, it may be a harbinger of a coming nuclear attack.

Earthquakes, Tornadoes, and Storms

In a high wind storm, which is building in intensity, it is usually better for the child or parent to try and make it home if he can do so within approximately 30 minutes, rather than ride out the storm away from home. The onset of the storm almost always gives sufficient warning to allow for this return home. However, once a storm hits in fury, one should not try to venture outside.

Tornadoes, however, require immediate action and shelter. Only if you are exposed to immediate danger should you attempt to drive yourself out of a tornado's path. If you are in a car and can't outrun a tornado, try driving under an overpass – get out of the car and climb up the inclined ramp on the side and get up and inside the shelter of the girders. If you are out in the open, look for one of the small stream culverts or farm access culverts that run under most freeways or other major highways. Stop your car and get inside the culvert – they are extremely safe against a tornado's fury. Be sure and cover your face with your hands to protect yourself from flying debris that may get sucked through the culvert. If you feel extreme winds, lay down flat on the bottom to reduce the ability of the wind to scavenge you out of your hiding place.

In training for an earthquake, help family members learn how to pick appropriate shelter during the quake. While it is always recommended to get inside a central closet, this isn't always practical. The biggest concern is avoiding falling objects in the house while you are running to find someplace safe. Plates come off shelves, bookcases tip over, and lamps topple over. Stay away from walls that have high shelves on them which may provide a source of falling objects. Even the center of a room under a table is better than up against a bookcase or shelf system. Unless you are in a tall apartment building where bricks or glass may fall down from the outside walls, going outside is sometimes a safer place to retreat. Don't stand around, however, on open ground. Pick a sidewalk or large driveway to stand on in case the ground should suddenly open up. This is highly unlikely in most flat locations, but is especially a high probability if your home is on a slope. If your house is on a slope that may slide in an earthquake, do not stay in the house. Better to take your chances outside and try to get to flatter, more stable ground.

Remember that with earthquakes, the highest window of danger is when the tidal forces on the earth are highest. The pulling on the earth's crust that happens when the sun and moon are close and on the same side is significant. If you live in an earthquake prone area, make it a habit not to drive on elevated or double-decker freeways during these periods. One website that tracks earthquake activity as it relates to earth-tidal forces is the SYZYGY.COM site by James Berkland, geologist. Check it out regularly. When outdoors during a quake, try to stay on paved surfaces away from power lines, and watch for toppling trees.

As to structures and their resistance to damage, single story framed homes of recent vintage with basements are best. They are generally safer than masonry houses or apartment buildings because the wood framing will flex rather than break apart under moderate forces. Modern high rise office buildings are usually designed to resist earthquakes well if you are already inside. They will sway, but will not fall. Do not approach them from the outside, however, as the glass curtain walls that cover the outside of the building will often come crashing off to the pavement below. If you are in an auto, stop your car on the open road, and stay inside. Keep the car running in case you have to move it quickly to avoid a problem.

During any lulls in quake activity, or at the first sign that it is abating, run and quickly turn off your electrical power (usually there will be a master switch outside by your electric meter) and turn off your gas meter. If any electrical shorts or gas leaks have developed, these precautions will keep them from damaging the house. Next you must

assume that water lines may be broken. The danger here is that any use of water in the city, downstream of a break, will begin to put suction on the pipes and draw dirt and other material into the water pipes. You have two choices. If you have prepared in advance with water storage, immediately turn off your main water valve so no contaminated water will come into your home. If you have no water storage, then you have to take a chance on trying to get some of the last water from the public system. Turn off the inlet valve leading to your hot water heater. This assures that no contaminated water will enter this tank – your only reserve tank of water. Next, begin to fill a bathtub with COLD water, watching for any brown water to emerge from the spigot. Run water as long as it is clear. Turn off the water as soon as you notice any contamination. You now should have some water to use for washing, toilet flushing, etc. Do not use it for drinking, however, unless you purify it with some type of liquid oxygen purification drops, like Aerobic 07 or another similar brand.

Summary

All this training may seem like a daunting job but it is every bit as important as the material preparations. Don't forget to review these procedures at least once a year. A one time mention will not be sufficient.

Section

II

Planning: New Construction & Remodeling

Chapter

3

Preparedness Planning and Threat Assessment

Crisis preparedness requires considerable flexibility since few people, if any, possess the foresight necessary to predict future threats and problems with absolute accuracy. While many have successfully indicated the nature and type of a certain future threat, no one can consistently predict the exact times and places for future crises. The purpose of this planning section is to outline a flexible strategy that will especially be useful for those who have to stay within society to earn a living.

SOME GENERAL OBSERVATIONS ABOUT SURVIVAL-ORIENTED PEOPLE

There are definite types of people who at present are attracted to the concept of preparation for future problems. This will not be true in the future after the onset of severe shortages or unrest, when *everyone* becomes interested in survival by sheer necessity. Life makes a believer out of everyone, eventually. Since critical resources are always scarce once the crisis arrives, only those who have made a prior "investment" in stockpiled supplies and skills training will do well. Currently, based upon my observations, the types of people most concerned about preparedness for difficult times have some or all of the following characteristics:

1. They are between 30 and 50, mostly middle-class people who seem to sense that the establishment isn't telling things as they really are. With access to a lot of alternative information, especially that provided by the Internet, many intelligent college-educated people are beginning to distrust the mainstream – a distinct change from even 15 years ago. These people have somehow developed a strong sense of feeling for the signals of conscience, allowing them to "see" that which the rest of the world is relatively blind to. This is a factor not directly related to age or experience, and isn't directly correlated to religious training – although many of these sensitive people have a religious orientation.

2. They are independently minded, generally. Most don't have a lot of friends, just a few select people. They often see themselves as alone in a sea of mindless humanity.

3. They are, almost without exception, politically conservative of liberty, distrustful of big government, and hateful of the coercive socialism that has forced them into a survival posture.

4. They are not generally the "back to the land" types. There is a real difference between the old "Mother Earth News" types, who are generally liberal and communal-minded, and those who are the new breed of concerned conservatives. "Back to the land" conservatives represent only a tiny percentage of the preparedness movement, based upon my observations. True conservatives see modern government as the enemy of freedom and the corrupter of the "masses" through social welfare and statist public education. Most preparedness-oriented people now live in the suburbs, rather than on farms. The rural farmer, who has followed preparedness techniques out of necessity and not out of an ideological sense of threat, may be prepared for the physical survival of hard times but probably won't understand the broader political battle going on. Interestingly enough, most modern farm people are no longer self-sufficient. They buy most of their groceries in town, rather than grow them. They are businessmen now, out of necessity, more than "country folk."

5. The majority of survival-oriented people are professional and business types – many are medical doctors or natural health practitioners. The rest are skilled laborers and technicians who are usually described as "Jacks of all trades." There is almost an uncanny absence of people representing professions or vocations that have a vested interest in the authoritarian bureaucracy, or the established sophisticated society. For example, there are almost no lawyers (who protect the authoritarian society), no government employees and bureaucrats (who constitute the authoritarian society), union people (who benefit from coercive wage laws), architects (who generally design only for the establishment), or public school teachers (who educate for the government). There are some few exceptions to each of these but, in general, these types are part of the problem, not the solution.

6. Half, I would estimate, are solidly middle-class and, therefore, financially harried by government taxation, which has decreased their confidence in government. The other half are in the lower fringes of the middle-class – frugal and cash poor with fixed incomes. This perhaps explains why the interest level in preparedness is higher than the level of money actually spent.

7. Most are property owners and about 10% are totally out of debt – a much higher percentage than the national average. They have something to protect and feel motivated to prepare. With the exception of some of the older, retired people and some of the young couples below age 30, there are very few apartment dwellers who even think about preparedness.

CONTINGENCY PROPOSALS

Based on this general background profile, we can develop a general contingency system to fit. I will then discuss how people who are exceptions to the general profile adjust for their situation.

The essential philosophy of contingency planning is to stay within the existing society, while it is feasible, so as to maximize one's available time and financial earning capacity, and yet be prepared to exit that society only when the actual threat demands. This philosophy of contingency planning also runs counter to the idea that there is a certain "ideal" location in the world. While there is no ideal location for everyone, there is a "best" location for almost every individual circumstance. This is covered more fully in my book *Strategic Relocation*. Suffice it to say, the need for contingency planning arises when families cannot move to a long-term safe location due to financial or other ties with their existing location. Additionally, some contingencies are necessary even in the ideal location, just so all your eggs are not in one basket.

The general rule for most people is to survivalize their present home on a minimum basis and find suitable rural property far enough away to offer safety from a general urban crisis. There they can establish either a small farm or a vacation retreat. Those who cannot afford a second place should try to make emergency arrangements with family or friends who may have such property. Look at the following situations and watch how we take this general guideline and modify it to meet specific situations.

Situation 1: The Suburban Medical Professional

A professional man lives with his wife and five children in a suburb of a large, metropolitan area in the eastern US – which is not secure from crime, social unrest or future potential nuclear strike. Due to having built up a secure clientele, he cannot leave the area without undue financial hardship. His wife is almost as concerned as he is about the critical state of the world, but is closely tied to social and family contacts in the vicinity. The children are aware of their parent's concern, but are not worried themselves since their world revolves around the peer climate of the public schools they attend. They would resist any major relocation or lifestyle changes vigorously.

This is the typical situation where I would recommend no major move outside the area. Depending on the seriousness of the children's peer pressure enslavement and the relative soundness of their immediate neighborhood, a move to another part of town may be in order. Finances permitting, I would highly recommend the transfer of the children to private schools, taking into consideration the potential of moving closer to such a school to avoid excessive commuting. This would be weighed against the increased or decreased distance the father would have to travel to his office. I would definitely recommend a move within the suburbs to another more suitable home if the house does not have a basement, or the potential of building a basement under a room addition. If there is a military facility nearby, a nuclear strike could be a serious threat and would require a basement level fallout shelter. The new location should also have sufficient yard space to grow a good-sized vegetable garden. Lack of sunny garden space in the present home would bring a mandatory recommendation for a move. The two prime,

short-term threats in a large metropolis are crime and shortages of food and water. One must develop some minimal self-sufficiency in these areas.

Once the determination of location is finalized, a general remodeling of the home would be in order so as to provide for security, food storage, water supplies, and energy contingencies (see chapter on the Four Sample Remodeling Layouts). At this point, the family is ready to select rural property suitable for a long-term retreat – preferably one with some recreation or farming potential to justify its existence in the event that a crisis is a long time in coming. The determination of such a location will depend upon such factors as survivability, climate, distance, transportation difficulty, finances, and overall desirability. Since this family resides in the east, which has the highest population density, they should tend to select something further west unless unique circumstances provide fair security in a remote location in the east. Only under exceptional circumstances would I recommend something in the far west due to the limitations and risk of long distance travel in a crisis. If the father is within five years of retirement, however, it might prove wise to consider an extended move so he may retire in an area of long-term strategic security. As we will discuss in the chapter on Preliminary Decision Making, there are few areas in the east providing long-term security due to excessive population density. That doesn't mean everyone should leave the east, only that more careful preparations will have to be made, with a commensurate higher cost in establishing secure facilities.

If the proposed retreat is an hour or two from the home, it may be suitable for absentee farming on a limited scale. Usually a professional person will have little time to properly manage a farming operation which requires constant maintenance. However, in cases where reliable part-time help can be secured, or where the land can be leased to others in the interim period, the farm may be able to operate without severe financial drain.

Situation 2: The Urban, Technical Professional

A self-employed technician with his own shop needs to expand. He lives in an undesirable, low class section of a large midwestern city with his wife and four children. He is considering relocating to a small town, but worries about whether there will be sufficient business for his specialized talents. The children are more ideologically aligned with their parents than in the previous example and dislike the public schools they now attend. They are involved in racial busing across town.

While he is free to move, I would caution against it since it would be unlikely that a small town would need his high-tech talents as much as the city. An excellent compromise in this case, where the city is surrounded by small farming communities, would be to move outside of suburbia 5 to 10 miles and find a small farm to purchase that can also house his newly expanded shop facilities. The distance is still close enough to service his clients who don't care where he makes his parts as long as he can meet his deadlines and is reasonably accessible. His children would like change school, but private schools may not be practicable due to the longer commute from the proposed new location. The mother is a capable women and has a good working relationship with her children. She opts to join the numerous families nationwide that are teaching their children in the home with nationally available home school materials. A more intensive

learning schedule is implemented to help the children have extra time to help with the new farm undertaking.

The location selected by the family is in the direction of lowest potential for real estate development and away from any major highways leading out of town. It thus offers sufficient security so that a separate retreat is not necessary at this time. I would encourage the family, however, to keep a future retreat location in mind and prepare for an eventual purchase of something more secure as funds become available. This family decides to make it a long-term family purchase involving all of the children so that each, wherever they decide to live, can have access to the retreat as a vacation home. I would encourage the family as a whole to start budgeting for future purchases so that the children feel a part of the ongoing preparation process.

The older farmhouse that the family purchases does have a basement. However, it is poorly constructed so they opt to remodel and add a large, secret storage area and security shelter under the new shop with tunnel access from the home.

Situation 3: The Florida Couple Living in a Retirement Condo

A retired couple purchased a condominium in Florida two years ago and has recently begun to be aware of sound investments and survival preparations. They have used up much of their financial flexibility in the cash purchase of the condo and are now facing a diminishing cash position due to marginal retirement income. The Miami suburban area where they are living is looking less security in terms of crime and racial unrest. They want to relocate but are hooked on the balmy climate. The condo doesn't have much more room than an apartment, so their ability to store even the bare essentials for self-sufficiency is limited. Its high rise location and dependency upon causeways and elevators for access make it highly susceptible in even a minor crisis.

I would urge them to sell within a reasonable time. Their age and health would determine whether or not I would recommend getting out of Florida completely. I am not enthusiastic about Florida's balmy climate for the same reason they love it. Too many other soft living people are attracted to Florida. Soft living people do not tend to be good survivors in a crisis – especially when the air conditioning ceases to function. That is not to say that all Floridians are soft, but the tendency for new move-ins to be so is real. At a minimum, I would recommend they move north into the mild climate areas of Georgia or the Carolinas – avoiding the major cities like Atlanta. The presence of viable agriculture in these southern states makes life a little more realistic for self-sufficiency than in the Miami area. If they would enjoy the drier climate of the west and could tolerate cold, dry winters, I would recommend moving to the far west (northern Arizona, Utah, or western Colorado). There exists a “banana belt” of warm air that extends from Arizona, continuing up through Las Vegas and terminating at St. George, Utah.

Next, I would recommend that they forget about condos and apartments and get a small home with a basement and a small lot sufficient to grow a minimal garden. They may protest that they don’t want any upkeep or maintenance and I would respond that they will live longer if they maintain some viable responsibility and light physical labor.

Besides, they will get storage space plus better livability for less price than their exclusive condo, and have money to save for the coming economic trouble.

Situation 4: The Employed Family Man on a Fixed Income in a Large City

The combination of an inflexible employment situation and a fixed income that is barely enough to live on makes it difficult to develop any viable contingencies. A first consideration must be whether or not his job situation itself will weather any of the predictable crises. If his job is non-essential, he should seriously consider looking for other training that would prepare him with other more useful skills, preferably those which would lead to self-employment. Otherwise, assuming that he likes what he does and has good long-term job stability, I would look for home-based self-employment opportunities that family members could help participate in to increase family income. At the same time, I would suggest a strong austerity program to decrease monthly costs and increase the family's internal motivation for preparedness. The foremost way to save in most situations is to cut back on non-essential spending for food items. Food may be a necessity, but eating out or buying lots of nutritionally poor, processed foods is not. Cutting out the extras and cooking from scratch can cut the food budget by at least a third. It is also necessary to eliminate or severely limit time spent watching television in order to find more time to devote to learning essential skills. Working together as a family on preparedness and training will do wonders for family unity as well.

Unless this family can start to increase income, decrease costs, and find more free time, they will not climb out of the static hole they are in. Even if more income is realized with an alternate job, there would be little time to put it to use in survival remodeling and preparedness, without some fine tuning of time priorities. Priority planning is a must. I would suggest a savings program to put away as close to 10% of take-home pay as possible. These savings would be applied to a carefully prepared list of stockpile items that need to be purchased. A regular savings habit would help stave off the frustration and sense of futility that accompanies the normal feeling that “we never get ahead.”

Some change in activity each month is necessary to keep one’s spirits up. First, get everyone educated about the threats we face and the possible solutions. Then, start implementing the lifestyle changes you feel are necessary to bring peace, order and healthy living back into your lives. This will improve everyone’s sensitivity to truth and get rid of bad attitudes. Next, start tackling the extra income problem, and so forth. While this type of family usually suffers from terminal apathy, those that make the fine-tuned sacrifices necessary (one day at a time) usually turn out to be the most capable survivors.

Situation 5: The Employed, Single Female Head of Household

The number of women in this category who are savvy about the needs to prepare are small in comparison to the total number of single women, but they are always very motivated and try harder than most. They struggle with despondency, like most women on their own, but seem to have a sense of a mission that keeps their children closer to them. While they usually have to work outside the home, they do so without the

unrealistic facade of "working-woman glamour." Most in this category do have a home, usually left to them if widowed or as part of a divorce settlement. While there is some security here, it usually leaves them with very little flexibility to move to a better location – especially when the home is saddled with high mortgage payments.

The options for this group of women are somewhat more limited than for families, since they lack a partner to share the load. In most situations, I would recommend trying to find a semi-suburban home at the rural fringe of the city so they can stay fairly close to work and societal obligations, without being at risk to high crime near the inner city. However, I would not usually recommend the small town atmosphere, unless they have family connections there. Single women are watched and distrusted in small towns. Moreover, gossip is rampant in small towns and there are no secrets. Whether single women with children still desire to remarry or not, I recommend they stay within suburbia where they can avoid being too conspicuous. There are exceptions, of course, especially for the woman who really loves rural living.

Since single-mother families are prone to future changes in living situations, I would not recommend setting up long-term, elaborate survival preparations in fixed, immovable settings. Flexibility is often as important as security. Doing minimal survivalizing of the existing home is the foremost recommendation, while developing contingencies aimed at being able to quickly relocate (even temporarily) with extended family, as necessary. Minimal survival preparations in a home do not usually require much modification. Most of her preparations can be taken with her (although not if she tries to leave during a severe crisis). She should plan on bringing her children in on the planning and implementation phase in order to increase their awareness and take their minds off their own one-parent situation.

While there are constant temptations to join forces with "co-ops" and informal partnerships which offer a little more security, I would look upon them with considerable scrutiny – especially the "I'll take care of you" type of offer. These rarely work out. She should become independent, but develop good networks and support groups with people who are also like-minded and seeking some self-sufficiency.

General Guidelines for Those who are Exceptions to the Foregoing

Unless your situation is very temporary, all homes, apartments, and condominiums (regardless of your location) should be equipped with the minimum survival preparations of a security system, water storage, food storage, communication equipment, emergency medical, essential tools, minimal alternate electrical power, and emergency transportation as outlined in the Minimal Preparations section on page 164.

Do not borrow money for survival. That is a true contradiction of the principle of self-sufficiency. In fact, work hard at trying to become totally debt free. If your income is insufficient to purchase additional reserves and preparedness equipment, you have three basic alternatives:

- Sell some non-essential items (boats, TV, extra or expensive cars, furs, jewelry, etc.).

- Increase your income by improving your skills for a higher paying job, becoming self-employed – even if only part-time – or having additional family members bring in extra income. (As a caution here, I do not recommend that mothers with young children work outside the home. There are many ways to utilize skills at home to earn extra income. Day care centers are not a suitable substitute for a mother's care.) If you are a good thinker with substantive ideas, learn to write well. I know of no better way to become independent than selling good ideas. With the Internet, you have a marvelous vehicle to get your ideas out to the world with minimal expense.
- Spend less. Every family can cut somewhere. Cut out movies, fancy foods, desserts, throw-away products, packaged prepared foods, eating out, excessive driving. Get a used economy car and get rid of those car payments. Let the kids know they have to sacrifice too – especially if they are always coming to the parents for a hand out for social affairs and dates.

Plan for contingencies and then accomplish them in stages. If you are very perceptive and can read the "signs of the times," you may be able to move out of danger in a timely manner and still keep ahead of the problems. A typical example for an apartment dweller would be:

1. Arrange finances so that you have net savings each month.
2. Survivalize your apartment with the bare minimums – using only equipment you can take with you.
3. Save up for a down payment on a small, older home with upgrade potential. If you are willing to sacrifice present comforts by living in the home while you remodel it yourself, great savings can be accrued. Every bit of work you do yourself is that much less extra money you have to earn and pay taxes on. Survivalize this new home with more than the minimums, especially if it has the potential of serving your needs for at least five years. Above all, get out of the rental market and into some type of home ownership. Governments, ultimately, have no other alternative than to tax by inflation. You can count on prices rising. Learn to pick the swings in the market, selling with prices on the rise, and taking your money to other areas where prices are *lagging*. It does no good to buy back into the same inflated market that provided your paper profits. You have a net loss counting false capital "gains" taxes.
4. Until you are able to afford some retreat property, develop a contingency living arrangement with a few friends or relatives in other parts of the country. Persons in areas not experiencing a crisis could share quarters with those who must leave their homes. This is a short-term solution and should be done with some plans to obtain temporary work in the new area. Try never to be a burden on others.
5. Buy a small piece of retreat land. You can always put a tent on it if you have to use it before you get anything built. Try to buy at least one half acre. Most people don't need more than an acre unless they can really handle the work load of larger acreage. Too many survivalists get saddled with 10 or 20 acres and don't have any children to help out around the farm. If you spend too much on raw land, you may not have enough money to build any facilities or buy equipment. Unfortunately, with today's subdivision restrictions and zoning laws, you can hardly buy a piece of rural acreage without buying at least 5 or 10 acres. This is fine if it is forested so that it acts as a buffer. If not, consider letting much of the land lie fallow or with a cover crop of clover.
6. Start by putting a small self-contained underground shelter on the property. The cheapest system by far is to simply buy a large concrete cistern, waterproof the outside, and bury it. Concrete cisterns are at least as cheap as plastic tanks and have square walls, which gives you better space utilization. When you expand, you can always connect up to it and use it for your secret storage. If you have to retreat to the property prematurely, at least you already have a secure stockpile underground to live off

of. Next, put up a small yet expandable house, or even a modular or mobile home. Hopefully, you have selected rural land where modular or mobile housing is not prohibited. Don't buy into neighborhood associations with covenants and restrictions – these cause long-term conflict and bad feelings.

GROUP AND COOPERATIVE SURVIVAL EFFORTS

There are numerous advantages in joining with other trustworthy individuals in striving for self-sufficiency – but finding people you will really get along with is the tough part. To the survival purist, this concept is inherently contradictory, as it involves dependence upon other people. However, there are various types of cooperative efforts, some more dependent upon others and some less. The formula for determining which group association, if any, is suitable or beneficial to you is mostly dependent upon the qualities of character inherent in each of the individuals concerned. This is far more important than seeking to align yourself with a wide variety of highly skilled people. Given the choice, I would much rather be with a group of highly moral, hard working people than a group of highly trained but temperamental professionals.

While true friends who share your vision and philosophy may be hard to find, consider it an essential quest to find mutually supporting people. Even if you choose not to live next to each other, it is essential to establish a broad network of people to fall back on as necessary. The possibilities of mutual benefit are excellent if the individual partners manifest a high degree of integrity and dependability. No amount of ambition, wealth, or talent can successfully substitute for essential character and the ability to get along well with other principled people. Again, as with all of the principles I espouse in this work, I try to encourage my readers to selection choices that are long-term and lasting as opposed to choices that give only short-term and superficial benefits. There are trade-offs, however, in people relationships versus conflicts over truth. I don't adhere to the modern tendency to put people relationships above ultimate truth. When there is a conflict between people's feelings and hard truths, we ought to give higher allegiance to what is right. People-pleasers, diplomats, and compromisers are incapable of ever solving serious problems. When straight talk and hard answers are necessary, people with more forcefulness and honesty are essential to a solid resolution of the problem.

The qualities of integrity and dependability are not easily recognized on a short-term basis. People have to demonstrate these qualities over a substantial period of time under realistic circumstances of trial and difficulties to merit a positive appraisal. Don't be fooled by superficial social skills, easily demonstrated in peacetime. The ability to recognize these valuable qualities in people is vital in the formation of friendships that will "survive survival" together. The types of relationships that will survive periods of great stress must be consciously cultured, improved, tried, and tested to be ultimately and totally dependable. It's easy to be apathetic about this subject with the thought, "Well, when the time comes, I'll depend upon whom I can, and hope for the best." That is easily said about anything involved with crisis preparation, and is as obviously short-sighted in scope, as it is indicative of poor human judgment. Ultimately, the failure to prepare in this area of mutual assistance is due to the misconception that the same goodwill among friends that has existed during the small crises in the past 20 years will still manifest itself

in the long-term crises of the future. In some cases this will still be true, but greater wisdom would dictate that one should select and prepare his friendships just as carefully as he does his preparedness equipment.

It is my opinion that the people worthy of total trust are those who demonstrate consistency of purpose and integrity, regardless of time, fads, money, or pressure of peers or circumstances. More specifically, I feel that the true test of a person's consistency is not so much what he does when compelled by force of crisis, but what he does, *before* the crisis, out of clarity of foresight and conviction. This characteristic of foresight is indicative of a special type of self-control, gained partially by keeping one's mind relatively aloof from the emotional brush fires of the day and instead, concentrating on the long-term trends involving people, government, and economy. Ultimately, these traits stem from a unique combination of spiritual sensitivity coupled with a good dose of self-discipline.

All this is not to say that I recommend a total rejection of friends who don't measure up to the highest of standards, as even partially motivated families can help and be helped. I only caution against unwise dependency links with problem people. Throughout the breadth of present day group self-sufficiency efforts, we find all types of contingency and dependency relationships. Even in large organizations, we find smaller, more tightly dependent sub-groups that exist within the organization than is characteristic of the organization as a whole – precisely for reasons of greater mutual trust. Perhaps a parallel might be drawn between the optimum establishment of multiple contingency retreats and contingency friendships, wherein one knows who he can turn to for assistance in various levels of crisis. It is a source of tremendous consolation and security to have friends who will stand by and assist you to the very limit of their means and will.

As I present a description of the various types of group efforts, consider your own relationships in similar groups and make a list of various friends and family members with particular talents and resources with whom you might be of mutual assistance in the future. [If you are tempted to list someone whose only redeeming value is financial, I recommend against it. The money will be accompanied by people problems that you may regret.] take a moment to reevaluate your present time spent in purely social endeavors to determine if free time might be spent more beneficially in cultivating these types of mutually beneficial relationships. I will discuss some of the pros and cons I see in each type.

Family Organizations

Some members of large families that originally organized solely for the purposes of holding periodic family reunions have found that they share some common intellectual, social, and financial pursuits. The more successful family associations have built mountain lodges or retreats; purchased ranches, farms, or even small production facilities and businesses – things which none of the individual family members could have afforded. However, the most serious source of failure in this type of organization is the lack of harmonious relations among relatives and in-laws. It has been my observation that long-standing family conflicts and resentments are rarely overcome. This is due, in part, to the severity of past arguments and the psychological wounds inflicted upon each

other. Because most families have some members who do not get along with others, do not feel obligated to include all family members in a family business organization. There really is nothing inherent about being a relative that should force us to endure obnoxious relationships when they are offensive. Work with those whom you can trust to keep harmonious relationships.

Business Organizations

I am referring here to relatively small corporations or partnerships which often have been formed out of mutual friendship and esteem between several talented people. There are certain legal advantages that a business holds over an individual in providing certain executives and employees with schooling, recreation, and contingency preparations. Some very astute business groups have made excellent use of pension funds to provide for preparedness rather than put it all into government securities which will certainly be controlled and restricted in the future. Some businesses have even built integral fallout and blast shelters under their shops or offices to provide for the employees and their families in a crisis. For businesses composed of dependent upon many key employees who cannot be easily replaced, what better way to provide insurance against employee hardship and disability in a crisis? For a successful survival preparation effort to exist within a company, there must exist a respect and friendship among the members that transcends strictly business affairs. Even within strong friendships, proper business contracts and agreements should prevail (if nothing else to avoid legal or probate problems should one of the principles die).

Special care should be taken to ensure that you diversify your business activities sufficiently as to always have a market for most of your products in a crisis. Stockpiling of critical business supplies is also essential to proper long-term operation of your business in a disaster or national emergency.

Religious Organizations

Religious groups normally share a fairly unified doctrine and philosophy of life among their members – especially religious groups with strong doctrinal or ideological foundations. This lends to a fine basis for mutual assistance and service in time of need. On the other hand, large, expensive, and sophisticated community churches that meet more on a social basis rather than on strict religious principles, do not possess any such advantage. They will become more divisive as hard times illuminate the shallowness of their material bonds and existence.

Several large religions, like the Catholic church, have large relief organizations to help distressed communities or people in disaster areas. Unfortunately many of these so-called relief organizations, including the Jesuit’s Caritas and the Quaker's American Friends Service Committee (AFSC), are dedicated almost exclusively to assisting the revolutionary Left around the world.

The Church of Jesus Christ of Latter-day Saints (Mormons) seems to come the closest to promoting a self-sufficient preparation of its people. The headquarters of the Church runs a large welfare self-help system composed of granaries, factories, farms, canneries,

and textile mills, and many sub-units of the Church have their own farms, ranches, or similar welfare projects, including local storage facilities. To further complete the preparedness link, each individual family is encouraged to have a year's supply of food and clothing on hand and to grow a garden. The Church has expressed its willingness to help other religious organizations with advice on how to establish similar systems. It hold regular tours of their facilities in Salt Lake City, Utah. I highly recommend the cooperative "no dole" system of the Mormons. The local welfare farms of the individual congregations are an integral part of the "no-dole" system. When people need assistance, church leaders are instructed not to give assistance outright without requiring some labor in return. Active members who have participated in welfare projects over the years, prior to any need for assistance, have accrued labor already. The total effect is the maintenance of character while providing for immediate needs on a temporary basis. The Church also runs its own employment centers for placement of the unemployed, and social service centers for counseling, adoption, and foster care. Of special interest to non-members is the fact that Mormon canneries are available for use by non-members of the church. These canneries allow people to work on the canning line and then buy what is canned at cost. Check with your local Mormon cannery for a schedule of what is being canned and when (contact information in the Recommended Equipment and Sources section). People can also get specialized food storage items through these canneries, like oxygen absorption packets.

Informal Friendship Cooperatives

There are definite advantages when non-related families join forces in sharing certain expensive facilities in a farm or retreat situation. Such things as electric power generation, water supply systems, and shops are quite costly. Since finding land with suitable running water for power generation is difficult and expensive, some cost sharing of both land and facilities is beneficial. I recommend that all cooperative arrangements be kept on a business-like basis to avoid conflict and to allow for equitable dissolution if disenchantment arises. I generally oppose shared living quarters except in emergency conditions due to the strain imposed upon normal family relationships. If you do choose to share quarters, I recommend that separate kitchen and personal living facilities be provided, if possible.

Perhaps the finest of all arrangements is when close friends and families buy adjacent properties in an area of good preparedness potential. If an association is formed, centralized recreation and energy facilities can be purchased, or each can purchase his own separately. Take special care in designing your organizational bylaws. Costs should be allocated fairly and according to use and initial money invested. Otherwise, great inequalities occur where families that are living full-time in the area use most of the common facilities and engender most of the maintenance, but the costs are borne equally by all. Avoid bickering over petty amounts and details, but ensure that sound principles of fairness are always employed. Additionally, I do not recommend that the association be a corporation as there is an implicit lack of personal sovereignty in such government sponsored ties. Try to avoid any arrangements that produce income, so as to avoid having to file an income tax return.

Here are some other potential group arrangements on joint or adjacent property:

1. One person with sufficient funds buys the land in an area that allows subdivision of acreage into 5 acre plots (other than an official subdivision with roads, sewer, and streets). He then sells fee simple lots to the other members. Now, each family has their own private property with the freedom to develop it as they wish. Each puts in their own septic system. An informal association can be formed to build and maintain roads, establish a common generating plant, a common shop, or common farm machinery. Or, alternatively, each can do everything separately on a smaller scale.

2. One person, who has ample funding, buys a plot of land and then sells condominium type rights to the others for an RV site with electrical and sewer hookups to the others. He establishes one central power generating station for every 10 sites, complete with underground, secured water and storage areas. Each condominium right includes an RV site plus one underground storage unit. Thus, owners can pre-stockpile items in the underground storage units and be assured that they will have all the essentials when they arrive during a disaster. Additional recreation facilities can be added to the central mechanical/storage, building such as a recreation room with group kitchen, a gym, or even a tennis court and rest rooms.

3. On a large scale, one developer could take a large tract of land and create several complexes – one as in #2 above, for trailer housing, another for RV's, and another for modular homes. He could even do another section for larger custom homes. All these developments could be built around one or more central energy and recreation facilities. The entire property would be fenced and have central security features, but each housing complex would be separated and shielded enough from the cheaper alternative housing so as to preserve each group's level of value. This type of development can be done in stages and can allow for people of different income levels to have a retreat facility. This system also allows for a great deal of individual autonomy, which is important. As I have said before, preparedness people are often very individualistic and don't like to be forced into group relationships. At least they like to be able to withdraw enough for personal privacy and comfort.

Arrangements to Avoid

I do not recommend communal or socialistic arrangements of any type. Common ownership among individuals of unequal talents and efforts is a type of fraud upon the hardest working person. These arrangements always dissolve into bitter struggles and hardship. Avoid any arrangements which run counter to the natural laws of human action, which always attempt to assess rewards according to each person's general and specific true worth.

I do not like arrangements where one owner sells "use" rights for a specified time, where no permanent ownership rights are accrued. Many such arrangements have sprung up around the Y2K issue, allowing people to buy a limited use of a certain property for a limited time. I can't help but feel they were dissatisfied at the end of the process when they didn't have anything to show for their investment.

There are many religious people forming communities with very strict theological and doctrinal oaths of belief. Religion is never so precise as to allow this for long without significant disagreements developing over doctrinal interpretations. Those who disagree with the majority end up having to leave. It is better to start with a broader ideological base, and then take more care to judge each potential entrant on major *character issues*, rather than doctrine per se. When I say character issues, I'm referring to such things as sensitivity to conscience, consistent self-control, non-materialistic desires, non-flirtatious personality, openness and honesty with others, etc. Doctrine is too easy to say "yes" to and yet fails to sufficiently guide character issues which create conflict. Sifting out problem character issues beforehand ensures greater harmony, as well as an orderly community where doctrines and beliefs can be smoothed out and agreed upon as you go. Remember that conversion to doctrinal truths takes time. Don't let differences of opinion on non-character issues cause rifts. Let time and God work them out.

I do not recommend retreats that are completely underground, whether for individuals or groups. An individual underground retreat, serving little more than a storage chamber, can be hidden effectively, if it is not used or stocked frequently. However, a multiple user underground retreat has several tactical liabilities:

1. It would require a bunker-type entrance and door, waiting to be discovered. The fundamental design error in planning, in this case, is the lack of an above ground, mini recreational facility that could serve as a front for the facility. Of even greater importance is the fact that owners should have the ability to enter into the underground portions unobserved from the outside, which a clubhouse would allow.
2. Anytime you are dealing with a developer of such a retreat, who needs to make a profit on his idea, you run the risk that he will advertise in such a manner as to compromise your privacy. Notoriety in a survival retreat is not in your best interest.

FLEXIBILITY THROUGH BARTER

I do not recommend using one of the many barter agencies that have sprung up in the last few years. The IRS has them closely watched and flags the tax returns of individuals dealing with such organizations. But of even greater concern is that most of these groups are handling thousands of your dollars in unsecured credits. In other words, when someone uses or buys your service or product, you are given a credit toward items in the barter exchange that you may want to use or buy in the future. But if the organization goes "belly up" before you use your credits, guess who is left holding the bag. You can't go back to the original purchaser of your product since someone else already purchased his trade material. If you deal in a barter exchange, insist that the company has verifiable *cash on hand* in an escrow account to cover all its customer credits.

Of course, the best policy is to store your own barter items that will be in heavy demand in a crisis. Even if that crisis does not come, you can always use the products themselves. You will at least match inflation. The criteria for good barter items are:

- **DEMAND** for the item is high, or will be high in a crisis

- **DIFFICULT** to home manufacture
- **DURABLE** in storage
- **DIVISIBLE** in small quantities
- **AUTHENTICITY** easily recognizable without an expert

Not all items meet all of these requirements. Food, for example, can be an excellent short-term barter item (especially in a famine) even though it may not have a long storage life. The following list provides examples of good barter items to start with:

1. SOAPS (bath, liquid detergent, laundry detergent)
2. CHEMICALS (rubbing alcohol, bleach, paints, paint thinner, insect repellent)
3. FUELS (gasoline, propane, diesel, kerosene)
4. HOUSEHOLD PRODUCTS (toothbrushes, razors, toilet paper, foil, light bulbs, matches, tape, needles, thread, zippers, buttons, safety pins, canning jars/lids, shoelaces, cord, rope, medicines, knives)
5. BUSINESS SUPPLIES (computer and xerographic paper, pens, pencils, forms, paper clips, staples, envelopes)
6. TOOLS & EQUIPMENT (generators, batteries, watches, guns, ammunition, wire, glue, tape, screws, nails, wrenches, solder, welding rod, hand tools)
7. CLOTHES (stockings, socks, underwear, winter clothes, coats, blankets, sheets)
8. FOOD (wheat, rice, beans, coffee, teas, vitamins, minerals, herbs)

ANALYSIS OF FACTORS AFFECTING YOUR PLANNING

The degree of self-sufficiency you desire or set as your goal should be primarily determined by your assessment of the following primary threats:

- Social disorder
- Governmental interference
- Natural disasters
- War

How you view the foregoing as potential threats on a worldwide or national level will primarily determine your motivation to prepare. The degree to which you feel they are imminent threats at your local level will determine your sense of urgency to respond defensively. Each of the foregoing will be discussed here in sufficient depth to illuminate the signs which warn of impending crisis and demonstrate the long-term results of even partial trends toward tyranny, social corruption, and disorder.

Social Disorder Factors

The consideration of social order stability is crucial to understanding how those around you will react in a crisis. Every historical experience involving a major crisis of any nation has shown that when individuals in general are emotionally and morally stable, they survive and emerge from that crisis as stronger and more stable individuals, possessing a stronger community and national pride. Conversely, with a decline in individual morality, emotional stability falters under stress and ultimately leads to the disintegration of the entire social order and, finally, the nation. I believe that the most significant reason for this phenomenon is found in how people respond or fail to respond to the internal workings of conscience.

The Importance of Conscience in an Orderly Society

All human beings, regardless of environmental influences, receive promptings from the subconscious mind that relays nervous feelings or calm feelings depending upon the rightness or wrongness of the intended attitude or action. While humanists believe that these feelings are environmentally induced, it can be shown that certain intended acts such as murder of innocent persons or immorality are almost always accompanied by nervous feelings, initially, regardless of how long a person has been taught that these acts may be permissible or has personally rationalized them away. To me this is indicative of ultimate truths in the universe and of the mind's ability to sense those truths. Whether one attributes the communication of those truths to Deity or to inanimate phenomena is important, even though some people do well following those promptings without thinking about the source. Here is my reasoning.

When one accepts the existence of a Supreme Being, to which we are ultimately accountable for our actions, there is a higher level of consciousness to spiritual perception. People who have some feeling for God’s existence tend to listen more carefully for those nervous feelings or warning signals than do those persons who actively try not to feel God’s presence. Assuming that there is no God leads to an attitude of less responsibility for one's actions or at least in terms of their ultimate consequences. The great danger inherent in the humanistic rational for conscience (avoiding actions which have harmful consequences upon others, while accepting or permitting those which only affect the performer alone, or consenting adults) is that there are many long-term, hidden effects to victimless personal corruption. Because conscience is driven from a divine, living source, it warns of these hidden effects. When individuals regularly disregard these warnings, it can lead to chronic bad judgment, first in selected areas of life, and perhaps later on in a broad range of decision-making. [In saying all this, I am not making a case for the rule of law to interfere in personal corruption that does not directly affect others fundamental rights--this should always remain outside the prosecutorial powers of government.]

The degradation of conscience starts with the rationalization of nervous feelings when one wants to pursue an action that one inwardly knows is not quite right, or even wrong. Knowledge of what is right and the desire to act in a certain way are clearly separate processes. What one ultimately desires will prevail over knowledge without the presence of self control. Just as sensitivity to conscience is enhanced by obeying the feelings of

your conscience (especially when you have to combat a lack of desire to do what you know is best), so individuals lose sensitivity to truth by rationalizing away their nervous feelings in an attempt to feel good about morally improper acts. This latter process is the key to understanding the collapse of character in humanity.

It is also essential to understand that merely possessing a religious belief or fervor does not mean that one is aligned with conscience. Most people, including active church members, exhibit a resistance to truth at the point where truth starts requiring innate changes in areas that are painful to them. While none of us is perfect, some are way ahead of others in developing the quality of close allegiance to truth – especially where personal weaknesses are involved. This *fervor* to overcome personal weaknesses, rather than rationalize them away, is the essence of progress and personal happiness. Rationalization and willful rejection of conscience leads to eventual loss of character, which is most often characterized by a growing determination to see every issue as relative and to deny the existence of absolutes.

Because these changes in people's relationship to conscience, (which I define as their inner relationship to truth) are subtle and slow to occur, the social stability level of society is not readily observable during a short-term crisis, when expectations for quick relief are present. People tend to maintain the same outward emotional facades in a small crisis that they normally employ to shield their personal, marital or family weaknesses from their associates. A far more accurate gauge of the moral/emotional stability level of society is the study of people's long-term interactions with others in relationships that have *grown common*, where friction most easily occurs.

The decline of American family and marital stability is therefore very indicative of social order stability, in general. An interesting conclusion can be drawn from the increasing rates of divorce, abortion, drug usage, pornography, and children born out of wedlock. In each of these cases, it is notable that the individuals concerned are attempting to seek a shortcut solution to the normal rules of society or moral laws of Deity. Laws protecting family relationships are designed to make it difficult to change marital covenants where serious and permanent emotional damage results the conflict and dissolution. The easier it is to dissolve relationships, the more people are tempted to seek divorce as an avenue for relief of temporary problems. But since relationships have long-term consequences, it is always better to reserve dissolution of relationships for cases of permanent and long-term problems. This has been the little understood role of the marriage contract. Strict barriers to dissolution of marriage tend to engender long-term endurance and permanent life style changes, all of which encourage people to absorb stress by the correct means.

This is not an indictment of specific divorces but rather an enforcement of the long-term strategic importance of endurance in personal relationships as a reflection of the stability of society. There are some good reasons for breaking bad and dead relationships, but only after a person has made the necessary personal changes in himself and encouraged the spouse to do likewise so that the dissolution is based upon real, innate, and permanent incompatibilities, not upon the superficial (which always shows up in the next marriage).

It is also a telling sign about our society to read and observe the typical advice from psychiatrists and marriage counselors. They usually emphasize *techniques of communication* and *interaction* gimmicks, not right and wrong. Professionals seem to be

loathe to be tagged with being "judgmental." But we need more correct judgment of in life, not less! Unfortunately, rarely does society expect real personal change as the solution to social problems. In the face of poor performance or bad habits, modern psychologists continue to search for reasons why the person has been somehow victimized in his past, as an excuse for present poor performance. But there is a subtle admission here that the professionals understand little about conscience. They at least fail to understand that no matter how much a person may have been "victimized," every day is a new day and each person gets an abundance of promptings from conscience about the proper way to act and feel as he goes through the day. Chronic mental and psychological problems are almost always directly related to having developed chronic bad habits and chronic insensitivity to the voice of conscience in prior years. If the person is still sensitive to the voice, but not complying, then his or her self-control skills are severely damaged, usually through lack of use.

A society whose individuals deny personal conscience, and whose professional counselors avoid making a determination of truth, cannot long endure in peace. The growing tendency for people to seek shortcuts in solving family aberrations lead to a similar propensity for individuals to seek short cuts for relief during food and fuel shortages which only need to *appear* long-term. Notice that the actual duration of the crisis is not the controlling factor, but rather what people *expect* the duration to be. Discouragement is extremely dangerous during these periods as it lends to pessimism and the conviction that the crisis will never end. These false insecurities begin to seemingly justify more unlawful actions associated with panic and mobocracy. It is helpful in our analysis of the stability of the social order to analyze the characteristics of the type of person who most easily breaks down under long-term stress (assumed or actual). This will assist our awareness of the levels of emotional stability present in the local community. We will look at the three most prominent characteristics under which most other minor traits fall:

1. Lack of Self Control

This trait is most often demonstrated in frequent loss of temper, moral problems, and/or financial vices such as gambling or "gold fever" about investment deals. It is often accompanied by at least a partial addiction to the various drugs available in certain beverages and smoking materials. Persons who remain overweight for any significant amount of time are also weak in self control and personal pride. Possession of any one of these weaknesses is indicative of a tendency toward lack of self control, if not the full habit already. Note that self-control can be exercised ***selectively***. Certain people are very good at turning on the self-control when necessary and then losing it when they want to give into something. Moral lapses among high-powered successful businessmen are a common example. But let us take note: if they can exercise strong self-control in any area, they are *capable* of using it in other areas as well. That they do not is a sign of lack of desire, not lack of the internal power necessary to control themselves. Some people, on the other hand, are just plain weak in everything. Too often, they suffer from lack of self-control training. Weak children can often be viewed as "good" children. It takes perceptive parents to recognize that they need to be tough on weak children even when those children have a good temperament. Parents need to create hard tasks for them

when young, so that they can learn internal toughness. Long distance running is a great teacher. Working hard in the garden is another. Learn to recognize when your children have innate weaknesses and work hard at helping them overcome those weaknesses while they are young and amenable to change.

2. Problem Personality Eccentricities

Here, I am not referring to the normal variations speech and individual expression, but rather to obvious tendencies to be temperamental, impatient, selfish, cocky, flippant, sultry, and display general intemperance in private or public places. These types of persons are often subject to highs and lows of exhilaration and depression. Their taste in clothing, cars, and personal objects may be faddish and mod, and their music tends to be of the unstable variety (wild, heavy beat and raucous primeval sounds). While many people exhibit one or more of these characteristics, the prime indicator is a bull-headed arrogance and refusal to humbly recognize any of the foregoing as personal faults; an attitude of "this is me, world – take it or leave it." In short, a callous disregard for how one's personality may offend others is what makes such persons obnoxious. These type of people often have one or two saving graces which they heavily rely upon to overshadow other faults. Permissive parents of such children may use a child's good points as an excuse to overlook the larger problems. In a crisis, eccentric people almost always exhibit an unwillingness to adapt to rapid change. Additionally, their eccentricities are a source of extreme irritation to those who are forced to mix company with him. Flaring tempers and stress reactions are almost sure consequences surrounding eccentric people.

3. Philosophical Relativism

Those who belong to this class may be of two different types: (1) the passive intellectual who is simply not inclined to find out if absolutes really exist, or (2) those who choose to defend philosophical relativism in order to avoid the guilt often involved with absolute moral truths.

The first type is not particularly a threat, but the second type is dangerous to the general moral order of society when they attempt to destroy moral absolutes strongly held by others. These intellectuals who are hostile to moral truths (usually well endowed with academic and civic credentials) attempt to pry away at the firm truths that are others' source of strength in a crisis. They are usually humanists, though many are also liberal, social Christians lacking any firm ideological base. Relativism is sometimes based upon an inner desire to convince oneself that small, gnawing guilt feelings are not based on personal errors, but rather due to environmental factors and conditioned by a religion-dominated society. This evasion of valid guilt feelings eventually leads to chronic bad judgment over time, even though the tendency may be selective at first (exercising good judgment in many affairs and poor judgment in others). Since survival in a crisis demands rapid and consistently good judgments, based upon rigorous thinking and the recognition of solid principles, philosophical relativists are among the first to be brushed aside as the irrelevant bystanders to life that they really are. Sadly, in the early stages of economic and political crises, these types are often brought in from universities to

provide excuses and placebos to keep the masses from rebelling against the faltering ship of State.

Social Factors Related to Metropolitan Density

The degree of self-sufficiency that you choose will largely depend upon how negative your assessment is of the impending social disorder in a crisis. For those who live in unstable, large metropolitan areas, the core areas are fairly unstable due to several factors:

- Most inner city people are low paid workers with little food or monetary reserves.
- There exists a high dependence upon government welfare checks and food stamps.
- Many rely on mass transportation, which is very susceptible to interruption in an earthquake or power outage. Buses are more resilient to interruption, although the bureaucratic policies of city transit management may not be.
- Due to high levels of benefit-corruption, class and minority consciousness, and feelings of being "victims," the potential for retaliatory violence is higher than in the suburbs.

The Youth in Small Towns Aren't Much Better

Unfortunately, the influence of state-wide standardization in public education (resulting in poor materials and little discipline), combined with the pervasive influence of national television programs and movies, has nearly eliminated the small town distinctions in the social behavior of America's youth. Only in the sense that there are fewer people, both in number and in density (which allows for more family influence), and less wealth (hence less sophistication), are there still some advantages to small town living. To the survival purist, rural America is still the only alternative to the widespread moral and emotional collapse of the urban areas. However, this is only true by degree of corruption and by virtue of lower population densities.

Having lived in several small towns as well as in large cities, I offer the following insights. While large cities have a high number of malcontents and welfare-corrupted people, they also possess the highest caliber middle-class, which is the most potentially active group able to counter oppression. This group usually possesses enough well-educated people with good fundamental religious philosophy to patronize high quality private schools, staff citizen-government positions, and provide a high quality social and cultural society. Much of this is missing in small rural towns.

On the other hand, though small rural towns always have some high-quality, but less-educated people (which is sometimes beneficial), there is a higher percentage of low-class, unthinking, peer pressure oriented people who fail to have the vision to support private schools, quality culture, and good government. Small town government is quickly demonstrating itself to be the soft underbelly of America. Soft, small-minded politicians are ripe for being swayed by credential-waving planners, bureaucrats, doctors, and other elitist public educators who push for liberal and leftist causes such as a nuclear

weapons freeze, building code regulations, restrictive zoning, and even gun control. Public school boards are especially prone to being swayed by the "certified" experts peddling all kinds of liberal "advanced" education methods and programs. In short, the increasing sophistication of deceptive ideas and practices is harder for unsophisticated people to unravel and resist.

Most of the former virtues of small town America existed by default. The big cities succumbed to vice and control, but distance and lack of communication isolated the small towns from many of these corruptive influences. Now the full presence of corruption, via public education and the entertainment media, combined with the soft mentality of some rural people, has almost completely negated the advantages of rural America, except as noted previously. However, even though most of the advantages are gone, I still prefer semi-rural areas due to lack of people friction, traffic, and congestion. In other words, while problems are there, the sheer quantity is lower. Don't expect to find high quality employees in a small town if you have visions of moving your business out to ruralville with a population of l0,000 or below. 25,000 to 50,000 inhabitants is the optimum size for cities when looking to avoid the worst problems of crime and congestion, while achieving the relative advantages of small-town shopping and culture.

The question for the non-purist may be, "How can I enjoy and be of assistance to the society in which I live, and still provide security for myself and family in the event of social unrest?" Any decision to stay within the existing social order should be accompanied by firm personal and family commitments to be of positive influence in the community. Trustworthy neighbors should be encouraged to store supplies of all types, though you should not reveal the full extent of your personal preparations. Keep it general. The Y2K crisis was an optimal opportunity to get people started on preparation. Now that this is past, it is necessary to slowly help people to understand the greater, but hidden, threat of Russian nuclear war and the betrayal of America by New World Order leaders who control this nation. In order to preserve the privacy of your shelter preparations, encourage others to buy how-to books on preparation, rather than display your own preparations (with some exceptions) as teaching aids. The degree of willingness manifest by one's friends and neighbors to follow or reject good counsel might be used as a criteria for sharing, if supplies should run short. Certainly no one should assume a totally non-sharing attitude if he intends to survive within a community. But neither should you be foolish enough to open up all your supplies to everyone who failed to prepare – your supplies would be gone in a day, and that wouldn't do you or your family any good at all.

Secrecy is an important but short-term solution to the threat of looters, as long-term starvation tends to illuminate the well-fed from the background of the starving masses. In timing your preparation efforts so as to avoid resentment from others, it is well to remember that supply storage during times of plenty is acceptable "wisdom of forethought," but buying for storage after shortages arrive is unacceptable "hoarding." Please also note, for your own protection, that even the presence of storage supplies in times of shortages will be viewed by some as "hoarding" – especially the bureaucrat charged with ferreting out stored food to determine your dosage of ration coupons. It is irrelevant to him when you bought it. All he know is that you have an "excess" while others have a shortage – and that may be deemed a crime!

Governmental Interference

The basic judicial and police functions of government, when *limited to defending true fundamental rights*, are a benefit in preserving public order under a proper constitution. Governmental defense of the "rights of the innocent" is essential to the preservation of stability, which allows others the freedom to produce and keep the product of that labor. However, when government protects the "rights" of criminals more than those of the victim, confiscates wealth for social welfare purposes, interferes with legitimate economic competition, and attempts to regulate and determine the range of free choice of individuals, then we become wards of the State. Judgment dies, the dole abounds, character is lost, and able people become benefit-corrupted. Finally, men and women who resist become targeted as enemies of the State. The instabilities caused by government interference in our lives are as follows:

1. Distortion of the Economic Marketplace

Persons of lesser talent are given power to demand a wage equal to those of greater worth. It becomes illegal to make judgments on the relative worth of a class or of any individual who may belong to a government-designated "disadvantaged" or "protected" group. Licensing to certify competency creates a protected class of professionals or laborers who can command a higher than market wage. Men who attempt to offer the same service at a cheaper rate are deemed criminals by the very attempt, not by any specific criminal act. Companies with significant lobbying power are given monopoly positions in the marketplace in telecommunications, trucking, railroads, etc. Government spending in areas of sub-market value (through subsidies or special minority investments) causes growth where it would not normally exist, robbing more productive and beneficial areas of the economy. Government borrowing distorts the demand for money and lessens taxpayer resistance to increased government spending. Borrowing inevitable results in increased *future taxation*. Since the long-term burden of debt is not felt by the public until many years later when interest payments become huge, there is little resistance to government use of debt--especially when the alternative is an immediate increase in tax rates. That is why taxes are a much better vehicle for helping people to resist government growth--the effects are immediate. With government debt, the financial danger is postponed until it is usually too late to recover.

2. Distortion of the True Worth of Individuals

Government propaganda on civil "rights" promotes the egalitarian lie that all men are equal and that it is an evil to esteem oneself as better than another, no matter how clear the facts. But the facts of life don't lie. As enforced economic equality grows, true justice, which is the allocation of just rewards in accordance with a person's true worth and effort, suffers. This distortion of market based judgments on quality leads to underlying resentment, and eventually causes class warfare and struggle. This is not the natural struggle for personal progress that is a normal part of the free market, but an unnatural enforcement of "equality" upon unequal people in accordance with the notions of Marx and other modern defenders of so-called social justice.

3. Destruction of Property Rights

Our power to have binding contractual agreements upheld by the courts has been weakened a great deal in the past 100 years. People can be sued by someone who has an accident on their property even when that person is guilty of trespass. Redistribution of wealth through improper taxation, and improper doling out of welfare is rampant. Legitimate tax avoidance abounds, but is forever the target of a cash hungry government. More "loopholes" are closed each year and eventually all legitimate producers become either employees of the State or tax-evaders – labeled as criminals, in the end, for wanting to keep a significant portion of what is rightfully theirs. The ultimate instability comes in the destruction of the economy by government interference, and the obscuration of what is "good" and "evil." Other "law-abiding" citizens perpetrate the greater evil of tattling on those fighting the State, who are defending their fundamental rights against evil laws and unjust confiscation by a benefit-corrupted majority. Heaven help those who cannot judge correctly the difference between good law and evil, or worse, who defer only to the authoritarian legal profession to make that determination. When people lose the ability or will to make proper judgments of good and evil (due to ignorance and corruption) ,and when a nations leaders refuse to make honest moral judgments in the halls of Congress or in the courts, the spirit of a nation is dead. Interestingly enough, nations rarely collapse completely under the burden of socialism. Corrupt nations die from invasion and war--the inevitable results of chronic bad judgment on both the individual and national level.

Natural Disasters

An interesting phenomenon has been occurring since the turn of the 20th Century, in that the frequency and intensity of natural weather and earth disasters has steadily increased. The common denominator this factor shares with the other two instability factors is that it cannot be effectively controlled by the individual. Fear of the uncontrollable only intensifies peoples' dependency on the elements of society (government, big business, and insurance), which are seemingly big enough to promise security, safety and relief. Thus, the increased frequency of natural disasters accelerates the power and regulatory tendencies inherent in these large hierarchical bureaucracies, and at the same time destroys individual self-reliance and initiative. With provisions available through federal disaster relief grants and loans, the individual rarely donates money in behalf of the stricken. His efforts seem so futile in comparison.

All of this leads up to at least three social order weaknesses which become evident during extreme or long-term natural disasters:

1. An impatient, demanding attitude about government relief, including negative work incentives that destroy self-initiate (so as to maximize your government or insurance claim).

2. The propensity to become frustrated and angry when and if the government or insurance companies cannot produce enough relief.

3. The general conviction that if government cannot handle it, no one can; therefore, each man is on his own.

Some will go to work, but most unenlightened people will demand or take food from others, till there is nothing left to take. Then, it is either work or starve. Even if these problems are not immediately forthcoming, we must not underestimate the direction in which we are moving. If you are still one of those who believe that the majority of Americans are good like you, take a good look around you while passing through any city over 50,000 and see what percentage of the people you see on the streets gives you a sense of trust and morality. Faith in the youth of America? Try the same test after walking through any typical public high school. The loud, uncontrolled conduct, punctuated with gutter language and rough dress styles, is not a pleasant prospect for the future.

Specific Disaster Threats

Earthquake

Following the emergence of the book, *The Earthquake Generation*, I received calls from an inordinate number of people concerned about whether the author's psychic-scientific approach was valid. My response was, "only partially," since I firmly believe that all psychic people receive their information from external sources – but that they are from the wrong side of the spiritual spectrum. The evil side has access to some truths, but uses those truths to induce some form of dependency upon these false, but easy sources. Ultimately, the intent is to lead people astray. I definitely do not believe that anyone ought to make any plans or decisions based upon new age or psychic predictions – especially the type that prove true once in a while. That only shows these spiritual mediums are deeper into the sources of deception than their amateurish counterparts.

There are a few places on earth which are highly stressed, geologically, and likely to shift in the near future. The Seattle, Washington area is one. The San Andreas fault is another. Another major fault line runs down the Western Rockies along the western edge of the Rockies from Idaho to southern Utah. This one is not a high stress fault and is not as inherently unstable as the Pacific Coast fault lines (which are part of the infamous "Ring of Fire"). If you live anywhere in California from the Bay Area on south to Los Angeles, you need to prepare for a massive earthquake. I personally believe that despite scientific advancement in the predictability of earthquakes, the next big one will give little advanced warning – except that it will probably correspond to maximum high tidal forces on the earth surface. The evidence is fairly conclusive that quakes do get triggered more often when the sun and moon are pulling together causing deeper and heavier ocean tides, and thus increasing the stress on fault lines. See the website, www.syzygy.com for details on this method.

Wisdom would dictate that, while you cannot avoid all earthquake risk, if you have to live and work near the danger zones, you can avoid establishing your office in an earthquake prone building, or worse yet, under or to the side of one that may come down on you. I would stick to single story frame dwellings if you have a choice. Even though many new steel high-rise offices will flex in a quake, the resulting whip of the building could be just as fatal and would certainly trap many people in broken elevators and upper floors of high-rise buildings. The chance of being literally ejected out one of the all glass sidewalls is also a real possibility. If you have any flexibility at all, I would recommend

a change of business location before the next quake so as to avoid the rush to escape the devastation. Above all, stay off high freeways and overpasses during periods of high seismic vulnerability.

Ultimately, I believe that God controls the rate, severity, and placement of natural disasters – for a variety of purposes, not the least of which is the punishment of gross human conduct when their "cup is full." As Gary North cogently put it, "If San Francisco isn't destroyed, God owes Sodom and Gomorrah an apology."

Except for the west coast, I do not rely extensively on earthquake maps to avoid earthquakes. Earthquakes really can and will happen anywhere and everywhere eventually. It's like fallout – better to plan on it and prepare against it than to try and run away from it. I don't mean that people should live in known high risk areas, but neither do I want people to feel like they never have to prepare for quakes because they live in an area where quakes have never happened before. We all need to prepare for a broad range of threats. I have seen many people get hung up on one aspect of preparedness and fail to prepare for other issues equally as important. The prime example is that most people prepare for minor crises that require backup supplies of food, water and power, while failing to prepare against the ravages of nuclear war. If one doesn't survive the radiation threat when it comes, they won't be alive to utilize the rest.

Tornadoes and Hurricanes

While these disasters presently follow somewhat predictable patterns in certain areas, they can also be wide-ranging, especially now that weather patterns themselves are becoming more unpredictable. Severe wind storms, called *hurricanes* in the Atlantic and *typhoons* in the Pacific are beginning to hit in some unusual inland areas. Tornadoes are also ranging wider than ever before. Unfortunately, the type of above ground construction that is lightweight and flexible enough to resist earthquakes is not suitable for high wind resistance. In low water table areas, the best place to ride out all these disasters is a basement level, reinforced concrete bunker which tends to "float" in the earth during a quake and is untouched in a windstorm. In the Gulf Coast areas where there are few conditions suitable for basements, above ground reinforced concrete structures with earth-bermed sides are the solution. Rather than making the entire house of that construction, usually it is more feasible to construct just one secure room or area as a storm shelter.

Tidal Waves

Tidal waves are so powerful in their effects that there is little that can be done in the way of secure construction to protect you if you insist on living so close to the beach to be in their direct path. The only sure way to guarantee against massive destruction of even reinforced concrete walls is to have the structure firmly anchored deep in the ground and then have the exterior walls heavily earth-bermed. This allows the water to flow around or even over the structure temporarily. If you are a few hundred yards inland where other structures will absorb the initial shock of the wave coming ashore, you may only have to design for sufficient strength to resist a disjointed rip tide going back out to sea, dragging a lot of debris with it. If you artificially raise the house high enough to avoid the

flooding, you are more subject to destruction if you encounter the force of the wave itself. Since there are no easy answers, I recommend no permanent residences on water areas subject to tidal waves.

Pestilence

Invasion by insects has not occurred to any large degree since the development of chemical control measures to counteract this threat. But with the growing propensity of mutant forms of insect infestations, resistant to chemical controls, we could experience some great insect plagues in the future. The present direction of environmentalism threatens the development of new and effective insecticides. Bureaucratic mismanagement of insect infestations, such as was exhibited years ago in California during Governor Brown's administration, should not be discounted in our prognostications about a fast moving infestation. I suggest stockpiling a wide range of environmentally friendly insecticides and insect repellents as a precaution against non-availability in the future. Naturally, you should learn to use chemicals with skill and caution – only using enough to do the job effectively. Fortunately, in both the agricultural and medical realm, there are natural alternatives that can (in moderate cases) effectively substitute for modern chemicals and drugs. Ultimately, in a large scale insect invasion, nothing may be effective except sealing yourself inside or leaving the area.

Plagues

Just as the established medical community has begun bragging about winning the war on disease, new drug resistant varieties of communicable diseases are coming back with a vengeance. Indeed, more new strains of dangerous bacteria and viruses show up faster than drugs or vaccines can be created. The track record of vaccines is filled with deceptive claims. The newest vaccine technologies are very dangerous to the immune system. The percentage of adverse reactions and death due to childhood vaccinations is growing each year, information that is being highly suppressed by the medical establishment – in collusion with government. Check out the website: **http://newatlantean.com** for an eyeful of vaccine horror stories. Fortunately, new knowledge about alternative ways of beefing up the immune system naturally through good nutrition and the judicious use of herbs, vitamins, and minerals offers solid promise of surviving these plagues, as long as you aren't swimming in a sea of sick humanity--another argument for not living in the big cities, or letting your kids go to public schools.

The Threat of Nuclear War

Although I outline the dangers of this subject much more completely in my book *Strategic Relocation*, I will give you a brief overview of the problem here. In short, the Russians have been cheating on all aspects of the nuclear and chemical weapons treaties they have signed with the US. They have continued the secretive production of nuclear, chemical, and biological weapons while giving US inspectors only token access to old, outdated facilities. Numerous defectors have verified what intelligence agencies have suspected. But the US government isn't even complaining. Indeed, each administration continues to run cover for the Russians – all the while certifying that they are in

compliance and worthy of more aid. Something is very wrong here – especially when you consider how loud the complaints have been about Saddam Hussein possessing "weapons of mass destruction" and not letting our inspectors in. Saddam is peanuts compared to his supplier – the Russians.

Tragically, the Russians do intend to launch a preemptive nuclear strike against US military targets in the future. Why? Simple. Communism isn't dead and isn't likely to give up the struggle until it fulfills its stated destiny of conquering the world. The "demise of the Soviet Union" is one of the most carefully crafted frauds in the history of the world. It was done with Western media collusion and is intended to induce the West to accelerate its disarmament and increase aid to our new Russian "ally." The free market is getting nowhere in Russia after years of Soviet era paternalism. In fact, most of the people are hostile to the phony free market they are experiencing. They are also hostile toward the US who they blame for ramming it down their throats. Russian Communism will always have to have an external source of economic prosperity to sustain its voracious appetite. I think they intend to take Europe, and they want to do it without a fight. The Russians intend to take down the US and its entire military in one massive nuclear strike, so they can induce Europe to surrender without a fight.

In fact, the Western conspirators, who more or less control all the governments in the industrialized world, are encouraging Russia to strike, by giving aid, looking the other way while Russia arms, and by weakening our own defensive posture. Remember that Western capitalists built up and encouraged the rise of Hitler in order to incite WWII. Why? To cause enough world havoc that people are induced to give up national sovereignty in exchange for the "world peace" promises of a New World Order through a more powerful United Nations. The establishment powers have been trying for years to get the world to give up sovereignty and voluntarily agree to international and regional control – always using free trade and prosperity as the carrot. But the closer people get to the realities of global control, the more resistant they become. Things are also moving too slowly for the Powers That Be. Even Europeans are resisting the price of austerity that the common market is requiring to achieve monetary union. So the globalist controllers in the US and Europe are intending to keep disarming unilaterally and to keep feeding and covering for Russia until the Russian bear is ready to strike. I don't believe that Russia will attempt to occupy the US –there are too many guns in private hands. But both she and the New World Order want the US taken down as the number one military power in the world. This then would leave only the UN as the sole Western power capable of fighting back and winning a long conventional war with the Russians. The West, I believe, will arm Red China in order to induce her to turn against Russia – which will then (in good Hegelian form) provide the New World Order a brand new threat after the war. Conspirators must always have an "enemy" in order to justify continued tyranny and control over the people. But upon forming a world police power, the UN will use this power to eliminate dissidents and "reactionaries" like you and I more than the Chinese. The new internment camps our government is building are not meant for illegal immigrants, but for patriots. It's a bad scenario, but I think you will see history unfold this way. So how do you prepare for all this? Above all, you must prepare to survive the coming nuclear strike. Believe me, it can be survived!

There has always existed a great deal of nuclear hysteria brought upon, primarily, by the concerted efforts of the radical Left and their media partners, many of whose motives are treasonous at worst and cowardly at best. My purpose here is not to argue what could or might happen in the "worst case." If I am correct in my prognosis, the "worst case" destruction is only going to happen to about a dozen cities which have huge military targets in their midst. The rest of the nation will only suffer from varying degrees of fallout. I often hear the most ridiculous statements, absolutely without foundation, about how most people exposed even to slow dosages of radiation will die of cancer, even if they survive the "holocaust." Everyone is quoting some "study" without checking on the motives of the experts pretending to be "neutral." The impression they give is that cancer is some automatic result of any amount of radiation.

In actuality, the condition of the body and its immunal functions have far more to do with the contraction of cancer or the failure to eliminate cancer than the radiation itself, when the exposure is slow and minimal. The human body is constantly coping with toxins and even some cancerous cells. It is when the protection systems of the body weaken or break down through long-term poor nutrition (which, unfortunately, is common) that these systems cease to cope with internal threats such as cancer. But this is hard to prove in each case, since individual factors are so complex. While it is true that some may die in a nuclear war, the chances of it being you, if you are not living near a very sensitive target area, are not very high. Most people will get very sick, however, which is going to be very unpleasant – especially since there are few hospital facilities that are protected. Most of the medical personnel are going to be sick along with the rest.

My point is that you should not be negligent in your preparation against future fallout. Fallout, frankly, is relatively easy to prepare against – if you prepare in advance. Hasty preparations in the midst of an attack will be helpful, but will not leave you without some ill effects. Don't be overly preoccupied with trying to find a "fallout free" location. Running away from fallout is like trying to predict the world weather patterns on the very the day of some future attack. You should, however, relocate away from known blast areas, and prepare for fallout wherever you are.

SUMMARY

I believe we have long passed the point where the good people of the world are in the majority. Good, reliable, honest people are a minority. If we had a severe worldwide crisis now, where governments would be powerless to help, I think we would have massive social unrest and anarchy on our hands. Some would prey on the innocent, while a few would rise to their defense. Presently, any crisis or war short of collapse will only engender a call from the world-wide majorities for more government power – not less – especially now that a so called "conservative" American President has stated that a government "Safety net" is a legitimate right for all people to expect.

Chapter

4

Preliminary Decision Making

My purpose in this chapter is to take you through the important steps of analyzing your present situation and location, and matching that against your ultimate goals. It is impossible to make good decisions unless you stop looking at the world as you *want it to be* and take a good hard look at what it *really is*. I don't believe in being optimistic any more than I believe in being pessimistic. Being realistic and brutally frank with life should be the goal of every prepared person.

It is my opinion that we live in the most deceptive age in history. Despite all the modern technology, most people know less about what is really going on in the world than any time since our nation's founding – even though they *think they know more*. The problem is not lack of technology, it is *lack of honesty* in those feeding information to you. There is a whole different world out there operating under the cover of secrecy, and what is worse, it has a very bad agenda – one that requires that the common person *not know* the whole truth, or even a major part of it. So the rule of the day is suppression of critical information. We live with an illusion of peace, where there is no real peace – while conspiring men are planning as I write to take us into another world war. We live in an illusion of prosperity, where there is no true prosperity – only the propped-up economy of debt, which will someday crumble into a depression. And war always follows these man-made depressions. Hopefully, you still have a few years to prepare, but you must not procrastinate any longer.

ANALYZING YOUR PRESENT SITUATION AND LOCATION

General Ratings of Locations

I'm disappointed, but not surprised, when I read certain popular books which rate various retirement areas based solely upon "quality of life." These recommendations always end up showcasing the elitist, sophisticated, country-club viewpoint. Even ratings based upon economic criteria end up emphasizing pro-growth, tax subsidized suburban areas that use a variety of government interventions to "stimulate growth" and "create new jobs." The hidden victims of these pro-growth interventions in local economies are the people who had their properties condemned to make way for new development (supposedly to increase the tax base), as well as all the taxpayers who end up having to

pay for new infrastructure caused by the artificial stimulation of growth. The latest figures clearly demonstrate that tax concessions to big business never really offset the increased tax burden of building new infrastructure (roads, sewers, water lines, and schools) to accommodate high growth rates. Yes, there are some well-connected winners in this game, but the common citizen-taxpayer is always the loser. In contrast, I look for slow growth and signs of stability. High growth always equates to heavy handed tactics by local government, pushing aside the rights of little people in favor of the money elements.

Growth Rate

For long-term security, you must first find small rural places that resist these inexorable trends toward statism. Slow growth is one key to stability. The next step is to find a state that does not have a state-wide growth control system. You might think this would be helpful to stability, but it is not. It might grow slowly, but it does so by the creation of a gigantic state land-use control bureaucracy that forces every county, no matter how rural, to comply – and compliance means hundreds of hired planners and bureaucrats. Mind you, all states are headed in the wrong direction, but some are much worse than others. There is even a national movement spearheaded by a coalition of liberals and environmentalists to counter "urban sprawl," which means they are trying to inhibit people from moving further out into the rural suburbs to get away from the high densities of urbanization. This is pressure in the wrong direction. America needs to be less urbanized--not more. After cities pass the 50,000 population barriers urbanization starts to lose its economy of scale and the per capita costs of government start to rise, rather than decrease. This is mostly due to the costs of managing increase friction between too many people.

What none of the urban planners factor into their so-called "benefits" of urbanization are two very critical factors:

1. *decreased* independence and self-sufficiency for the millions that flock to the cities.
2. *increased* susceptibility of these people to government control and enforcement in a crisis.

But perhaps that is precisely what the "powers that be" want: fewer self-sufficient and independent Americans and more people with no choice in a crisis but to call upon more government control and "assistance."

State Regulations

One of the things I look at most heavily is how controlled any particular local area is by a political establishment that constantly pushes its society toward greater government power and control. I watch sadly as well-connected businessmen show no resistance to the loss of freedom as long as it means more growth and more sacrosanct job creation.

It used to be that entrepreneurs were the first to fight increased government regulation and interference. But the new breed of corporate managers are devoid of ideological convictions. Many times I find them in collusion with the socialist, big government elite. Oregon, Washington, and California have suffered for years under both. The old time,

wealthy power-politicians ruled for many years in the urban areas of these states. Eventually they were replaced by the new intellectual socialist breed from the liberal universities. The old business-dominated newspapers slowly evolved into radical leftist organs that still like to put on a pro-business image. The wedding of the two became a reality in the '80s when big business interests started to endorse "enlightened social policies" as their method of "buying-off" the liberal press, whose constant attacks on capitalist selfishness kept making them look bad. But the west coast is not the only place – this same trend has followed in every mega-metro area where liberal newspapers control the attention of the unthinking majority.

Whether or not compromising power politicians can be defeated depends on the effectiveness and integrity of the opposition leaders, and whether they have access to the media to counter the constant barrage of subtle propaganda. This is still futile, however, in states where the people have been sufficiently corrupted so as to not want the hard truths any longer. They become trapped by their own lack of understanding and failure to see the legal pitfalls underlying euphemistic and politically correct legislation. States that have large groups of fundamental Christians tend to set up opposition movements which, though in the minority, are sufficient to keep debate open. Oregon, Washington, and California are wrapped up tightly in pro-government policy, although every once in a while the conservatives will get lucky and pass a measure (like property tax limitations) that sets the liberals back for several years.

Political Climate

Equally as important is to look at the degree of gullibility and vulnerability of people to the effects of liberal propaganda. Are they losing their children to the disinformation and demeaning social pressures of public education? The good old American farm family is prime game for these and other subtle societal changes. Look at the number of liberal farm states voting for more government subsidies, whose people still regard themselves as "Conservatives."

Boom towns and college towns spell ultimate death to a city or state. The first brings in big money, corruption, and a good share of workers looking for a fast buck. The second brings in excessive sophistication, snobbery, and social welfare policy – all in the name of culture and education. I am not against education, but I am against the false worship of credentials rather than true competency, and the false pride that comes from worshipping the education elite who run a college town. The spirit of false educational pride seems to infect people in a college town even down through the high school level.

The General Area

Sit down and make some estimates of the following factors that relate to the suitability of your present location.

I. **People:** Some of this has to be based on general feelings or estimates as you observe your local community through the years. Be careful to avoid overly optimistic judgments that come from not having much contact with the problem people of your community. Take a good look around, especially at the areas you don't often frequent.

A. Population density per sq. mile (see the appendix of *Strategic Relocation*).

B. Ratio of productive to non-productive people (number of persons on welfare divided by total area population).

C. Ratio of people with high moral standards to those of low moral conduct (this is difficult to estimate). Some general factors to consider are number of churches in the community versus the number of bars, adult bookstores, or other problem attractions.

D. Potential racial conflict problems. Do you have a significant minority population that exhibits hostility to the majority? Is there a large quantity of low class, corrupted people within one or more of the minorities? Are these malcontents organized or incited regularly by leftist oriented leaders? Are radical race-conscious organizations active and growing among the minorities?

THE OPTIMUM LOCATIONS: Don't live in areas with more than 100 people/sq. mile – 35-50 is better. If you are in an area with a higher density, you really need to have a contingency retreat in a nearby rural area. Look for a good mix of middle class business people and hard-working farm and agricultural people. Farm communities hardly ever have sufficient interest in politics, law, or economics to understand the issues and resist bad thinking when influenced by slick talking, pro-government types. They often have good gut feelings about generalized principles, but get tripped up by the complex details of law. Avoid college towns unless the college is a religious based, conservative school. Otherwise, colleges almost always promotes a liberal, snobbish atmosphere. Look for populations where there are few minorities – enough to give everyone a taste of other cultures, but not so many that racial or culture wars would be inevitable in the future. Look for a sincerely religious populous, but not those for whom church is merely a tradition or mostly social function. There will always be some socially-centered churches in every community, but at least half should be solid, fundamental-type churches or synagogues that adhere to Biblical commandments without embarrassment.

II. **Churches:**

A. Are there a variety of religions represented?

B. Is there tolerance of opposing religious viewpoints without persecution?

C. Are they mostly conservative in view or are they liberal, social/prestige churches?

D. Do most attend church for social reasons or for true worship?

III. **Economy:**

A. How diversified is it? Does the surrounding area have a sufficient agricultural base to produce local food without importing it from nationwide suppliers? Is the job base widely spread among numerous companies or are most people employed by a single industry or company?

B. How dependent is the area upon external transportation factors (trains, trucks)?

C. How union-oriented is the job base? (Large union representations, including teachers lead inevitably to strikes).

D. How control is the area by big corporations or government bureaucracies?

THE OPTIMUM: You're looking for a fairly self-sufficient community in terms of food, water, and some fuels. Naturally, you can't get self-sufficiency in the total industrial sense outside of large cities, but then again, these big cities are never self-sufficient in food. Farm service communities come the closest to this ideal. Avoid single industry or "company towns." When the company or industry has a set-back, the whole job market collapses.

IV. **Utilities:**

A. How much of the electricity and gas supplies are produced locally?

B. If the area has local coal, gas, or hydroelectric power, how large a percentage of the total energy needs does it supply? Does the local electric company have back-up generation capability should it not be able to buy power from the national grid?

C. Does your community have abundant forests and wood supplies to revert to wood heating in case of prolonged electricity or gas outages?

THE OPTIMUM: While hard to find, there are some communities that have local hydro, coal, or gas power plants that provide for near total self-sufficiency in an energy crisis. Electrical power makes everything operate in our society, so self-sufficiency in this area (though rare) is worthy of searching out.

V. **Local Government:**

A. How competent and efficient is it? Are taxes for county or city services low? Are there constant accusations of corruption or complaints about public services?

B. Is it controlled by an established power elite, no matter who gets elected?

C. How much regulatory control is there in land-use planning and building permits? Avoid areas with state wide land use control agencies.

D. Is the tax base reasonable and the administration efficient? (Overall tax base is mostly controlled by how much spending goes to public schools – who have an exclusive monopoly on tax revenues. Get a chart the local school district that shows comparative state rankings of spending per

student in public schools. Compare the school district's spending per child to national rankings. If it is in the higher percent range of states, the area has had excess influence from the education lobby. Bigger spending is always symptomatic of problem education – just the opposite of what the educators say.

E. Is the police force competent and principled? Almost all major cities have corruption in the police forces, and many smaller communities do too.

THE OPTIMUM: Most towns of 50,000 to 150,000 people are fairly competent, efficient, and corruption free. In fact, this is the optimal size for a city. Past this point, the cost per inhabitant for government services starts to grow, rather than diminish. The frictional costs of regulating and policing too many people with too many laws makes it less efficient. Below 50,000, small town corruption can take hold in what used to be infamous in the stereotypical southern town. Some small towns are delightful and clean as a whistle – but there is truth to the problem of a small tax base, especially when there are too many state mandated government services. Still, small towns can almost always get away with a smaller tax base through more efficient administration.

VI. **Climate:**

A. Check on the average humidity in the area. Highly humid climates are generally bad for health and attract lots of insects. Dry is better.

B. If the region has enough rainfall to grow crops without irrigation, then you are probably in a tornado belt, or have high amounts of coastal rains.

C. Is the area subject to annual hurricanes or flooding from large storms? Is it in a tornado belt?

D. Does it have severe, sub-zero cold in the winters?

E. Is it in a climate belt that is only tolerable with air conditioning?

THE OPTIMUM: The best climate for health and security is the dry continental air of the intermountain west – from northern Arizona up through Nevada, Utah, Idaho, and eastern Oregon and Washington. Also included are western Colorado and Wyoming. These climates are full four season climates, and have moderately cold winters that are mostly dry and sunny. I realize that many of my readers love living in warm climates. The trouble is that other soft, lazy, criminal people love soft, warm climates, too. The California climate is one of the best in the world, but for that reason it becomes a negative – way too many people are attracted to this area, and the potential for massive social unrest in California in a crisis is very real. Colder climates tend to drive away a lot of problem people. Severe northern climates (exposed to cold Canadian air masses) do an even better job, but this cold is severe enough to be dangerous to those unprepared to survive it – especially if gas or electricity becomes unavailable.

VII. **Location relative to strategic threats:**

A. Are you in an extensive resort area? These areas are usually quite vulnerable, both economically and in social terms during hard times.

B. Is your home on a major secondary road with lots of traffic? High visibility locations are dangerous when a crisis forces lots of refugees to take to the main roads.

C. Are you near a major freeway or highway exit pattern from a large urban center? Privacy is compromised as well as security in a mass exodus from the city.

D. Are you in an earthquake, or natural disaster zone (tornado, hurricane, tidal wave, volcano)? Your ability to recover from these threats will be limited in tough times.

E. Are you near a primary nuclear target (strategic military base, command and control facilities, or military related industrial base)? Avoid these areas by at least 25 miles and make sure you are not downwind from any of the major wind patterns in these areas.

The Specific Neighborhood (Suburbia)

I. **People:**

A. Are they of a caliber that you are comfortable with?

B. Is there a racial problem?

C. Do you have any close friends near by?

D. Do the children in the neighborhood have extensive bad habits (drugs, vandalism, late night annoyances)?

E. Does the area have a significant crime problem, especially with gangs?

II. **Facilities:**

A. Can you do most of your shopping locally?

B. Can the community support your work endeavors?

C. Are businesses generally honest and trustworthy?

D. Do you have access to a local bank not controlled by a big national bank?

E. Do the recreation facilities meet your needs?

III. **Schools:**

A. Do you have access to competent, well disciplined private schools?

B. Are public schools locally controlled with limited taxing power? Are taxes low?

C. Are there any strict standards still existent in the public schools? (It's practically illegal to have any real discipline in public schools today.)

Your Source of Income

1. Is your means of income crisis-sensitive? In other words, will your job or business be one of the first or last to go in a recession or crisis?
2. How dependent is your job on factors outside your control (e.g. transportation, UPS strikes, regulatory shutdown, union strikes, etc.)?
3. Do you like what you do and are you planning to continue working?
4. Do you have to commute long distances?
5. Do you have to transit risky or highly urban areas to reach your work?
6. If your are retired, are your retirement funds all in paper assets that could be lost in a market collapse? Are your pension funds heavily invested in paper markets?

The Analysis

Your answers to the foregoing questions will determine whether you come to a generally negative or positive assessment of your present location and situation. Yet they do not actually provide you with all you need to know to make your final decisions. The other more important questions have to do with how your optimum criteria relate to your real alternatives. For example, suppose your community is rated very poorly in the area of moral integrity and benefit-corruption of its working people. Do you have any other nearby communities to select from that have any better ratings? You may not if the type of job or profession you have is tied to the demands of a large metropolitan area. Almost all large urban centers have huge populations of welfare-oriented, benefit-corrupted people – although there are usually suburban areas far enough away or expensive enough to isolate you from these urban problems (temporarily).

To complete the accumulation of data for your final decision, you must find some potential alternative locations and rate them as well. Sometimes this is difficult if you follow traditional methods (talking to Realtors, Chambers of Commerce, etc. who always put a positive spin on their communities). My book, *Strategic Relocation* is a good place to start if you determine you need to relocate, and also if you are considering establishing a contingency retreat in more rural areas but your job or family ties keep you in the large metro areas. For purposes of this chapter, I will present a simple decision making chart which will help you derive answers to critical questions.

RELOCATION DECISION-MAKING PROCESS

The following questions will assist you in deciding if you should relocate, and if not, what contingency plans to implement.

I. Is my present situation and location safe and satisfactory?

A. YES. Perform the minimum survivalization of home and acquisition of storage items to be prepared for small or temporary emergencies that may occur in your location (see Minimal Preparations on page 164 in the Four Sample Remodeling Layouts chapter).

B. OK FOR NOW, BUT THE TREND IS GETTING WORSE. Go to step II.

C. NO. Go to step II.

II. Considering my financial, family, and real estate situation, can I or do I want to relocate?

A. NO. Perform maximum survivalization of present home and select suitable vacation/retreat property that fits the retreat criteria. Blighted problem areas of the city should not be between you and your direction of escape toward the retreat.

B. NO, BUT MY PRESENT HOME IS NOT SUITABLE FOR SURVIVALIZING:

Sell and purchase a more suitable home within the best slow-growing suburban or semi-rural area available to you offering the least negative factors. Perform maximum survivalization within your budget on the new home and select suitable vacation/retreat property within transportation range.

C. YES. Perform minimum survival preparations within your present home, emphasizing equipment and stockpiles that you can take with you when you relocate. This ensures you will not be caught unprepared should a crisis come before your move is complete. If you have some preparedness features that will remain with the home, this may well enhance the value of the home to a potential buyer. Go to step III.

III. Select two or three general locations based upon the following considerations:

A. Rate the following criteria according to their importance to you:

- Security and survival potential (privacy and freedom from threats)
- Suitability for business or employment opportunities
- Recreation
- Family ties
- Essential facilities (good private schools, stores, etc.)
- Quality of people
- Self-sufficient utilities
- Climate
- Terrain, soil, and water features

B. Talk over the various pros and cons of each location you are considering with other family members involved. With your spouse, take time alone to study a map with the potential locations indicated. Check your feelings for which areas you feel most comfortable with.

IV. Plan and take a trip with sufficient time to extensively visit each potential area.

A. Evaluate the area according to the specific criteria you have determined to see if the location matches your expectations.

B. Check your feelings. I cannot emphasize enough how important it is for both husband and wife to feel good about a potential site and the move (as long as they are both of like mind about the need to find a safer location). If your spouse is totally oblivious to the future problem and senses no danger, then you have a really serious problem, for which I don't have a ready solution. However, if your spouse is in tune with you on the problem, make sure you are united in your final decisions. Often, all of the intellectual factors are present but one or the other spouse senses a "nervous feeling" about the proposed location. Almost invariably, the one with the nervous feelings turns out to be right (unless they are the type that feels skittish about everything new in life).

Make your selection when you are SURE, and then start to plan the move. Don't burn all your bridges at once. Start making purchases gradually and transition slowly so that if things don't work out, like the sale of the former residence, you won't be stuck. Don't engender more debt, and don't quit your job unless you have the conviction you can transition to other gainful employment in the new location.

General Comments

It is my firm opinion that the world is not yet completely controlled by those who conspire to set up a world government. They clearly have *effective control*, but <u>not</u> *absolute control*. They rule by using a wide range of incentives (including rewards, money, position, pressure, threats, and even elimination of those who get in the way, if necessary) to control many people who may not actually know they are dealing with an evil, broad-based conspiracy. The dark side of government still has to work to denigrate the opposition and keep the public deceived. In other words, I don't believe that everything is going to go to pieces in one big momentous turn to martial law and instant tyranny.

Rather, I believe that a gradual but steady deterioration through slow corruption is taking place, with occasional and ever more frequent spikes of catastrophes which will result in a further separation of the good people from the bad. Things are picking up in pace, however. Without a doubt, nuclear war is coming. The West is covering up for the massive and secret build up of new nuclear, biological, and chemical warfare in Russia, as well as dangerous technology transfers to Red China. These preparations aren't being done and covered up for nothing – they will be used in the next few years.

In general, I believe you have time to prepare and make any moves with wisdom and planning. Don't make panic moves. Maintain your financial lifeline as long as you can. Moving to a fully rural and isolated retreat can be disastrous to your finances if you try to live only on a fixed quantity of savings. Paper investments cannot be counted on in the next depression. Unless you have experience with how much money you can pour into farming and preparedness/self-sufficiency equipment, you should plan on having a lot of capital reserves – not just in paper assets. The establishment always creates a depression before a war. A financial collapse increases isolationism, speeds up disarmament, and makes a populous turn inward so they won't notice what is going on around them.

Remember, the purpose of contingency planning is to broaden your options and disperse your resources sufficiently so that they aren't all eliminated in one fell swoop. If you have significant reserve capital assets, I recommend you start liquidating enough to buy all the self-sufficiency equipment you can now, in advance of trouble. These supplies will dry up rapidly in a crisis or panic situation. If you depend upon a steady flow of retirement income, try to redeploy your assets into income-producing, debt-free, commercial real estate. The best bets are medical-related commercial office buildings. Medical services will never diminish in this world of bad eating habits, medical drug dependency, and government subsidies. Doctors will never be able to cry out for moratoriums on rent payments as may happen in residential apartment investments.

Do store some junk silver dollars for ultimate barter, as well. I prefer the Morgan silver dollars above all other coins. They are still legal tender and are big and heavy, making them easier to convince the general public of their worth. Numismatics will not have much barter value since only experts can properly evaluate them. In the long run, nothing eliminates your need for money more than having stockpiled supplies of all sorts, so that you don't have to go out and purchase anything. That's the ideal. Even if you can't do it perfectly right, you can barter away the things you don't need for other things you do need.

DEALING WITH CLIMATE TYPES

Hot, Humid Climates

The key to environmental control in this type of climate is **dehumidification**. This is best accomplished by mechanical air conditioning. In the compressing process, moisture is squeezed out of the conditioned air and drained to the exterior of the house by the air conditioner's built-in drain line. Without access to large amounts of power to run air conditioning, however, you must rely on increased **air velocity** to give a cooling effect. This is only marginally effective, especially at very high humidity levels when evaporation rates are minimal. Also problematic is the lack of natural air currents in tropic and subtropical inland climates. Frequent rains raise the humidity to the level where evaporation loses much of its effectiveness. The lush vegetation in tropical and sub tropical areas limits the available air at the ground level, almost entirely. Homes in these areas should be able to open nearly 50% of the available wall space, and should have high, peaked ceilings with vents at the apex to foment large convective currents

upward. The home site should take advantage of the highest ground available to avoid high water tables in lowlands. The high ground also helps take advantage of even modest air movements. Other alternatives to high ground are wind channels formed by ravines or nearby mountain updrafts. Large bodies of water create morning and afternoon winds due to the temperature differences between the land mass and the water. Coastal sites are especially advantageous if high enough off the beach front to avoid tidal waves and if they are built strong enough to withstand hurricane force winds.

Hot, humid climates also breed tremendous quantities of insects and other pesky animals. Termites and carpenter ants are ever present threats to the structure. Molds and fungus also predominate. Thus, tremendous care must go into the finish carpentry and caseworks around the home's openings to ensure a complete seal against these damaging threats. Wood must be treated for dry rot and contain anti-fungal coatings. If near the sea coast, screens should be of the nylon variety to avoid corrosion. Large overhanging porches and window awnings are necessary to protect screens and furnishings from the penetrating damage of high ultraviolet light emissions from the strong tropical sun.

Masonry is often a preferred building material in tropical climates. However, great care must be taken to maintain a waterproof surface both inside and out; otherwise, the masonry will absorb tremendous amounts of water from the air and harbor mold and mildew. Special mold and mildew resistant paints should be used. Certain types of wood, like teak, redwood and mahogany are especially suited for tropical climates. Though expensive, they have naturally occurring chemicals that resist rot.

Hot, Dry Climates

Shade from the sun is the primary key to mitigating the effects of hot, dry climates. Wind control is a secondary concern. Due to lack of moisture, in combination with constant solar radiation, natural vegetation is very sparse in desert-type climates. Tall hardy trees of the drought-resistant shade variety (Russian olive, Siberian elm, etc.) can be grown if even a little bit of starting water is available. These provide some very pleasant aesthetic features to the otherwise barren environment. The desert palms have some unique advantages over other more leafy shade trees in that they provide shade only at the top and allow unrestricted air currents to flow into the house below. They are also more resistant to sun damage than deciduous trees. However, they do not grow in the higher altitude deserts of the intermountain west, which have cold winters.

All houses in hot, desert regions, ideally, should be designed and built with parasol-type roofs. The roof is perched over the structure much like an umbrella, supported by short struts which vent the air, rather than allowing the roof to contact the top of the outside walls directly. Thus, if you were up in the attic, you would be able to see out through a 6-12" gap between the lower part of the roof and the house proper. As the sun heats up, convective air currents rise to the apex of the parasol roof, which must be designed with a continuous, high volume air vent along its entire ridge or peak. This allows hot air to escape without ever contacting the ceiling of the home. In this design, there is no enclosed, hot attic to contend with at night. Eaves (roof overhangs) should be very ample to allow total shade on all walls if possible. This feature usually provides a verandah around the entire house to support the large overhangs. Without a shaded verandah, you

should use hollow vented wall cavities into which air is circulated upward and out the parasol roof. Care must be taken in dry, desert heat to allow for wind shielding if the wind velocity becomes too uncomfortable. Windows that are subject to low east or west sun should have low-E glass or reflective coatings to keep out the sun's rays. Roll-down shutters or adjustable awnings can also work well. This special roof design will be discussed in another chapter.

Cold, Dry, High Altitude Climates

This climate type is associated with high inland mountainous desert regions characterized by dry, hot summers, and short, cold, mostly sunny winters. The key to mitigating this climate's effects is **super-insulation**, which shields the home from large temperature differentials. Window sizes should be moderate except for south-facing solar windows – and these should have fixed foam board or rolling quilted material for insulation at night. Selective thermal reflective coatings (Low-E) are widely available to keep heat reflected inward. Site selection calls for wind shielded areas, avoiding outcroppings and mountain peaks, as well as canyon entrances. For example, the inland deserts of Utah, Idaho, and Colorado are low wind areas except in the aforementioned mountain or canyon areas. Coves at low or intermediate elevations and mountain steppes (benches) provide good wind shelters and keep you out of the coldest air which always settles along rivers or valley bottoms. The site should utilize existing trees to the maximum for summer shade, but not so much as to block solar heating potential in the fall, winter, and spring. In sites without the foregoing natural shelters, consider building partially underground or providing earthen berms against the north walls for maximum insulation.

Cold, Wet Climates

The key to environmental control in this climate type is **moisture control**. Even in areas where the temperatures are not severe, warmth is difficult to retain due to excessive humidity in the air which lessens the effectiveness of clothes and home insulation. Vapor barriers on all home interior wall surfaces are a must (just under the sheetrock). Waterproof basements with properly built perimeter drainage lines will control all but the worst water table problems. In wet soil areas, plan on using more modern waterproofing materials than asphaltic emulsion. The newer *elastomeric bituthane* or *acrylic urethane* materials are much better than asphalt. Roofs should be of the highest quality with large overhangs and ample gutters to keep water away from basement and foundation walls. The ground around the house should always have at least a 1 or 2 inches per foot slope away from the house to avoid pooling of moisture against basements or foundations, and have percolation barrier plastic sloping away from the house under the soil and extending about six feet away from the house. Normal insulation is sufficient in wet climates which are fairly mild in temperature. In high humidity areas, more can be accomplished with a dehumidifier in the central heating system than with additional insulation. Caution must be taken to avoid sites in low valleys where the cold air and humidity tends to collect during winter months. The intermediate elevations are the most favorable in terms of temperature control and the avoidance of high water tables. Wet climates are almost always very humid in summer, so having a house on a slight rise or hill provides good summer breezes.

GEOGRAPHIC SITE MATCHING

This section describes the advantages and disadvantages of several different geographic types.

Flat Plains

Pros:

- Usually flat fertile farm land
- Isolation from big cities and their inherent people problems
- Moderate wind sites for possible wind-powered generator or water pumping

Cons:

- Lack of protection from winds
- Lack of forestation, generally
- Rainfall generally sufficient but droughts and dust storms are possible
- Subject to dangerous summer thunderstorms and tornadoes
- Some groundwater contamination from farm chemical use
- Extreme earthquake danger over long distances due to liquefaction of soils

Environmental Control:

Super insulated design should be used to counter the extremes of hot humid summers and cold windy winters. All homes should have a basement level high security room or other tornado shelter. Extra water should be stored in a cistern against possible droughts. Design the house with the main floor 3 or 4 ft. higher than the native soil. Berm up the earth around the house to give the appearance of a gradual rise, providing relief from the heat and more pleasant exterior views. It is amazing what even 3 extra feet of elevation does to the aesthetics of your outside view. Plant windbreaking tree lines and erect solid fences for wind and snowdrift control. Drill a well of sufficient diameter and depth to provide some irrigation water during periods of drought – at least to allow you to survive with your own personal garden and orchard. Install a wind powered or solar water pump to ensure a continuous supply of water. Even if you don't have enough wind for electric power generation, moderate daily winds are usually sufficient to pump water.

Broad, Forested Valley

Pros:

- Good, rich soiled farmland when cleared
- Ample wind protection
- Good emergency wood supply
- Normally ample rainfall or snowmelt for growth of plants and trees

Cons:

- Soils are clayish due to constant leaf mulch deterioration
- Usually too desirable and thus, higher population densities
- Not enough wind for power generation, generally
- Not enough change in elevation for hydro-electric power, generally
- Valleys in the midwest and south subject to severe thunderstorms/tornadoes
- Extreme earthquake danger from even long distances due to liquefaction of the soil

Environmental Control:

Generally the same as the previous category for northern climate zones. In the south, home should comply with design criteria of sub-tropical climate with tight control of humidity and insect infiltration. Design for moderate earthquake stress loads even if the area has no prior fault history.

Low, Wide, River Valley

Pros:

- Well water available
- River may provide irrigation and power generation capabilities
- Good farmland, usually a nice fertile sandy loam soil
- Low wind velocity (generally)

Cons:

- Cold air settles into these valleys in winter
- Warm and humid in summer due to body of water present
- Flood danger
- Water power with low head is expensive to build and maintain
- Extreme earthquake danger from over long distances due to liquefaction of soils

Environmental Control:

For house site, pick a small rise or high spot in valley so as to avoid cold trough in low lying areas. This also safeguards against floods and water table problems, and provides a little more air circulation. Do not pick a site in the flood plain – eventually a flood will strike. Design for moderate earthquake stress loads even if the area has no prior fault history.

Narrow Mountain Valley

(Higher altitude)

Pros:

- Trees usually present
- Aesthetically pleasant
- May provide a good wind site with daily local flows

Cons:

- Short sunlight pattern leading to cool summer weather
- Shorter growing season
- Wind venturi effect through valley
- Soils may be rocky
- Flood danger – narrowness of valley adversely affects escape possibilities

Environmental Control:

Pick home site on high ground sufficient to be above highest possible flood level. This helps avoid the coldest temperatures as well. Place home in a leeward cove of the valley out of main wind channels, but close enough so that a wind power plant may utilize wind channels without long transmission line losses. Design for super insulation to ward off the winter cold. Use breathable wind barrier paper (Tyvek or equiv.) to cover home prior to final siding. Provide roof structural members sufficient to handle the winter snow loads.

High Mountain

Pros:

- Aesthetically beautiful
- Forests available
- Isolation from large groups of people
- Good water sources; potential for gravity feed storage tanks from higher elev.
- Wind and water power generation available
- Earthquake faults may exist, but no wave action in the soil occurs in mountains

Cons:

- Most of the land is government owned (at least in the West)
- Isolation from people and facilities (depending on your point of view)
- High snowfall
- Short summer
- Cannot raise food easily, without extensive greenhousing
- Land is hardly ever level
- Ground is usually rocky

- Soils on steep slopes may be unstable

Environmental Control:

Find land available next to national or state forests so as to increase your effective backyard, and to restrict others from encircling your property. Design high storage potential into home and provide for fully independent power and water facilities. Design roof and home to withstand high snowfall, and potentially high winds. Avoid locations near tops of mountains or in a venturi-type wind channel. Some food can be grown in specially-heated greenhouses.

SPECIAL ENVIRONMENTAL EFFECTS

A knowledge of nature's key characteristics can be of significant advantage in cost and energy savings if they can be suitably employed in the site selection process. Many of these have been briefly mentioned in previous sections, but an analysis of the causes and effects of each will be presented here.

Air Temperature Pressure Gradients

Certain localities can be depended upon to provide steady air movements due to unequal heating/cooling of the air. Since air is heated more rapidly in a dark forested valley than in the mountains surrounding it, this air will tend to rise as it becomes less dense during the daily heating cycle, and then be displaced by cold cascading air coming down from the mountains during the cooling portion of the day. As the sun starts to warm the southern and western slopes of the mountains in the late morning, air flows will move up the mountain sides. In the evening, the higher mountain air will cool first and descend through the canyons and flow back into the lowest parts of the valleys. Thus, stream sites are beautiful, but colder in the evenings and nights. The warm air of the day is only displaced at the lowest depressions in the valley. The displaced warm air rises to the level of the foothills where it generally stabilizes until morning, if other surface winds are not present. This is the reason most orchards in cooler climates are found on the higher ground rather than on the valley floor where frost settles. The most graphic way of feeling the sometimes dramatic temperature gradient is to ride a bicycle or motorcycle down a road from the foothills into a valley in the early morning and feel the various temperature levels.

Wind pressure gradients, on a local level, are formed in a similar way near large bodies of water. A large lake will heat up more slowly during the day than the land mass surrounding it and, thus, air will tend to flow from the water to the land. At night, the land loses heat more rapidly leaving the water warmer. The air then reverses and flows out toward the less dense, warmer air mass over the water. This information is useful for ventilation, but the air movement is not usually strong enough to be harnessed by wind power.

Wind Venturi Effects

Whenever a large air-pressure gradient exists, wind will begin to move from the area of highest pressure to the lowest. As this wind meets various obstacles, it has to flow over and around them. Due to its fluid characteristics, the wind compresses and accelerates over and around these obstacles. When two objects are in close proximity they form a *venturi* or increasingly narrow channel through which the wind must accelerate in order to pass through. These venturi effects are pronounced where canyon walls converge into a narrow gorge or chasm, or when the canyon makes a sharp bend. Two hills close together can produce the accelerating effect. The top of a mountain, though not a venturi per se, does accelerate the movement of air as it passes over the top as well. These are prime locations for wind generators, but not for homes unless you live in a humid climate, where maximum wind is desirable.

Altitude Effects

The two primary concerns with altitude or elevation are temperature and oxygen content. As altitude increases, temperatures drop, as does the quantity of oxygen available to the lungs, due to lower air pressure. These effects are not detrimental to humans up to 10,000 feet, and they have the advantages of allowing for less humidity as well as lower summer temperatures. The diminished oxygen content has a strengthening effect upon cardiovascular systems, when coupled with a rigorous exercise program, wherein the body is forced to adjust to the lower oxygen availability. Athletes train at high altitudes to increase their stamina for competitions held at lower altitudes. High altitude living can be an advantage to those who learn to live there and adjust, and a disadvantage to whose who are temporary visitors or intruders. However, the advantage to any human tapers off very fast above 10,000-12,000 feet, due to severe weather, greater solar radiation, and much reduced oxygen which strains all biological systems.

Trees and Vegetation

Vegetation, in general, does many things besides provide fruit, wood, and visible beauty. Plants consume carbon dioxide and give off oxygen as waste, which helps purify and maintain our atmospheric balance. Plants absorb a tremendous amount of the sun's energy without radiating it back into the air. There subtle coloration enhances their anti-reflective properties which soften the glare around a house. Heavy vegetation can reduce odors in the air and attenuate noise from roads or neighbors. Certain trees and plants provide shade and visual blinds for privacy. Due to the versatility of various types of plants, such as deciduous trees, we can plant windbreaks which will channel air into or away from the house in summer and let the air pass through in winter when the foliage is gone. If wind directions change or vary during the winter, a combination of deciduous and conifers can channel the favorable and exclude the undesirable winds of winter. Large stands of trees and brush can almost totally reduce the effects of high winds at the surface level, and yet permit a wind powered generator above tree-top level.

Water

Large bodies of water affect the micro-climate in any community, whether by causing morning and evening breezes, increasing the humidity, or increasing the rainfall or snowfall downwind of the water. Many thunderstorms are formed over large bodies of water which provide the quantities of water vapor necessary to build large cumulo-nimbus cloud formations. While rivers and lakes provide a general cooling effect by their constant evaporation of water (which absorbs heat in the process), this advantage is offset considerably by the increase in local humidity, which increases discomfort. Small and large lakes can provide increased solar energy, due to their reflective qualities, as can fields of ice and snow.

Ground water is generally of benefit for plant growth, wells, and springs, but can provide serious basement insulation and moisture problems if the ground is too wet. Ground frost can have disastrous effects on foundations as the frozen earth expands and contracts with alternating freezes and thaws. Homes constructed in northern climates must include foundations deep enough to penetrate the normal frost line so as to avoid this heaving. Also remember that water in abundance is an essential element for the breeding of many undesirable insects and other animals. This, combined with warm, humid summers, can provide sufficient year-round breeding to become a highly bothersome problem (as in Minnesota's Land of 10,000 Lakes, Alaska, and most southern tropical climates).

Soil

Prior to buying any potential land for self-sufficiency purposes, with the intention of growing food, a soil analysis should be made. The local county agricultural extension service will usually do this for a nominal fee if you provide the soil sample. The sample is important, not only to determine what nutrients are present in the soil, but to analyze texture as well. Coarse soil particles provide good drainage, which is essential for some types of plants, but naturally requires more water due to its inability to retain it. Extremely fine clay soils may be rich in nutrients, but due to their impenetrable nature and higher water runoff characteristics, these nutrients may be nearly unavailable to most plants. But no normal soil sample will give you the most essential data – how many essential minerals your soil contains.

If the land you are buying has been farmed for any appreciable length of time, you may safely assume that the essential mineral content (or its availability to plants) is low. Commercial farmers add fertilizers, but a broad range of essential minerals is almost never added, except by some organic farmers. In reality, there is a microscopic process involved in the depletion of minerals available to plants which is directly related to the use of chemical fertilizers. Bacteria and other soil microorganisms are the agents primarily responsible for breaking down hard mineral and soil particles into organic minerals small enough to be absorbed by plant roots. Heavy or prolonged use of chemical fertilizers tends to sterilize the soil of these microorganisms, and the soil quickly loses its apparent supply of minerals. You can spend considerable money on kelp and other mineral-rich additives to bring your soils back up to full richness, but even this will only be a temporary fix unless you go back to organic fertilization with animal manure and help the bacterial growth to reestablish. Adding other forms of organic

matter and letting it compost naturally in the soil will accelerate this process. In summary, the basic problem with commercial fertilizers is that they tend to kill off the normal bacterial populations in the soil which are the prime agents that break down soil particles into usable minerals for plant extraction and use.

Soil also provides a basic shield from heat and cold for basements or underground structures. Normally, temperatures underground are stable, averaging between 45 and 60 degrees, depending upon location. This also corresponds to the temperature of ground water in the local area. Although it takes large amounts of dry earth to match commercial insulation (approximately three feet of dry earth equals one inch of polystyrene rigid insulation), soil is very cheap and plentiful. Loose, sandy soils with good drainage are slightly better insulators than dense clay, which retains a high moisture content.

Cloud Shading

Prior to making a solar powered, self-sufficient home site selection, make a careful study of the local cloud and weather patterns during various seasons. Clouds may be generated locally through convection, evaporation, or interaction with mountain ranges. Some mountain faces will engender near constant cloud coverage within a mile, due to prevailing local winds and cloud formation, while a site beyond that cloudy area will result in nearly constant clear sky conditions. Similarly, if your site has a large body of water to the south, the daily cumulo-nimbus cloud formations that are created by that water will create much unwanted solar shading. This effect is usually only pronounced in the summer. If you want summer shading rather than solar energy, this can be an advantage. Homes that are using solar for electricity production as well as winter heat will want to pick a site and climate almost free of shading.

PREFERRED CLIMATES AND TERRAIN FOR SURVIVAL RETREATS

I prefer mountainous and hill country terrain that is moderately forested with a mix of various types of trees. The most stunning mixtures of trees are found in the Intermountain West where the altitude is high enough (6,000-8,500 ft) to allow alpine types of firs to grow with spruces, hardy pines, and deciduous aspens and birch. Firs and pines grow down in the 3,000 to 4,000 foot level in the northern states of Idaho, Montana, and eastern Washington – simply because of more rainfall and colder winters which allow the snow to stay on the ground longer. Higher altitude provides a pollution-free, airy, and balmy summer that rarely gets excessively hot. The winters are cold but dry so that clothing effectively keeps the cold from penetrating. I prefer mostly inland mountainous areas which have a predominance of bright sunshine in winter to offset the cold. I also prefer four distinct seasons, with enough altitude to have snow in the winter.

The lack of humidity in the arid western states is a real plus – clothing warms better, winters seem less cold than the temperature may indicate, the summer heat is less intense because evaporation is more effective, and air conditioning can be supplanted with evaporative coolers which cost much less to run than air conditioning. The insects are

much less a problem in the arid West as well. Winter kill of insects keeps many types from breeding at all, and those that do thrive in the climate are kept under control by cold winters.

DETERMINING YOUR BUDGETARY LIMITATIONS

The first preliminary consideration, though not necessarily the prime one, is financial. Contrary to most financial advisers, I highly recommend that your survival residence be built without debt, if possible. Or, at least with other personal loans that do not involve a scrutiny and hassle of a bank mortgage. There is no such thing as a true preparedness home that is owned by the bank. If you have so much money that you don't have to worry about foreclosure in an economic depression, then you shouldn't have a mortgage anyway, despite the tax counsel you may have received to the contrary. Better to sacrifice some of your financial leverage now for long-term security later.

Realistically, there must be some leeway in this financial philosophy of the high security residence. Most families can barely afford a single family dwelling of any quality, let alone a preparedness home which will cost at least 30-50% more due to its multi-fuel equipment, alternate energy systems, and larger land requirements. If you must borrow for the home, try to build as modestly as you can so that you can pay it off in less than 15 years. Frankly, I don't think we have 15 years of good times left – probably less than 5 – so your chances of losing the home are great with a mortgage hanging over it.

A true survival retreat, on the other hand, should never have a direct mortgage. If you ever need to use it as a retreat, I doubt you will be in a position to make your payments. If you have considerable assets, there are other ways to borrow money to build (even if at higher rates) which won't disclose the property or purpose of the loan. Several signature loans from various sources for "home improvement" (of the existing home) can be lumped together to get your project off the ground. If you plan on having a preparedness residence plus a survival retreat (accepting the potential of "walking away" from the main residence, if it comes to that), then by all means, keep the mortgage on the residence and have the retreat free and clear. It is also important to have the property in the name of a trust or other legal vehicle to make it difficult to trace.

Often as a new house progresses and the inevitable cost overruns accumulate, couples are tempted to cancel preparedness equipment and features in deference to luxury items. This used to be an acceptable compromise for many families back in the days when they still had plenty of time to prepare, and they installed all the plumbing and wiring (for future equipment) within the house so they could cheaply do the installations later on. However, we are now quickly approaching the year 2000 problem and many other major crises thereafter, which may make any delay in buying preparedness equipment a very unwise decision. Alternate energy items like generators and solar panels will become instantly scarce, and probably never abundant in a long-term crisis, due to excessive demand. On the other hand, some luxury or convenience items will be in surplus, due to decreased demand, since people may lack purchasing power.

Additionally, there is a high probability that in a large scale economic crisis, the government will put a moratorium on home mortgage foreclosures, at the sacrifice of what's left of the free-enterprise banking system. This will only benefit those who weren't in the first group of foreclosures, however, so all the risk of foreclosure is not removed. I fully suspect that the most realistic scenario will involve some special "deals" proposed by the government to "share" in your home ownership in exchange for "paying off the banker," which will eventually evolve into true lack of ownership through lack of control over your assets.

It would be well to remember how easily the government can change the rules on any law or system that was initially viewed as a benefit. Just as people will find their IRA money *trapped* and controlled by future rule changes, so those who bargain with the government over their mortgages will be controlled. Take a lesson from the 1982 Mexican confiscation of the private banks and the instantaneous robbery of all dollar accounts, exchanging them for lower worth government bonds, denominated in pesos instead of dollars. I predict that in the future you will see such a domino effect resulting from socialist economic defaults that a movement for a "new" and "more stable" international monetary system will sweep the world and be implemented by government negotiations and outright edict. Now that all US banks are required to be part of the Federal Reserve System, they will have no choice but to comply or lose their charter. The initial theft of private funds will not be onerous, but the rules can be changed so easily once the control structure is in place.

Whatever your situation, pick a figure of what you expect to be able to afford in a new residence or retreat. As of the year 2000, divide that figure by an approximate $100 per square foot building cost and you come up with the general square footage of the main floor plus any unfinished space in the attic. Garage and basement space, or finished attic space, should be calculated separately as these share the same roof and foundation with the main floor and thus cost less. I generally estimate finished basement space or second story space at half of main floor space. Your building costs may be somewhat lower in your area, but you'll still pay more for the custom nature of a full preparedness home. It is better to estimate a little high. If you can't live within these budgetary and floor space restraints, then you need to implement some of these alternative cost cutting measures. :

1. Cut back on floor space where you can (in multi-levels this adds up).

2. Find some more money or a cheaper way to build, using much of your own labor

3. Cut back or delay installation of expensive finish or decor items

Chapter

5

What Do You Want In a Home?

Before we can develop a preliminary home design, we must determine what types of rooms you desire in a home and how these rooms should be distributed among the various levels. Even if you decide to select a stock plan from a book, this process will help you educate yourself on the design features you want to look for. I prefer that *form follow function* so I generally design the home from the inside out. We can often design the exterior look and roof shape to match any number of styles, but it is much more constraining to design the outside first and then try to squeeze what you want inside.

A preparedness home does not and should not look like a bunker. To avoid drawing undue attention and to keep a low profile, we want the home to look fairly conventional. It can still be attractive and have legitimate stylish features, but it should never be ostentatious or showy. The home can be colonial, traditional, or any other style you wish, though it should not make extensive use of large glass walls unless you are willing to pay a large premium for protective window coverings. That is not to say you can't design a large glass wall for view, but we need to implement other compensating measures to overcome the liabilities of view windows. This can be done by framing a view with a window that is more horizontal than vertical, for example.

To begin our general excursion through the various options in home facilities and rooms, let us try to differentiate between the essentials and the nice-to-have features. There is, naturally, a wide degree of overlap between these areas. I will not dwell on the obvious, but you should try to list the things which impress you as being necessary in a secure residence. I will take you through a listing of the various normal possibilities. You may want to add others if you have unique needs that differ from the ordinary. Plumbing and wiring should always be designed to accept the maximum loads you would anticipate, including any later upgrading or remodeling. Even if you cannot afford certain expensive self-sufficiency equipment, I recommend installing the wiring and plumbing for such equipment in the original construction to minimize remodeling costs later. This includes sizing the initial service entrance for electricity and plumbing large enough to handle any additions.

LIVING AREAS

Living Room

When an informal family room is also present in the home, this room is primarily used for the entertainment of guests or for more formal get-togethers. The size of this room will depend upon the maximum number of people you anticipate entertaining on a formal basis. Normally this is the largest of the living areas. However, there is a trend to do entertaining on a less formal basis, centering around the family room or deck, and to use this room for quiet conversation of small groups. Thus, small living rooms are becoming popular, much like the old *parlor* concept. This works well with the great room concept (sort of a huge family room, great hall with fireplace, and dining area all in one). The trouble with homes that only have a great room is that they lack a small cozy room for private discussion. So even though I tend to favor great rooms as the main living area, I also like a small parlor type living area near the entry, if it can be accommodated into the floor plan. Sometimes a small study off the entry can serve this purpose as well. The living room should include some type of fireplace, unless the family room is the larger and more "lived-in" room of the house.

Family Room

When a separate living area, designated as a family room, is provided, it usually becomes the most well-used room in the home besides the kitchen. The furnishings are less formal, more rugged, and usually more comfortable. Built-ins might include book shelves, toy lockers or cabinets, hobby center (a sit-down counter/work space and storage area), and/or an administrative center (counter and telephone desk). It is generally situated near or open to the kitchen (which seems to be a natural gathering place due to the presence of mother and food). Sometimes families will place a large family room in a well lit area of the basement, which is good for teenagers and relatives where some separation of noise is important. When only one main living area is desired or provided for, it should tend toward the family room concept (if you have a large family) and toward the formal living area if you do not have children. I caution, however, against the tendency for older, retired couples to regard the family room as unnecessary since their families are grown-up and not living at home. By the nature of the preparedness home, we must accept the possibility that other relatives or friends may be in need of shelter or temporary assistance in hard times – perhaps even long-term emergency accommodations. Providing at least two separate living areas helps to alleviate much of the potential noise and confusion of multi-family units living in confined areas.

Parlor or Sitting Room

This old-fashioned living area has generally been absorbed by portions of the conventional living and family rooms or study. It does, however. still have some usefulness under specific needs of certain professional people, as previously introduced. It provides more privacy than a large, contemporary living room. The furnishings of a parlor can be customized to those who need to consult or discuss important matters in a smaller private room. Parlors tend to be detailed and intimate, as opposed to the more

business-like nature of an office or study. This room has traditionally been the off-limits area for children, making a room that was always tidy and presentable. It also makes a nice quiet private reading area and can be designated as a "library" with appropriate bookshelves.

Lanai

This type of living area, from Polynesia, is analogous to a large screened porch or covered deck, though usually more formal and tastefully decorated with plants and natural objects. In areas with mild climates or warm summers, this additional living area is very useful and a pleasant compliment to the home. Lanais are usually screened in from floor to ceiling, offering the maximum outdoor view without the bother of insects. Most common uses are for formal entertaining, casual dining, or late evening conversation. Lanais are a must in areas like the South which have high concentrations of insects.

Patios, Decks

Low yard maintenance is a secondary objective of preparedness homes, and can be achieved partially by the implementation of patios and decks. By patios, I am referring to ground level, hard surfaced areas utilizing brick, stone, or concrete aggregates. By decks, I am referring to raised surfaces usually constructed from beams and wooden decking material. Both serve essentially the same purposes as the lanai, except in a less formal way, due to the open air aspect. Care must be taken to assess the livability of these unprotected open air areas, lest they prove unusable due to insects or excessive wind, cold, or heat. My primary caution in the design of patios and decks (and their mini-relative, the balcony), is to avoid adding too many merely for the sake of appearance rather than utility. Bedroom patios or balconies are rarely used, unless they provide an outstanding view or setting to be enjoyed. I especially deplore the proliferation of sliding glass doors leading from bedrooms to decks or balconies, which are rarely used. Besides causing excessive heat transfer problems, which will be discussed in detail in a later section, they are cumbersome to operate and somewhat of a security problem. The use of windows and a one or two sliding or french doors is one of those cases in which some security and environmental control is sacrificed in favor of aesthetics and light. We make certain trade-offs in these cases, trying to achieve appropriate views without excessive security violations.

PERSONAL AREAS

Master Bedroom Complex

The ideal facility for the parents of a household is a combination of connected rooms: a bedroom with small sitting or reading area, bathroom, vanity/dressing area, and walk-in closet. My basic philosophy on personal areas is that they should provide considerable privacy through use of quality sound insulation as well as higher security wall construction – otherwise they could hardly be classed as "personal" areas. The heads of

the home are quite vulnerable to pressure in a crisis situation and need the special privacy and security features of solid doors and intrusion resistant walls. I normally design the bathroom facilities in such a way that dressing or cosmetic functions do not interfere with the use of the essential bathing and toilet facilities. Although I most often include a sink in the bath, I nearly always provide another in the vanity/dressing area to increase the bathroom's utility without substantially increasing the cost. It is also preferable to perform dressing functions away from the moist air found in the bathroom proper.

Wardrobe style walk-in closets should be well lit and large enough to dress in. Otherwise, where space is at a premium, I utilize a wardrobe wall or corner. The sitting portion of the bedroom can consist of a corner with small built-in shelves and a couple of comfortable chairs, or a three-walled enclosure for more privacy. I am not recommending that a full office or den be placed in the master bedroom, but rather an area lending itself to quiet conversation, contemplation, and study. There is nothing wrong with an office being close to the master bedroom, but it should be in a separate room. A walled-off sitting area can also double as a crib room for infants when they need to be accessible to the parents during the night.

Children's Rooms

The number of children's rooms will generally correspond to the number of children expected in your family (plus at least one for emergency or guest accommodation). Except in special circumstances, I do not recommend you build a home with less than four bedrooms (master, guest, and two children's rooms). Since smaller children generally prefer to be with other children, I do not suggest private rooms for children under 5 or 6 unless such a diversity of age is present that togetherness is a liability rather than an asset. Large or elongated joint bedrooms for children over this age may have some partitions to allow for privacy in a personal area. Privacy becomes even more essential when children begin to have homework in their school studies. One of the most prized aspects of personal privacy for children is the ability to safely store their possessions away from others. Don't skimp on closet space, and where possible, include large, deep shelves to the left or right of the hanging area within each closet. Low height or dual height hanging rods are helpful for younger children. When the children get older the lower rod can be used for short items such as shirts, skirts, etc. Utilization of built-in dressers and desks is an excellent way to use space more efficiently. Hideouts, play areas, children's coves, etc., are fun considerations, especially if you have adjacent attic areas or upper lofted ceilings.

However, I do caution against excessively large bedrooms (in excess of 15 or 16 feet in width). The Minimum size for a private bedroom should be 9’x11’ so as to provide space for a bed, dresser, and a small desk. Bedrooms are generally the least used rooms in the home (when other facilities are provided for study and play), and such large unused spaces are quite costly in terms of efficiency. Additionally, excessive furniture is usually purchased in an attempt to fill that excess space.

Guest Room

This room is an essential inclusion in even small homes as guests have to be accommodated at all times of the year, even outside of a crisis. When short of space, this room, with an appropriate hide-a-bed couch, can double as a den, study, library, or even a parlor. A basement guest room can be nice, if you have natural light. It offers more privacy for both the guest and the family, and better sound insulation as well. Sometimes windowless rooms can serve for overnight guests if the room is only used in the evening or night. Long-term guests obviously should have a room with daylight windows (also a requirement of building codes).

Library

Libraries are essential in a home if you desire to establish a serious learning atmosphere for children and a secluded study area for parents. In order to do so, the library must be stocked with the essential books of greatest utilitarian value, which may be unavailable in school or in small public libraries. Most of the finest conservative economic, political, historical, and religious works are not to be found in public facilities, let alone the wide range of necessary survival publications covering practical subjects from agriculture to construction. A child's formal education in these times must be supplemented with more correct information than is presently being disseminated in public education. Unless a scholarly environment exists in the home, children will follow the path of peer influence, which is generally non-academically oriented. If you establish a library, it ought to be a true library – accessible at all times to quiet study. Furnishings should include comfortable reading chairs with good lighting and a writing table. The size depends upon the number of people who would make use of it at any one time.

Den

Many of the rooms we have been discussing are interchangeable with one another. This is sometimes true, and may well be implemented as such, according to your lifestyle. However, I wish to present them in their separate context so that those who have specific needs will not fail to design their home accordingly. Sometimes a “den” in certain parts of the country equates to a family room. But here, I refer to the parents' (though couples sometimes have separate facilities) personal study space, private office, small library, trophy room, collections room, or plain reading room. Most often, private conversations with individual family members or guests are held here due to its small, intimate size.

Conference Room

When one of the family members has significant leadership in civic, church, or other organized groups, it is sometimes necessary to have a room which serves as a conference room (other than the living room). The conference room should be large enough to accommodate a large table providing layout and writing space for business or organizational meetings. Large dining rooms may serve this purpose, or even an ample-sized den with an integral conference table. Very rarely would a person have enough conferences to warrant a completely separate room. But even if infrequently used, the room can serve other purposes.

KITCHEN WORK AREAS

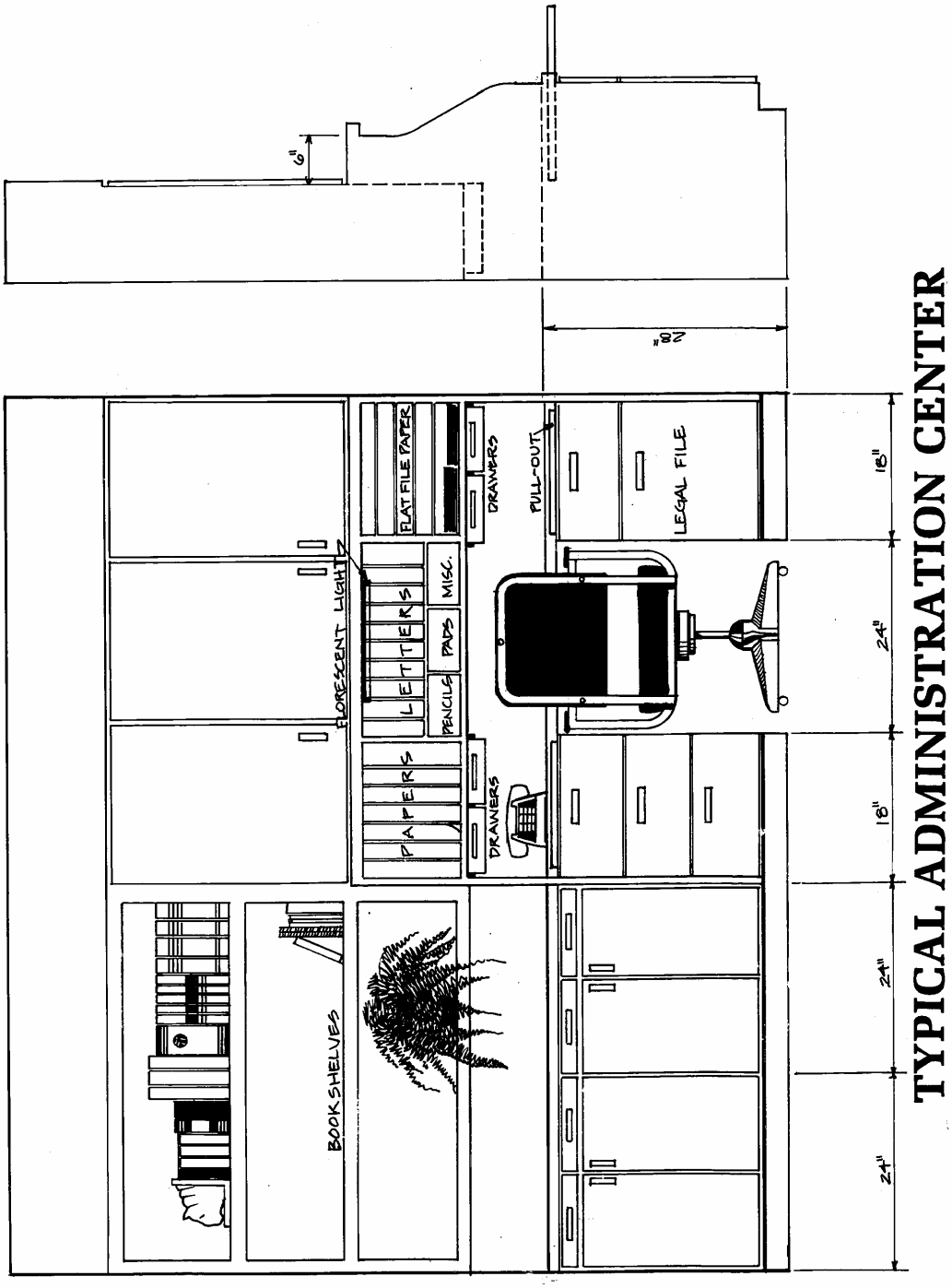
The arrangement of various work centers in a large functional kitchen determines the efficiency of the space. Efficient work space is a combination of sufficient connectivity and closeness to avoid walking too far, and separation of areas so that multiple tasks can be performed simultaneously. A properly designed, large kitchen should have the following unique work areas:

- Administrative center
- Preparation center
- Cooking center
- Bake center
- Cleanup center

An eating area may also be in the kitchen and can serve as a temporary work area. It is recommended that each of these centers have all of the tools required for their various specialties, within easy reach. This may sometimes require duplication of common utensils or their placement in some jointly accessible drawer or cabinet. There are several alternatives for the placement of these work areas, relative to one another.

Administration Center

The administration center (see illustration below) is essentially composed of a counter with lower cabinets and drawers, integral with a desk area. Cabinets, shelves, cubby holes (one for each member of the family for sorting and storing mail or papers), bulletin/black board, key hooks, and telephone may be included, as needed. Administrative counter space is essential to the efficient sorting and temporary placement of miscellaneous papers, schedules, telephone notes, etc. Placing this central counter area near the door is ideal for depositing items which need to be retrieved before leaving, such as school books and lunches, briefcases, grocery lists, keys, etc. It is important to note that this area should not become cluttered with these items lest it defeat its purpose as a means to better organization. The ideal location of this administrative area is on the periphery of the kitchen near a major traffic area leading out the main entrance or toward the family room.



TYPICAL ADMINISTRATION CENTER

Preparation Center

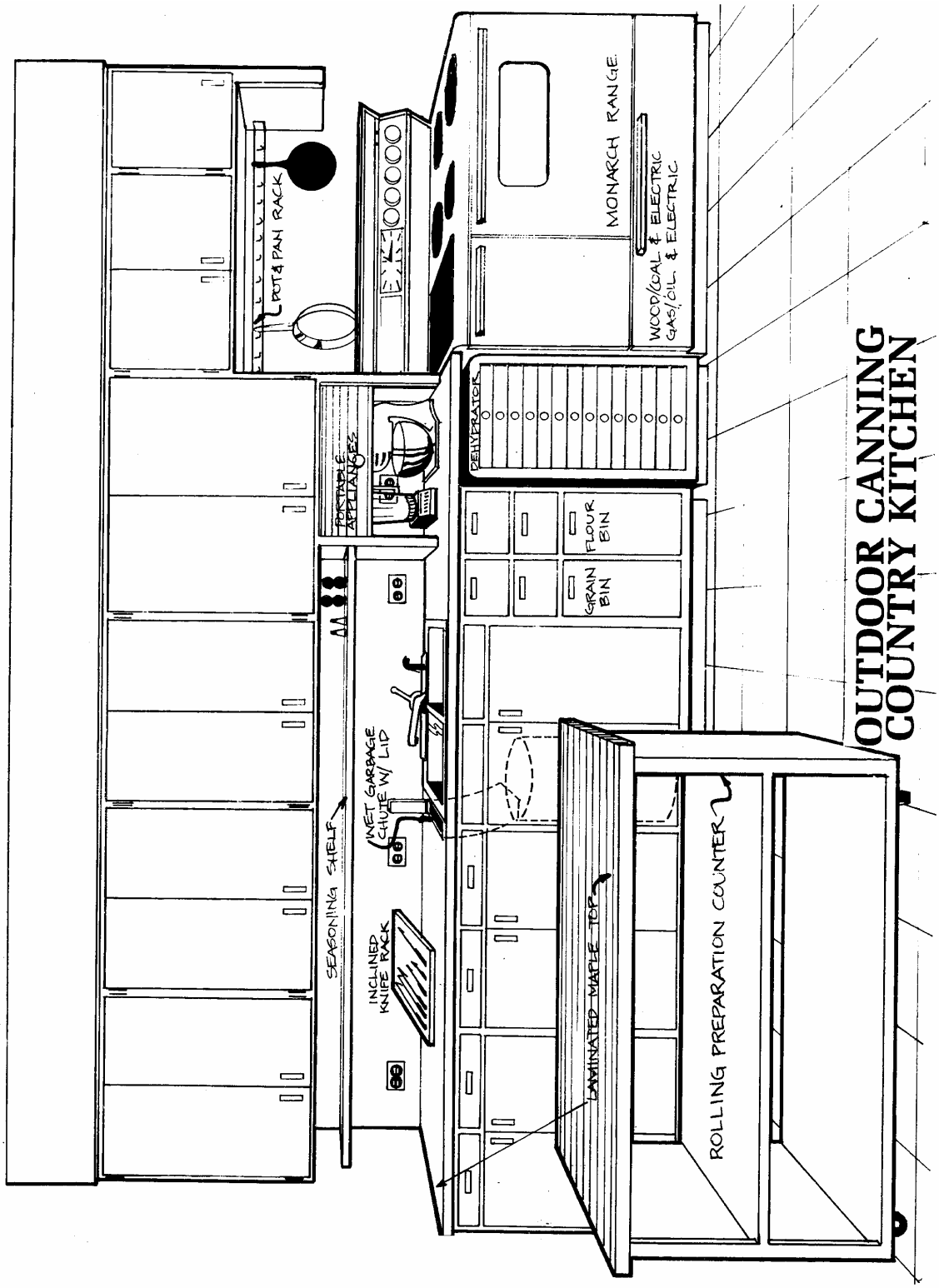
The preparation center is an area near a sink where food is cut, chopped, mashed, strained, cleaned, etc. A butcher block type countertop made from maple or birch is ideal for this area (wood counters require occasional disinfecting and reoiling with vegetable oil). Large squares of acrylic cutting boards, built-in or portable, are an alternative to the butcher block counters. A wet-garbage access hole through the counter, or cutting board fitted over the disposal portion of the sink, is a nice option, especially when linked to a gray water composting outlet. Built-in or portable equipment should include the blender, food processor, vegetable grater, juicer, can opener, etc. Knives, strainers, peelers, vegetable brushes, colander, strainer, bowls, platters, etc. should also be stored in this area. Efficient layout usually allows the cleanup center to join the preparation center at the double sink area; however, if this is not feasible or desirable, a separate sink should be installed for the preparation center (a small "bar" sink makes a good, less-expensive extra sink and is handy for those who want drinks, or to wash hands while the main sink is in use). The refrigerator must be accessible to the preparation center, but as the cooking, baking, and eating centers share common use, a compromise location is usually found.

Cooking Center

The cooking center may be designed as a large island since most other service areas relate in some way to cooking, and an island would allow common access from at least three sides. The cooking island would house the electric or gas range (or stove top) and additional heat resistant counter space for hot pots and pans to be placed. The microwave oven and alternate energy means of cooking can be included nearby, such as built-in barbecues, a wood cook stove, or LP gas burner. The best designs allow the transfer to alternate forms of cooking without breaking up the normal kitchen efficiency pattern. Unless a downdraft ventilator range top is used, a large, outside ducted hood should cover the island to allow for heat or smoke dissipation when required. Storage areas for cooking utensils and pans should be contained within the island or hung on the hood or rack above. If an island is small or unworkable in your kitchen layout, the cooking appliances should be located near a wall, preferably one with a chimney flue for alternate energy sources which require one. Wood burning facilities can be designed to house water heating units, ovens, griddles, and heat vents with blowers to duct excess heat to various parts of the kitchen or eating areas when needed. The microwave oven (see my ***warning*** in appliance section) should be placed where it is very accessible to the preparation and eating area--built-in just below eye level is optimum. Optional Outdoor

Canning/Preparation Centers

(See illustration.) This is a unique design to eliminate the hot, steamy atmosphere associated with canning in an indoor kitchen. The outdoor (screened porch) canning kitchen is a true country design with butcher block, laminated hardwood tops for preparation surfaces. The roll-about island is extremely useful for gaining additional space and for transferring prepared foods to the canner or the dehydrator. Drawer space should be ample (one above each cabinet door except under the sink). To promote composting for total conservation of resources, a garbage slot with a receptacle below the


OUTDOOR CANNING
COUNTRY KITCHEN
MONARCH RANGE
WOOD/COAL & ELECTRIC
GAS/OIL & ELECTRIC
POT & PAN RACK
DEHYDRATOR
PORTABLE APPLIANCES
FLOUR BIN
GRAIN BIN
INSET GARBAGE CHUTE W/ LID
SEASONING SHELF
INCLINED KNIFE RACK
LAMINATED MAPLE TOP
ROLLING PREPARATION COUNTER

counter makes it easy to collect wet garbage for the compost pile. Ample, open shelf space above the counter keeps things handy and the counter uncluttered. The ideal location for this type of outdoor kitchen addition is on the exterior wall opposite the normal kitchen, where you can tie in to the existing plumbing. Screened-in walls will eliminate flying insects. This is a good place for your wood burning backup multi-fuel stove. There are a lot of totally manual wood/coal cook stoves on the market still (see Lehman's Catalog). The outdoor kitchen is also a perfect place for the installation of a barbecue grill and/or wood oven – fun for entertaining on a nearby deck or lanai.

Bake Center

The bake center uses, as a rule, such different utensils and materials that it lends itself to being separate from wet food preparation areas. This area centers around the oven, stove top, and the built-in appliance center. Cabinet spaces should be designed for spices, flour (bins are nice to store large quantities of flour, wheat, rice, etc.), cookbooks, canisters, baking sheets and pans (narrow, vertical slots are nice for these), and other frequently used ingredients and utensils. Butcher block, granite or marble counters are handy for kneading and rolling out dough since they are much more stable than the portable or pullout work surfaces. If extensive baking is done, a separate oven in the bake center may be warranted.

Cleanup Center

The cleanup center should be accessible to all areas of the kitchen, but above all, it should be placed near the primary eating area to facilitate the transfer of dishes to the dishwasher and sink. A portion of the cleanup center counter area can also double as an eating bar, which is an extremely useful way of expanding the eating facilities for a crowd, and can also be used for buffet-style service. Most families prefer to use it for breakfasts or lunches when it is more efficient than eating at the table. In this case, the kitchen breakfast area is best located on the other side of the cleanup center, for close access.

The equipment in this center should include a double sink, the dishwasher, drying/drain racks for doing dishes by hand, and places to store and dry dish rags, towels, scrubbers, rubber gloves, soap, etc. Additional equipment that should be convenient to the eating area (toasters, broiler ovens, or microwave oven) may be well suited for this extended counter. Storage of dishware is often located in this area, in a suspended cabinet structure above the cleanup center for storage close to the eating counter or adjacent nook.

EATING AREAS

Nook or Breakfast Area

I always recommend an eating nook or breakfast area, either as part of a large kitchen or separated from it by a bar or island. Although other cultures have more formal eating habits for all meals, I tend to favor the American tradition of making breakfast and lunch

informal. Usually, most Americans do not use the formal dining room except for guests, special occasions or, at best, the Sunday meal. For this reason, I feel the nook is the better "buy" in terms of efficiency and durability as well, since its less formal nature allows for a wider variety of floor covering.

Some prefer kitchen designs with the nook or breakfast table within the kitchen area proper. While this can be convenient, the stumbling over kitchen chairs can make it more of a nuisance than a benefit if not designed with appropriate walk-ways around the table, which can, in tern, present other difficulties since work areas may now be too far apart. If all work areas cannot be fitted within an L shaped kitchen, then the table option is not usually a good idea. There are new and innovative ways of using sit down counters as part of the center island which can accomplish the same efficiency without the space requirements of a table. With the inclusion of swing out chairs attached to the underside of counters, the entire chair/clutter problem can be reduced.

Dining Area or Room

I feel no particular preference for a dining area over a separate dining room other than cost and wasted space if the dining room is hardly used (as is often the case). When used only two to four times per year, I feel the expense of a separate dining room is very costly in terms of conservation of resources. Many aesthetic purposes for formal dining areas are associated with formal traditions rather than for preparedness purposes. I like a formal dining area, personally, for holiday dining and special occasions, but would place it low in priority if design space or finances were limited.

Picnic Areas

In locations not plagued by insects, I enjoy and recommend a planned picnic area as a very pleasant break from the normal indoor routine. These are usually associated with patios and decks off the kitchen or family room.

UTILITY AND WORK AREAS

Sewing Room

I recommend a separate sewing area due to the large amount of cabinet space and layout room required to maintain a serious sewing operation. It is most often acceptable to combine this area into the laundry area (if excessive heat and moisture are not present) since they both share equipment such as the ironing board, and because it makes mending handy prior to washing. Sometimes a play room is also a fine location for sewing since children like to be where their mother is, and often the mother likes to keep an eye on the kids. A nearby Ping-Pong table is great for cutting out patterns or laying out a new design.

Laundry Room

Except in a very small cabin-type survival home, I strongly recommend a complete and ample laundry facility, including a deep laundry sink and manual washing equipment. The most essential piece of emergency laundry equipment is a hand-operated wringer, which are still available as “chammy (chamois) wringers” at some auto parts stores (special order). Without electricity, the laundering task becomes one of the most arduous and time consuming, and the persons wringing water out of clothes will especially appreciate having a hand-crank wringer. Without automatic clothes drying, ample indoor space for hanging clothes in a heated, vented area will be needed. The best locations for laundries are near exterior walls to facilitate dryer venting. Laundries also serve well as mud room entries if located near a rear entrance. In the latter case, having a half-bath facility nearby is also convenient.

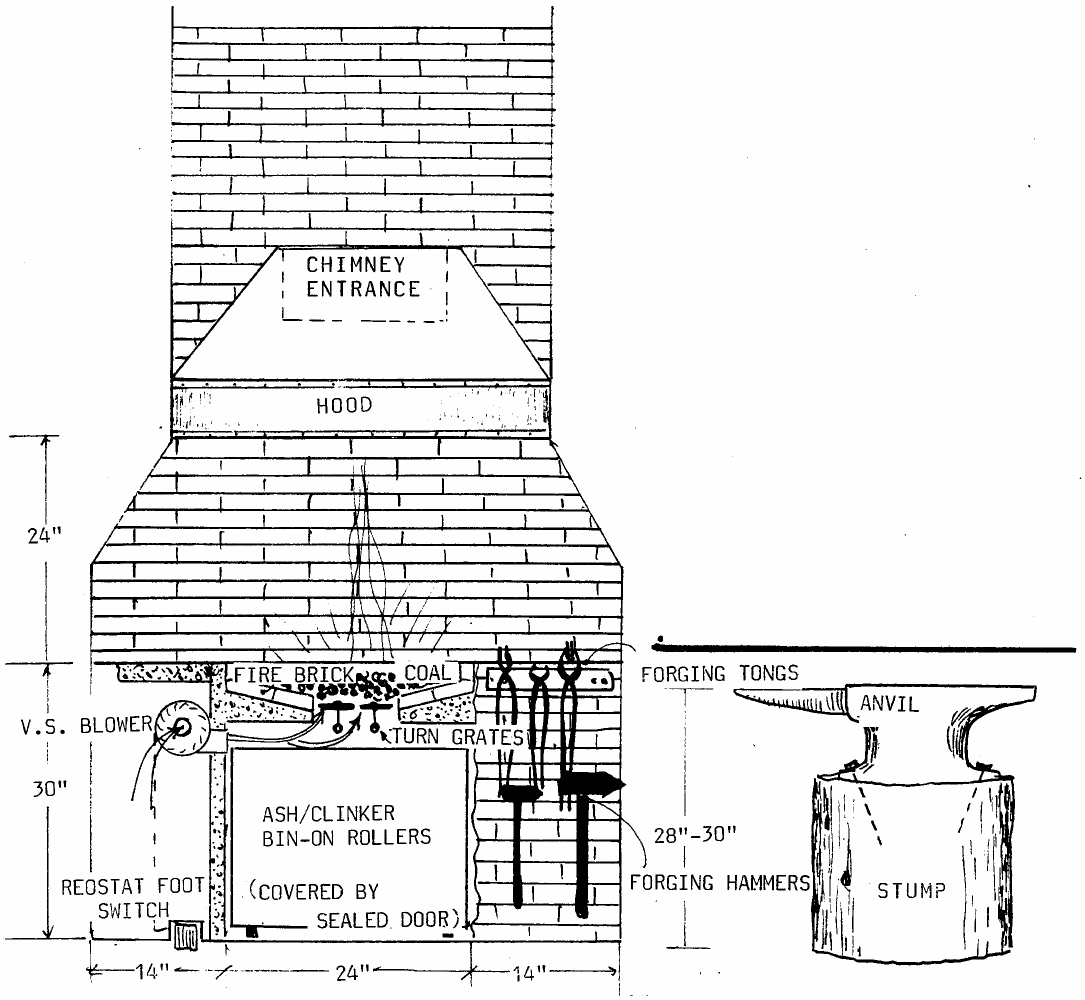
Workshops

Many professional people are reluctant to accept the inclusion of manual work areas within the home, as they do not feel they have the time or inclination to use them. While this may be true for the present, I suggest that such work facilities will be the most active part of the home in a long-term crisis. Indeed, many professionals will be out of work and will have need of alternate means of maintaining and repairing their own homes and equipment. There is even the prospect of being able to provide repair services to others for additional cash income. An additional advantage is the training potential these facilities would provide for children in the home – training which may be even more essential toward preparing them for the future. I don’t wish to overlook, as well, the recreational aspects of shop type work, providing meaningful and beneficial relaxation. A basic combination metal/wood shop will be acceptable for most non-enthusiasts. The truly skillful technician will desire various separate shop facilities (metal working versus wood) according to his abilities.

The Wood Shop

Of all the home shop facilities, the woodshop is the easiest to use and master. Many of the comforts of home in a survival situation may well depend upon quality of the wood shop and the owner's ability to make useful items. Extensive equipment is necessary in the survival woodshop due to the future lack of ready cut and prefabricated materials. A 16 inch surfacing planer will be a necessity when sizing large planks to beams in identical shapes and dimensions. A large bandsaw is essential for resawing of logs and large beams. Radial saws should be at least a 12-inch model; however, I would caution against equipment with excessively large motors wired for three-phase, and voltages higher than 240. This form of electric power is rarely available for residences. Keep in mind that sandpaper, glue, drills, and screws, etc., should be heavily stocked so as to avoid painfully inadequate substitutions.

The woodshop can also serve other functions besides production and repair. It is an ideal training ground for boys and girls in the family in the areas of hobbies or special projects. With the demise of other forms of expensive recreation during hard times, the family



HOME-BUILT FORGE

generally congregates around the hobby centers. I heartily suggest that you plan for some shop areas even if you lack the aptitude or desire to utilize tools at this time. Necessity will often provide the needed motivation to learn when the desire for the repair of an essential piece of furniture or automobile equipment becomes great.

The Metal Shop

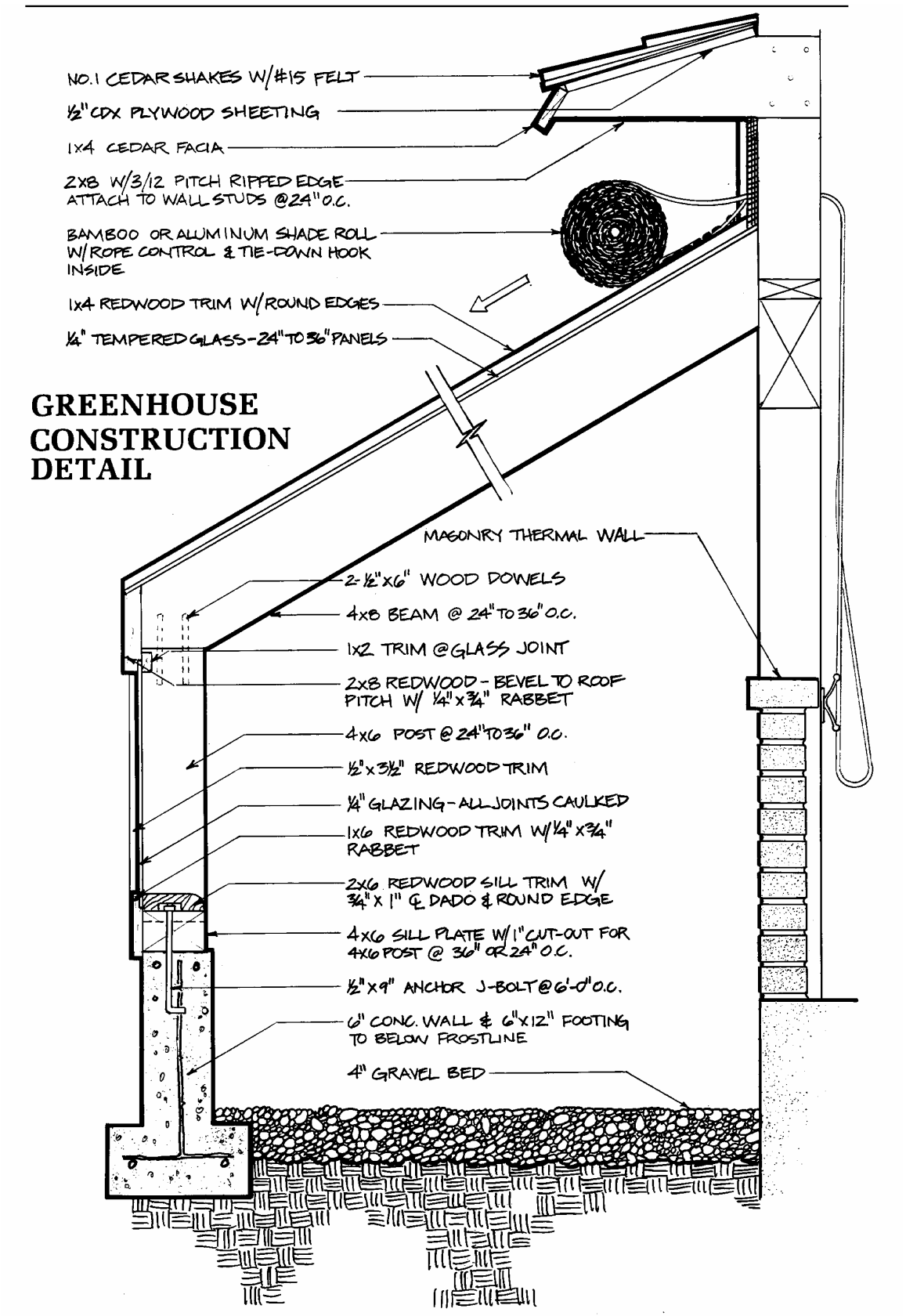
Sufficient equipment should be installed in this shop to take care of automobile mechanical repair, machining of metal replacement parts, welding (arc, gas, spot, and if possible, inert gas welding), casting, forging, sheet metal working, cutting, drilling, surfacing and finishing. A sufficient supply of raw metal material is necessary in various forms of rods, bars, sheets, and plates, as well as supplies of welding rod, acetylene, oxygen, helium, hack saw blades, files, and grinding wheels to complete the mating of raw material to machines. Space permitting, scrap and materials should be scrounged from available junk and surplus sources so as to have raw materials on hand to modify or make parts from scratch. Forging and casting can be performed in a basement fireplace, suitably designed with a blower for increasing oxygen flow to the fuel source (see previous illustration).

Hobby Center

The main workshop is usually not appropriate for some hobby or craft type endeavors of the younger children in the family. Thus, to keep young children away from larger, more dangerous machinery, as well as to keep one's supply of tools free from misuse, misplacement and loss, many families will opt to establish a separate hobby room. Many will enjoy having a separate hobby and craft area away from the sawdust and noise, well stocked with hand tools and light, portable electric tools. Many of the new battery operated tools are small and sized appropriately for hobby work. This area is most often combined with a large family room or a recreation room in the basement.

Greenhouse

Greenhouses (see illustration) are most efficiently designed in conjunction with a portion of the home, allowing the transfer of heat to and from the greenhouse as needed in either area. This is especially true of solar-heated units. A potting and garden workroom should be close by, and designed in with the home unless the greenhouse is to be located remotely due lack of direct sunlight on the home. The illustration shows a section drawing of a greenhouse added to the south side of a brick home. The top of the greenhouse addition slips in under the roof eaves so as to conceal a rolling external bamboo or plastic shade which can be rolled down over the glazing to keep the sun out during the summer. This greenhouse design encloses some existing south side windows. If excess heat from the greenhouse is needed inside the home, these enclosed windows can be opened to allow the hotter greenhouse air to enter.


NO.1 CEDAR SHAKES W/#15 FELT
½" CDX PLYWOOD SHEETING
1x4 CEDAR FACIA
2x8 W/3/12 PITCH RIPPED EDGE ATTACH TO WALL STUDS @24" O.C.
BAMBOO OR ALUMINUM SHADE ROLL W/ROPE CONTROL & TIE-DOWN HOOK INSIDE
1x4 REDWOOD TRIM W/ROUND EDGES
¼" TEMPERED GLASS-24" TO 36" PANELS
GREENHOUSE CONSTRUCTION DETAIL
MASONRY THERMAL WALL
2-½"x6" WOOD DOWELS
4x8 BEAM @ 24" TO 36" O.C.
1x2 TRIM @ GLASS JOINT
2x8 REDWOOD - BEVEL TO ROOF PITCH W/ ¼"x¾" RABBET
4x6 POST @ 24" TO 36" O.C.
½"x3½" REDWOOD TRIM
¼" GLAZING - ALL JOINTS CAULKED
1x6 REDWOOD TRIM W/¼"x¾" RABBET
2x6 REDWOOD SILL TRIM W/ ¾"x 1" ℄ DADO & ROUND EDGE
4x6 SILL PLATE W/1" CUT-OUT FOR 4x6 POST @ 36" OR 24" O.C.
½"x9" ANCHOR J-BOLT @ 6'-0" O.C.
6" CONC. WALL & 6"x12" FOOTING TO BELOW FROSTLINE
4" GRAVEL BED

ENTRIES

With the exception of very small cabins, where space is at a premium, I prefer to have entry halls at all major doors into a home. This, in combination with a cleanup area near the utility entrance, helps immensely in maintaining the cleanliness of the home. Entry halls also provide a transition area and shield to the main living areas so that coats may be hung up, boots removed, umbrellas stored, and even hair combed or hands washed prior to entering the living area. These small entries also enhance your ability to contain and restrict entry to unwanted persons. Additionally, the entry serves as a traffic junction for the various walkways or stairways leading to other parts of the home, as will be detailed in the layout portion. Variations in entries are:

- Air lock
- Mud room
- Traffic areas

Air lock

A two door entry (minimum four feet between doors) provides an "air lock" chamber which helps prevent drafts from entering when one door is closed prior to opening the other. There are numerous security advantages to this system as well. If a particular entrance is not used often, an air lock may not be necessary, especially if you are in a low wind, mild-climate area. The doors most used by children should have an air lock. Even in the summertime, the air lock entries serve a useful purpose in helping to cut down on insects and hot air entering the home. One or both doors can be replaced with screen doors during temperate weather, if desired.

Mud Room Entry

The entry most accessible to children or outdoor work areas should be a "mud room" entry. This room should include a floor drain, a small wash basin and possibly a half bath and a bench to sit on for taking off boots, etc. Additional features might include a coat closet or hooks for drying rain gear or wet coats, and additional storage for boots, hats, gloves, small sports equipment, etc.

Traffic Areas

Although traffic areas and hallways should be kept to a minimum for space efficiency, I suggest they utilize a washable, durable floor covering other than carpet for ease of care – especially in the hallways coming out of the mud room. If you have tile or hardwood floors in traffic areas, be sure to use various types of floor mats or rubber backed carpet runners in entry ways to absorb dirt and grit that otherwise may be tracked into the house.

RECREATION ROOMS

Playroom

An absolute essential when you have a basement and a large family is a recreation or game room. Even without children, I consider it a needful facility for contingency in case you must provide accommodations for a family with children – especially in times of cold or inclement weather when children need an indoor place to play. The smooth concrete or wood play surfaces can be used in a variety of ways from storage to hobby use. Large recreations rooms can often provide a number of other living accommodations such as a second kitchen, hobby areas, and living functions. Exercise areas are often combined with a playroom.

Exercise Room

This type of facility is highly recommended and can occupy a portion of the playroom or be separate. Some parents enjoy having such a room or area as part of, or adjacent to, the master bedroom area. Families who invest the time and money in good exercise equipment are far healthier, stronger, and better motivated than the average. Size should allow for a padded floor mat (gymnastic or wrestling type) for exercises other than weight training. Some type of aerobic exercise machine is just as important as a strength machine. There are a number of universal exercise machines on the market which take up little space. You can choose from several styles of exercise: walking, running, bicycling, rowing, stair-stepping, cross-country skiing, etc.

Handball/Racquetball Room

I consider this a luxury, but certainly nice to have for teaching children good hand-to-eye and muscle co-ordination, not to mention excellent cardiovascular exercise for all. This type of room needs extensive height, uses both the basement and main floor areas. The standard footprint is 20’ by 40’.

Outdoor Gym Area

A large outdoor patio area with a basketball hoop will provide for many excellent sports activities. A fixed wall for handball or tennis practice can also be provided in conjunction with this sports patio as well as a place to mount a net for volleyball or tennis. Two story designs on a slope can usually find a way to put this area under the cover of the higher level roof line.

Swimming Pool

If you go to the expense of having a pool, I would recommend it have sufficient length (at least 40 feet) to provide room for swimming laps. Round or oval pools, although more aesthetic, are not useful for much more than diving and lounging. For those with high end budgets, but limited space, there is one type of pool that circulates the water toward you, so that you can swim endlessly without going anywhere. The new ozone and

ultraviolet light water filters are worth looking into as substitutes for chlorinating your pool.

Indoor, Underground Pistol/Archery Range

Due to future restrictions on weapons, I suggest the implementation of a narrow range along the longest basement wall (with concrete, sound insulated walls and ceiling). Mechanical ventilation is a must for removing lead fouling and other noxious gases. One can also build a longer rifle range using 24”-30” culverts buried in the ground leading away from the house. Targets are retrieved and set by a pulley and cable setup. The tunnel can also serve as an underground ventilation tube, or even emergency exit.

STORAGE ROOMS

There are a variety of storage facilities possible depending upon the level of self-sufficiency and stockpiling capabilities you desire. All types, I feel, will be essential at some point in the future, but you will have to determine the size and type of storage you want based upon your individual desires and needs, and the raw square footage necessary to accommodate the physical size of the projected stockpiles.

Root Cellar Storage

The traditional root cellar is still a necessity for providing cool, moist storage for such roots and fruits as potatoes, carrots, turnips, squash, apples, and pears. The size can be quite small and can usually be fit under any existing concrete surface in your plan, such as a porch or even a portion of the garage if the floor is reinforced. Most plan them as an extension of the basement, but they must be completely separated and insulated from the heat of the house. Cellars must be able to maintain cool temperatures (35-55° F) for best results, with humidity above 80 percent. The floors can be earthen, sawdust, gravel, or concrete. Actual specific design depends upon the types of fruits and vegetables you plan on storing. Some need to be stored in moist surroundings, others open to dry, cool air. Most fruits and vegetables prefer cool temperatures and moist humid atmospheres as previously mentioned. However, garlic, sweet potatoes, winter squash, and onions need to be stored at a slightly higher temperature (45-65° F.) and dry. Melons, peppers, green tomatoes, and eggplant prefer very cool and moist. Design your bins so that air can circulate freely. The cellar should be dark and have no windows.

Food Storage Room

This room should also be in the basement where cool (55-60° F) constant temperatures prevail. It should be large enough to store a 1-3 years supply of food. Food maintains its quality much longer if stored between thirty-five and fifty degrees, but those temperatures are hard to come by without air conditioning or refrigeration equipment. There are two levels of food storage rooms to consider. The first should be a modest room in the basement with easy access (meaning close to the stairway and without high security door). This room would house a portion of your regular use canned goods and home canned food. Behind a concealed entrance within this first store room, and through

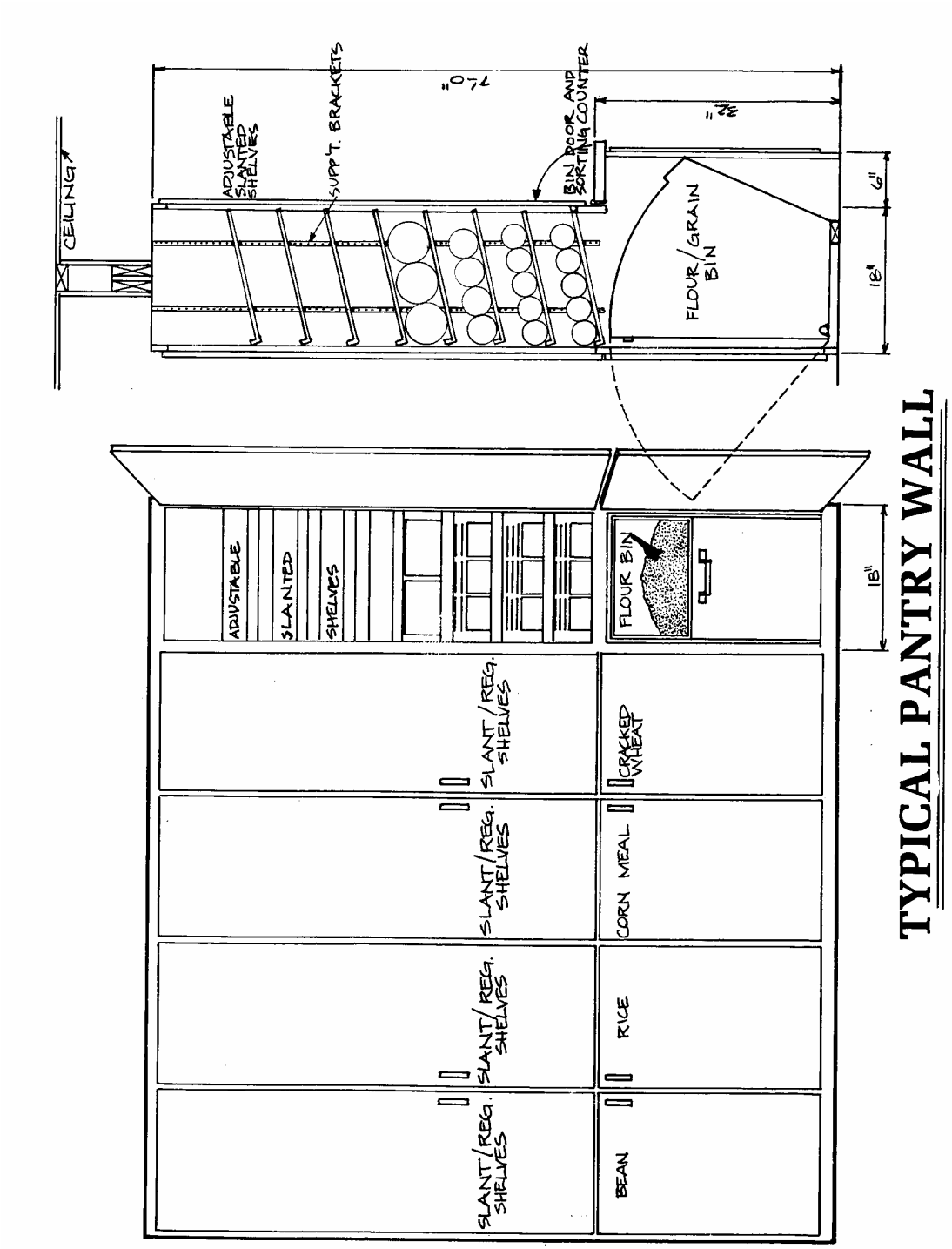
a hardened security door, should be another larger food storage room The second room is where the bulk of the long-term supplies are kept. If thieves or government agents come to steal or confiscate food, they only find the smaller supply – not the larger, long-term storage. The first room gives them the satisfaction of having found something, and hopefully they will not keep up the search and find the second concealed entrance.

Pantry

An ample pantry cupboard (closet or room) designed as part of the kitchen is a necessity to avoid the inconvenience and too frequent use of the main storage room. Even more importantly, concealed entrances should receive a minimum of use to avoid marks of activity. Grains and flour should be kept in sealed containers in this main storage room; however, many people favor the use of flour or grain bins in the pantry for convenience. Use of pantry supplies should be frequent enough to avoid insect contamination from non-sealed bins.

Storage shelves for food can be constructed in a variety of ways for convenience. Special slanted shelves can be constructed for canned goods of all types which gravity-feed the entire supply of cans forward so that deep shelves can be utilized and older purchased food is used first (see illustration). They have the disadvantage, however, of making the shelves always appear full, which hinders the vigilance that must be maintained over inventory control. They are also quite tedious to stock. Conventional shelves should be made of at least 3/4" plywood or particle board over horizontal 1"x2" inch supports with vertical supports every 24 inches. Normally, shelves for cans or bottles should be no deeper than 18" to avoid accessibility problems. Main storage shelves should not have doors as they are difficult to get around, among many rows of shelves. Use bungy cords stretch between supports to keep cans and jars from fallout out.

The visible pantry (see illustration), on the other hand, lends itself to some of these more sophisticated storage mechanisms. Where space for a pantry room is not feasible, an entire wall can be lined with 9" wide shelves which will normally last a month's supply without a trip to the main storage room. Three-inch shelves, integral to pantry cabinet doors, can add significantly to the available space and aid the finding of products as well. Large circular carousel-type storage units can be used to fill corner space. A unique combination of pantry and storage room can be had in a single level home with the storage room adjacent to the kitchen. The wall separating the two is widened to 12" - 18" with pantry type doors on the kitchen side. Slant shelves are installed so the cans or bottles can be replenished from the rear of storage shelves, and can be accessed from the kitchen side. A small shelf 10" - 12" in width is provided on the storeroom side for intermediate handling, sorting, or even the placement of a wheat grinder, etc. I like to have enclosed pantry work areas for a wheat grinder to reduce the noise when it is running. The lower cabinets have large bins for cereals, grains, or beans which rotate forward on dowels for easy access.



TYPICAL PANTRY WALL

Administrative Storage

In this age of increasing government regulations, important papers are numerous and difficult to keep track of. Loss or misplacement can mean many wasted hours in attempting to locate them or get additional copies. Obviously, if you have many papers relating to a business, you would use a home office instead of the admin. center (covered previously).

For easy access, a small fireproof vault, safe, or metal lock box should be hidden in or near the master bedroom or office. In the safe, important documents or money can be kept safe from fire and routine theft. I normally recommend that the money typically spent on a safe deposit box rental could better serve being invested in a small private security system at home. It is more convenient and actually safer if well concealed at home rather than in a bank, where you may be denied access when you need it. I also like to encourage people who have nice homes, and who might be subject to frequent burglaries, install a cheap safe with some "throw away" or fake items of value (glass jewels, outdated stock certificates, some cash, foreign coins, etc.) to give a thief should your life be threatened and you be forced to reveal where your "valuables" are. Your imagination can produce many suitable hiding areas for your real safes Naturally, the highest valued items should be stored in a hidden location within your high security vault room.

Yard and Garden Equipment

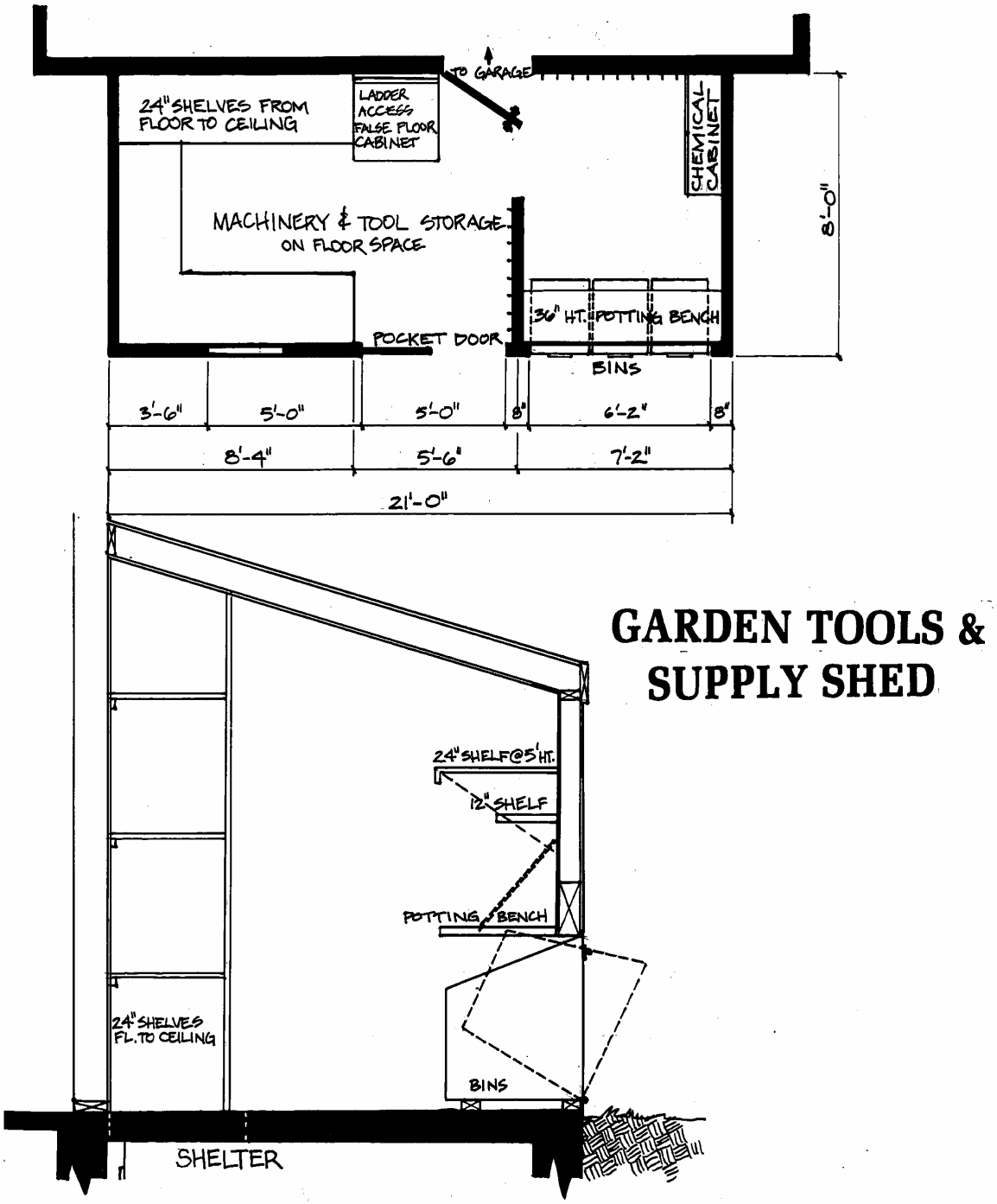
(See illustration) The side yard usually serves as a suitable location for yard equipment and garden supplies. An 8'x12' shed built on a concrete slab in conjunction with the fence is normally sufficient to house the rototiller, wheelbarrows, carts, and hand tools. A small locked cabinet should be provided for any chemicals, and several flip-top bins should be installed for storage of fertilizer, peat moss, barkdust, or other mulch. Enclosed coverage for garbage cans usually fits well into this shed scheme (if the location is handy for pick up and emptying). If designed prior to construction, a vegetable pit cellar can be nicely constructed underground using the concrete slab as the ceiling. Vegetables can be kept fresh all winter long if stored in such a cool place and packed in straw, sawdust, or other insulating mulch.

Dry Goods Storage

There are four basic types of DRY STORAGE GOODS which need facilities:

- Household products and accessories
- Clothing and bedding
- Outdoor equipment
- Shop supplies

These types of storage facilities have less critical temperature criteria than food storage. For this reason, attic space can be used for some of them even though temperature variations are greater than in basement space. However, in many cases necessary security



precautions against burglary and theft require that only secure storerooms be used. Because of the variety of items, a lot of organization is required to separate and store small sized parts and supplies. Significant inventory control needs to be exercised on clothing for children, especially when different sized clothing is stored that should be used again before the youngest of the children outgrows it.

Clothes Closets

Each bedroom needs standard three foot deep closets for clothes storage as well as ample shelf and closet space for children's play and sports equipment. In reality, closets can be as small as 24" deep and still easily fit clothes hangers. This is important to know if you are trying to squeeze a closet into a small space. Besides bedroom closets, every home should have a variety of other closets: hall closets for linens, broom closets for household cleaning equipment like vacuum cleaners and brooms. Each bathroom should have a linen closet inside so that no one will be without a towel or washcloth. Main floor areas should have a guest closet and a coat closet in the entry hall. Cloth material storage closets should be provided in the sewing room or laundry. I also like to see spaces for bins in the laundry room for sorting clothes. If each person has a bin, they can more easily pick up their own clothes after they have been folded and sorted.

Garage

If sufficient storage has been provided for within the house, the garage should not have to serve as an "overflow" area, as in conventional homes, and therefore can be counted on for true vehicle storage. A two-car garage is a bare necessity in a modern home. If you have room for a three-car garage, or a separate building for extra equipment and vehicles, so much the better. This gives you the flexibility to store a boat or even another car of the same make and model, which you can keep for spare parts. The extra space can also provide room for auto repair if a formal shop is not included. There should also be room to store extra equipment and implements in the garage for ease of access. Thus, the minimum width and depth of a two car garage should be 24' by 24'. I prefer 26' depths if you have the room. This allows for ample cabinet space along the sides without interfering with normal entry and exit from the cars. It also leaves room at the head of the garage for bicycles and a small workbench.

MECHANICAL AREAS

In every home design, you need to work in space for mechanical equipment such as wood stoves, water heaters, furnaces, generators, water storage tanks, electrical panels and controls, etc. Here are some guidelines.

Water Heaters

Ideally all water heating tanks should be relatively close to the area of use so as to avoid long runs. With a long pipeline, you must empty that pipeline of the cold water before you get hot water. This wastes time under normal conditions, and is a waste of time and water during periods of water shortage. But there's a problem. It is costly and takes

space to put a water heater near each sink – not to mention the energy lost by keeping so many tanks hot. So, as a compromise, I often try to tie several points of use to one water heater, and put that water heater in the basement just below or to the side of the area of use. We can then put another water heater at the other end of the home to serve another cluster of bathrooms/laundries, etc. Things are further complicated with gas water heaters since we have a flue to worry about – which must have access to the roof or an outside wall for venting of fumes. With gas or LP units, I try to place one of the water heaters next to the furnace. Another can go anywhere as long as it is fairly close to an outside wall. We'll talk about other complexities later as we deal with tying water heaters in with wood burning furnaces/stoves and solar water heaters.

Furnaces

Heating equipment almost always requires a flue as well, and so we must find a way to accommodate these chimneys. More and more heating units of the super high efficiency gas units don't require a true chimney – only a 2 inch PVC plastic pipe, since the gases are cooled sufficiently to avoid a metal chimney. Some of these can even exit the exterior wall, horizontally. But with most conventional furnaces (wood, oil, or regular gas or LP) a masonry or a double wall metal chimney is required. Thus, most often I try to place the furnace in the basement near a fireplace or regular chimney system, and then make room for an extra flue. In places where the building code prohibits LP gas in the basement (to avoid pooling of propane in case of leakage), you must find a main level location. A garage wall adjacent to the home often works well. Almost all manufactures have kits that can vent to a side wall, as well as up to the roof. Take care in designing furnace placement to think about where the duct work is going to go. Ducts that take advantage of being placed up inside floor joists don't have to be furred down, which intrudes on ceiling height. Almost always some ducts will have to run counter to the direction of the floor joist, and must get around rooms and stairwells, too. Take your preliminary plan to a furnace installer and have him help you work out a good duct layout.

Electrical Panels

Electrical panels need to be in a convenient location for you to reset circuit breakers when they trip. They may also be in a utility area of the home. You cannot put them in a closet or in any place where they will be covered by coats or brooms, according to the building codes. The most common areas are found at the juncture between garage and home, or in some utility or laundry/mudroom area. However, in a preparedness home, with significant alternate energy equipment that ties into the basement high security shelter, I almost always design the electrical panels into a room in the basement fairly close to the stair- well, but also close to the high security room, so that the interconnect wiring is kept as short as possible. More on that later. I'm only suggesting general guidelines in the beginning to assist in your preliminary planning. In large, expansive homes, you may have several subpanels around the house – especially for an apartment you may place above a garage, for example. If the occupants pop a circuit breaker, you won't want them to have to come down to the basement to reset the breaker.

HIGH SECURITY SHELTER

The placement of the high security shelter is almost always in the basement, except in areas of high water table. My preferred location for such shelters is underneath the garage space. Basements are rarely placed below garages, so it is an excellent place to conceal a set of secure rooms. Such rooms will be designed with a 12” concrete ceiling that is reinforced with steel, so it will support vehicles above with no problem. Shelters are detailed extensively in the High Security Shelter chapter later on.

LAYOUT CONSIDERATIONS

After this general perusal of the possible room facilities of the preparedness home, you should make a list of what you want. The next step towards correlating these desired facilities with the realities of your budget is to devise a general layout or floor plan so that the size, shape, and number of floors can be determined. Don’t turn to any stock plans yet. I think you will find your abilities to judge a stock plan to be greatly enhanced if you consider the general layout criteria first. While the criteria presented on each room type are fairly definitive, they are by no means absolute. You must be the final judge of the layout's desirability according to your lifestyle, but keep in mind that some lifestyles simply will not fit into a preparedness or security environment and must be altered or a serious degradation of survivability will result. You must be the judge of that, as only you can change your lifestyle prior to the onset of a real crisis. Budget, upkeep, efficiency, lay of the land, sun and wind direction, future lifestyle changes, number of children expected in the future, etc., are all valid considerations in determining the layout.

When the time to compromise arises, keep in mind that you don't save very much by simply cutting down the size of rooms (unless they are extremely large). If you have a multi-story home, cutting down on the main footprint of the home does save a lot of money, since the other floors are reduced as well. However, on a single level home, cutting room size or foot print only cuts about 50% of the average per square foot cost of a home. The number and complexity of facilities (baths, kitchens, etc.) are what add up to high cost. In fact, the more you cut down on the size of rooms while still maintaining the same number of facilities, the more costly your home becomes on a per square foot basis. The total cost comes down some, but the changes you make are usually irreversible (very costly to undo later if you decide to remodel). It is better, usually, to attempt to achieve the size, proportion, and number of facilities that you really need and want in the first phase of construction. You can always delay certain aspects of finish and equipment installation until you can afford them. Cutting these kinds of future options makes better sense than eliminating things that cannot be added back later.

BASIC STYLE CONSIDERATIONS

As I have implied previously, there are not a lot of significant style limitations for a preparedness residence, as long as the house meets the more important criteria of

maintaining a suitable low profile matching your surroundings. In my opinion, it is more important to have a suitable and mostly conventional facade than to live in an underground bunker-type retreat. While there are many self-sufficiency advantages to underground homes, the notoriety that it lends to your profile is a definite disadvantage. High security homes can usually be designed to look completely conventional, both inside and out. Indeed, they should appear normal in order to be discrete. There are certain needs of self-sufficiency and security that require underground or earth bermed structures within the secure home, but these can be handled in basement spaces. With the use of super insulated construction techniques we can now achieve near identical energy conservation for above ground structures as below ground. While this does not totally alleviate the need for underground space, it does allow us the fullest degree of flexibility in design for architecturally pleasing exteriors that match almost every style.

The primary style limitations are those which have excessive glass or other architectural features that are wasteful, costly, and lack security. Again, this does not mean that you cannot have some large windows in a secure home, only that you must be willing to accept the costs and trade-offs involved in protecting those aesthetic choices. As to windows, I prefer to capture specific views with just the right amount of window that is necessary – rather than design a glass wall simply for style. Owners must always understand the trade-offs involved when we go outside the limitations of modesty and efficiency. Almost any size of window can be protected, but large, motorized security shutters can cost up to 4 times the window wall itself. You can build almost anything you want, but some things will cost you a lot more than the benefit is worth, as compared to a modest treatment of the same view.

Certain architectural styles are more limiting than others. A Georgian colonial is more restrictive with its specific classic details and pillars than “California ranch” style which is only restricted by certain heights and roof pitches. Naturally, the more free flowing shed or gabled roof styles offer the designer the greatest leeway in floorplan and elevation. Wanting a classic or highly traditional styled home is only a problem when you are unwilling to live within the criteria under which those homes were designed. A person who simply must have a rambling California floor plan, but insists on a three level colonial style is going to be in trouble. He has conflicting criteria that, while not impossible to meet, are exceedingly costly.

For example, certain traditional homes typically had small floor plans not exceeding 2,000 square feet. When you attempt to impose the strict architectural proportions of a Cape Cod style home over 6,000 sq. ft. of floor plan, you end up with a building nearly 100 feet tall to keep the same symmetry. Don't get angry when the designer cannot give you both the rambling floor plan and the tall look (and still stay within your budget). If you want a colonial home, make sure you understand the types of rooms that traditionally accompanied those designs. Great rooms, parlors, back porches, and upstairs bedrooms were almost always present. While most of the room proportions can be altered to achieve modern efficiency, the overall size restrictions and height and roof proportions will remain fixed and relatively unyielding. Certain traditional styles also require more symmetry than what you desire – equal, matching sets of windows on either side of the home.

Certain styles are also more economical to build than others. Due to high labor costs today, traditional homes with extensive use of architectural details in fancy exterior and interior moldings, columns, and facades can be excessively costly. Invariably, clients end up sacrificing most of the self-sufficiency and security features in order to afford the inevitable cost overruns in decor. Single level, rambling floor plans with many odd shapes and angles are almost always more costly than rectangular, simple houses with multiple stories. Domes are only less costly if you do not compartmentalize them into the number of rooms typical of a normal home. The extra cost of building custom cabinets and partitions to meet odd angled walls is exorbitant, so don't be fooled by the low cost estimates for one big great room under a domed roof.

Underground homes are still more costly than conventional above-ground construction because of the various technical featured for structural strength and the vastly superior waterproofing measures that are needed underground. While there are always a few exceptions to the foregoing, especially in cases where owners serve as builders and overseers as well, this is the general rule. This is not to say that the costs for specialty construction should be this high, but they usually are, simply because they are specialty work and people charge more to cover for their unfamiliarity with the unique procedure.

Other restrictions to style may be a high priority for passive solar gain. At a minimum, this style requires a southern orientation and optimal wall and roof angles for passive solar glazing. Many times, sloping terrain will restrict your use of a particular style.

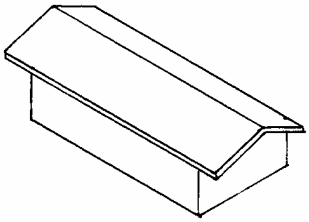
ROOF DESIGN TYPES

The shape of the roof is a fairly critical factor in house design. It is unfortunate that in the past two decades conventional residential architecture has been far more responsive to stylish demands than to the practical selection of a roof style which meets the ultimate needs of the home. The roofing needs of a home far exceed the need to shed water. The correct choice of roof has to satisfy all of the following needs:

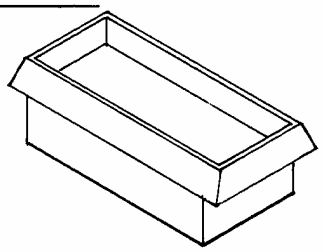
- Support the highest calculated live snow and wind load potential for your given area, without sagging or failing
- Effectively control summer heat gain in combination with the insulation on the ceiling
- Maintain the integrity of the waterproof surface against sun exposure, high winds, rain, mildew, rot, etc.
- Be fire resistant
- Provide impact protection against hail, vandalism, and forced entry
- Provide support and correct orientation for solar collectors

Be aesthetically pleasing to the overall design – without weird shapes and angles

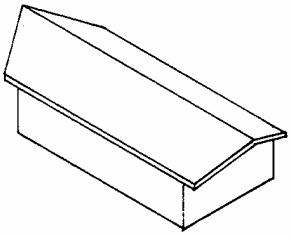
ROOF DESIGN TYPES



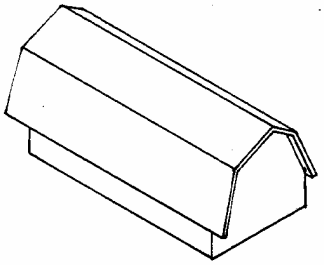
LOW PITCH



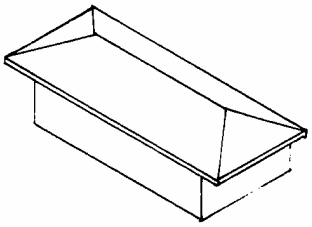
MANSARD



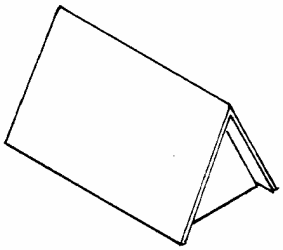
FRENCH HIP



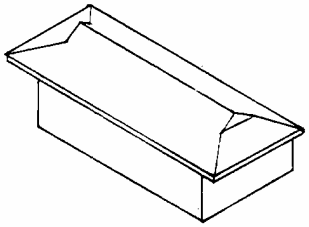
GAMBREL



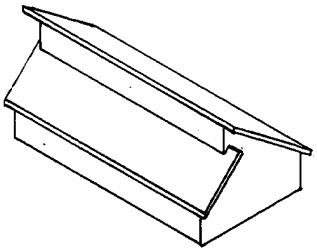
HIP



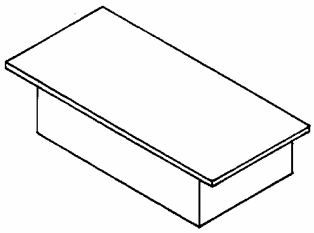
"A" FRAME



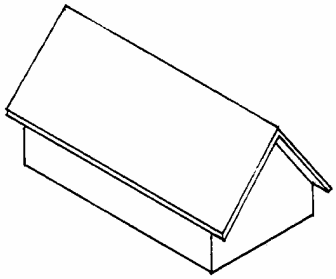
DUTCH GABLE



SHED



FLAT



HIGH PITCH

Many of the foregoing needs have more to do with roofing materials than style, which will be covered shortly. Our primary concern at this point is with roof shape and structural support.

ROOF SHAPES

(See illustration.) This is a simplified drawing of basic roof styles to help you recognize the choices. In reality, almost all complex homes use a combination of roof styles and pitches. The most common today for luxury homes is the use of steep, multiple hipped roofs, with layered gables over windows.

Flat

The flat roof is more versatile in covering irregular house shapes than the pitched varieties. It is perhaps the least costly, as well, since the ceiling structure is also the roof structure. Though not considered a direct advantage, the flat roof lends itself more to vertical additions to the structure. Finally, the flat roof offers excellent concealment for a variety of equipment which can be roof-top mounted, such as heating and air conditioning units, water storage tanks, pumps, and solar collectors. This presumes, of course, some facade shielding such as the parapet wall or false “mansard” designs to complete the obscuration process.

The list of disadvantages is considerably longer, however. All flat roofs have some slight slope to their design and construction to facilitate water run-off. However, this is rarely sufficient in most cases to prohibit the pooling of water which, in combination with small fissures, causes eventual leakage as the roof ages. The normal roof coatings utilizing asphalt emulsions have many drawbacks, including decomposition under effects of heat and sunlight. The drying of the asphalt causes small cracks which normally would not cause leaks if the water were allowed to rapidly run off. However, since water on flat roofs forms shallow pools, any imperfection in the membrane will allow leakage. There are many newer, but more expensive roofing surfaces. However, since these are primarily made for commercial type roofs, the costs are higher than residential work. Another disadvantage of flat roofs in snow country is that snow loads build up vertically, freeze and plug runoff drains. Use a sloping roof in deep snow country.

A good reroofing job on a flat roof is sometimes difficult to achieve if faulty underlayers, which may not be removed due to high cost, contain air pockets and moisture which causes the new roof surface to separate, flex and crack – especially when walked on during the fall when the roof surface may be brittle due to the temperature change. I have listed some of the new miracle roofing materials in the “Recommended Equipment and Sources” section for your information. They range from latex to special butyl rubbers. These new compounds are easier to use and seal, even on top of old roofing materials. They last far longer and, naturally, are more expensive initially. It is well to remember that the largest part of the cost of commercial reroofing is in the labor and overhead of the contractor. The actual cost of materials purchased are not that significant compared to the labor, so don't skip on quality.

Since flat roofs lack both an attic area and as well as forced or convective ventilation, they cannot match a pitched roof for holding off heat gain in the summer. In the winter, their only disadvantage in loss of heat due to lack of attic space for extensive insulation. This limitation can be overcome through proper design thickness of the ceiling joists or trusses. But perhaps the biggest disadvantage in the cold northern climates is their inability to withstand heavy vertical snow loads without a substantial increase in the size of structural members. Reinforced concrete and steel flat roofs are used in many commercial buildings at ski resorts and other mountainous areas, but not without large and expensive structural components.

As a final note, it is well to remember that the flat roof lends itself well to fireproofing since its concealed nature allows the use of a much wider variety of fireproof surfaces which would not be very aesthetic on a pitched roof. This, combined with the ability to conceal solar collectors (for the sake of safety from vandalism), will be the two prime reasons for using flat roofs in the security context. Flat roofs are generally constructed with special truss beams of wood, metal, or combinations of the two.

Low-pitched Roofs

These roofs of less than a thirty degree slope are the most common in modern conventional construction. They are usually designated as a 4/12 pitch or a 6/12 pitch, and so forth. The first number represents the vertical rise in either inches or feet, and the second number represents the corresponding horizontal run (nearly always a twelve). So a 3/12 pitch is very shallow. It only rises 3 feet for every 12 feet of horizontal distance. A 12/12 pitch, in contrast, is a steep 45 degree angle. Low-pitched roof styles have only limited usefulness in the preparedness context. They are generally not steep enough to shed snow for mountainous terrain and are too low to allow for any useful attic space. But they do provide substantially better ventilation than a flat-pitched roof in the face of summer heat, if provided with large vent openings and/or electric or mechanical ventilators.

Low-pitched roofs are normally constructed from pre-built trusses which are shipped to the site ready-made. These have both cost and structural advantages over the individual rafter method of construction, which may sag in time if sufficient compression webs are not installed. Do not space trusses wider than 24” to avoid sagging sheathing over time. At certain sun angles, a cheap roof starts to look like the ribs of a starving horse.

Low-pitched roofs are generally ideal for solar collectors in terms of inclination toward the sun (in southern latitudes), but they do not provide any visual protection from discovery in times when collectors may become targets for vandalism.

Hip Roof

The hip roof is a variation of the pitched roof in that the ends slope towards the peak as well as the sides. The primary advantage here is a lower profile roof at the ends which make for better design in high wind areas, and may allow for solar collection on a portion of the roof which would not otherwise have the proper inclination without rotating the position of the home on the lot. The major drawback with the hip roof is inadequate

summer ventilation, since all sides are closed in. Larger soffit vents at the eaves all around are therefore necessary.

Hip roofs of *steeper* pitches are becoming more common. These high pitched roof shapes, in combination with other gables, are used in Country French and other traditional styles in vogue today.

Gable Roof

The gable, though used most often as a term to describe a small peaked roof covering for an attic window, when describing a roof plane actually refers to any peaked roof which has an equal and opposite pitch on the opposite side. Gable roofs are usually pitched from 6/12 to 14/12 to give a rustic or chalet look. This roof style is extremely useful since enough head room exists to permit attic bedrooms or storage areas. This extra room is an economical way to gain space since the only extra cost involved is about 10% more roofing and about 50% more side wall material on two ends. As previously noted, modern designs employ combinations of tall hips and gables, stacked in multiple layers to give interest and style to expensive homes.

A-frames and Gambrel

The A-frame is a gable roof which simply extends all the way to the ground level, eliminating the need for walls on two sides of the home. This design originated with the desire to economize on construction costs while achieving a high sloping roof for shedding high quantities of snow. But it also incurs the same headroom liabilities as an attic room. Some space is definitely unusable for standing, but can be used effectively as storage space or sitting room to some extent. Some variations of the A-frame are noted here. The most common is the chopped A-frame, which replaces the sharp peak with a narrow flat roof, allows a more vertical wall to be used on the sides for more head room. The flat portion of the roof must not be so large as to incur excessive snow loads. Some mistakenly refer to this as the Dutch Gambrel, which is incorrect. The GAMBREL is actually more like the traditional American barn shape. The gambrel style is attractive when done in beam and decking construction.

The Lean-to or Shed Type

This type is so obvious and common that few realize it has a place in larger homes. If you will observe one of the many “modern” condominium projects, you will notice that nearly every roof is a complex joining of many shed-type roofs. A combination of various shed roofs is one of the most economical and flexible of all roof designs. In more conventional shapes, the lean-to roof can be employed for specific purposes such as passive solar heat collection, or to provide second level living areas.

Mansard

The mansard is a take-off from a traditional French style that looks very nice in expensive, continental, multi-story buildings of stone and slate tile, but that looks cheap and awkward when used on a typical American tract home with asphalt shingles. In

America it has been used most often to obscure the height of a second story with a flat roof, and is often associated with apartment buildings built in the ‘60s. It is fairly useful, when designed properly, to shield equipment mounted on a flat roof. But the style should carefully follow the original French and have slate or other more appropriate roofing to match Continental classical styles.

Circular or Special Shapes

Circular and special shapes are possible using beam and decking construction, primarily, with appropriate center supports. The added cost of heavy beams, either rough sawn or glue laminated, is often offset by their great strength, allowing you to use fewer support members in the construction process. One specialty type of support system for a circular pitched roof is the cable-truss (see illustration on Post and Beam Construction in chapter 8). This truss eliminates the need for a center support by causing the downward center weight to push against the high stress cable which connects each support beam around the wall circumference – effectively forming a rigid cone. I always specify that the holes in the beams must be protected by metal sleeves. Otherwise, under the high stress of the beams pushing against the cable, there is a danger the cable might start to split the beam longitudinally. Remember to figure the holding power of all the decking that will be nailed to each beam as the roof is installed. This takes a significant amount of the load off of the cable itself.

SOME FINAL COMMENTS ON STYLE

In my opinion, the most economical style of home is one that is generally rectangular or L shaped with a full basement matching the main floor plan, a main level double garage, and a gable roof line that is pitched sufficiently to allow at least half of the attic space to be usable for living space. This is usually referred to as a “story and a half” construction. The style can be either traditional (like a French chalet), or modern with “shed” style roof lines. If properly sized, most of the upper floor windows fall within the gable ends and a few dormers windows on the front. Sometimes, a full second story with balcony can be done in the rear. The home looks like a single level (with steep roof) in the front, and two story in the rear, hidden from view.

However, if you aren’t on a tight budget, feel free to design something more stylish and fitting to your taste, as long as you stay conservative. Most people don’t realize that with careful attention to room shapes, furniture layouts, and traffic patterns, much extra space can be cut from a floor plan. The most pleasant and satisfying homes I have ever designed are ones which are relatively small and efficient. Using interesting ceiling shapes plus paying careful attention to window placement can keep a home both cozy and unique. Most people make the mistake of making a house too big. The end result is lots more labor, property taxes, and furnishing cost. If you want a large room for entertaining, do a great room, but keep the rest of the house modest in size – especially the bedrooms, where most people add wasted space that is rarely used.

LAY OF THE LAND

The important aspects of the actual property are:

- Vegetation
- Slope and variation of the terrain
- Soil composition and rock content
- Water table
- Solar orientation

Prior to starting your initial layout, get a copy of your plot boundaries and accurately plot the position of every major tree or terrain feature you do not want disturbed or that you may want to design around. The slope will generally determine whether the garage is located on the main level or in the basement, the front or the rear. The solar orientation of the lot will determine a good portion of your roof (even if you only consider adding solar in the future). It will also influence window, greenhouse, and possibly room design and placement. The water table or rock substrate will determine the depth of the basement and the type of plumbing you use in the basement. The soil composition will determine the structural nature of the foundation and, if large rock formations are present, the strategic and aesthetic placement of the home.

I strongly encourage the conservation of as much natural vegetation as possible, which will influence the design of the house considerably. The vegetation may determine window placement for views. As for existing trees, deciduous trees on the southern and southwestern portions of the lot (in the northern hemisphere) should be retained as sun shades in the summer with the dual advantage of letting the sun pass through in the winter for solar heat gain. However, you should be aware that even bare trees reduce the solar radiation by 15-20%. If summer solar pool heating is desired, these collectors should be located elsewhere. Pools should be located on a site with the least wind, and where the greatest privacy is possible.

I normally prefer that the garage be placed on the main level with additional driveway access to a daylight portion of the basement where most of the storage facilities are located. In split level elevations, dual access can be provided by a main level circular drive in front with a driveway leading around the side to the actual garage. If the elevation split is from one side to the other (long-wise to the house), a similar design can provide for two entry levels as well. Where water tables or bedrock prohibit a basement, and the earth-berm effect is used to artificially create a gradual mound around the above ground basement, the garage entrance can be either at ground level or at the higher bermed level if an additional elevated drive is designed to provide access to the main level in an aesthetic manner.

ROOM LAYOUT

The LIVING ROOM usually carries the highest priority for the best view site in the house, as it is the prime entertainment area. The largest windows are in this area for the

same purpose. However, large vertical window sizes are quite costly in terms of heat loss. Thus floor to ceiling windows are rarely justified, especially when most of the view can adequately be captured by large horizontal windows. The living room should not be farther away from the kitchen than one room, usually a dining area or family room. It should also have direct access to the entry hall, and fairly close access to a guest bath. However, a guest bath should not have its door visible or open to the actual living area. The entertainment deck or lanai is usually tangent to the living area also.

The FAMILY ROOM has quite a few more options for placement due to its less formal nature. It carries the same closeness criteria to the kitchen as the living room, though it is usually separated by the breakfast area, instead of the dining room. Garages are often allowed to attach to one side of a family room and serve as a second entryway, though I do not prefer such an arrangement if there is a lot of traffic between garage and kitchen area. When large scale entertaining is anticipated, family rooms are sometimes placed next to living rooms with a partial or movable wall section so that both may be utilized for large numbers of guests.

Families with several children usually prefer a greater degree of noise isolation between the two rooms, which they achieve by distance separation, even to the extent that the basement may be a desirable location. Other noise areas such as laundry rooms or shops should never be placed near the living room, but are sometimes acceptable next to the family room.

PARLORS or small SITTING ROOMS should be placed immediately off the front entry for attending to guests as soon as they enter. CONFERENCE ROOMS or OFFICES/DENS can be farther into the house since some of these functions are personal and may be desired close to a bedroom wing, for example. The lanai should be off of the family room, not obstructing the main family room view, but usually to the side so as to share the outdoors and view.

The KITCHEN is one of the major focal points of the home traffic pattern and should not be too far removed from the secondary entry. Kitchens should be some distance away from the main entry. The kitchen forms the center, or hub, of domestic work areas, as well as eating areas. Rooms or facilities which can be tangent are: the laundry room (if on the main floor), sewing room, guest bath, stairwell, administrative desk/counter, or family room. Mandatory connections are the eating nook and dining room, pantry, and outdoor eating deck/picnic area. The kitchen should also not be too far from the garage to facilitate the unloading of groceries. Ideally, the garage entrance opens into a utility hallway with mud room entry, laundry, and closet areas located to either side as the hall leads to the kitchen or family area.

OUTDOOR CANNING KITCHENS are placed toward the side of the house with the greatest concentration of utility type rooms and facilities. Ideally, it should be on a wall adjacent to the laundry or existing kitchen to make use of common plumbing. If an outdoor kitchen is adjacent to the outdoor entertainment area on the main floor, it can serve as a barbecue area. Many old-fashioned outdoor kitchens were in a separate cabin close to the house – especially if utilizing an old world brick oven that was wood-fired.

BEDROOMS, being the least used rooms under normal conditions, are suitable for placement either upstairs or in the basement. However, some people have strong objections to either or both locations. The American tradition seems to call for the master bedroom being placed on the main floor, though about 1/4 of modern homes have master bedrooms upstairs. Children's bedroom and guest rooms usually are split between the upstairs (if a second level is available) or on the main level. Areas that commonly build basements use this lower level for extra bedrooms as well. I prefer the master on the main floor and in a zone which allows the parent to protect access to the children in case of fire or intrusion. However, very suitable arrangements are available with all bedrooms upstairs, or even some children's rooms downstairs.

Another prime criteria involves bathroom placement. Because bedrooms are quite flexible in their size and arrangement, the bathrooms can generally be placed so that they correspond to the plumbing of the main floor kitchen and guest bath, or laundry. Care must be taken in visualizing where the fireplace chimney or chimneys will penetrate the upper living areas. Where possible I like fireplaces on interior home walls so that the masonry chimney doesn't act as a giant heat sink to the outdoors in winter time. But, often this is not possible or desirable when you have a particularly dramatic setting for a fireplace on an outside wall.

The SEWING ROOM has a high degree of flexibility as to placement due to its quiet nature. Its main requirement is to be accessible for corollary functions associated with sewing: ironing and mending. With this in mind, the optimum location would be near the laundry-ironing area, though possibly not in the same room to avoid the moisture and noise associated with a laundry room. (Proper venting eliminates a great deal of the moisture problem.) Separate sewing rooms are the best, but sewing areas have been effectively situated in master bedrooms, guest rooms, family rooms, lofts, and basement recreation/hobby rooms. Most women seem to require three things more than anything else in a sewing room:

- Good, natural light
- Ample storage space
- A large cutting/layout area (which can be done in another adjacent room if the sewing room is small)

Women with small children have found it necessary to sew in an area where the children can play nearby.

The essential criteria for a LAUNDRY ROOM are ventilation and noise isolation from quiet areas. With these two criteria alone, the laundry on a main floor usually ends up on an outside wall and next to the garage – preferably part of a mud room/wash room entry system. This offers an excellent cleanup area for those entering from the garage. Having the laundry placed below upstairs bedrooms allows for a suitable hamper and laundry chute system. Laundry rooms sometimes go in the basement, though climbing stairs to service the laundry becomes the main deterrent (unless most of the bedrooms are in the basement also). There was a fad in design at one time of putting the laundry rooms upstairs near the bedrooms. The initial logic was that this would be closer to where dirty clothes were generated and would save steps. It turned out to be only half true. The

main problem was that laundry is usually done during the day while the mother is on the main floor in the kitchen or working with children in the family room. Having to run upstairs to run loads of wash and put them in the dryer proved not to be convenient, especially with large families.

WORKSHOPS should, ideally, be located in a separate building from the house if feasible. But when in the home, their placement should be in the garage or basement under the utility areas of the main floor. When a large outside deck is planned, the shops can be placed beneath the deck with design provision for a waterproof type roof under the decking surface. In every case where shops are within the house, good sound insulation construction techniques should be utilized, as will be described later. Shops on the main floor should be located next to or as a part of the garage, as long as the car storage function of the garage is not hampered. This is ideal if you can afford the expansion of your main floor square footage as it offers the easiest delivery of bulky shop materials to their storage and use areas. Shops in basements without drive-in lower entrances should be provided with slot type openings at least 4 ft. wide at the top of the basement wall to stockpile material. I have often used a step down garage level to provide a 1 foot high by 81 inch wide opening leading down into an adjacent, but lower level basement shop.

The GREENHOUSE should be located against a portion of the southern or southwestern exterior wall with access preferably to the kitchen area, so that fresh vegetables can be gathered for meal time. Due to the rigid sun orientation requirements of the greenhouse, all other criteria for access must be sacrificed to accommodate this facility. If this is a design problem, plan on building a separate greenhouse close by.

EXERCISE rooms should be placed where convenient for use by the most people. Some couples prefer an exercise area off the master bedroom so as to be able to exercise in private as soon as they get up. For family use, an exercise room works well in the basement as part of or adjacent to the recreation room. Garages are not the best areas, especially if unheated in the winter.

SPORTS ROOMS have no particular criteria except to provide ample size and height for basketball or racquetball courts, both of which require a 20 ft. height. A gym of this type will occupy two floor levels if the ceiling height is 10 ft. For the non-purist, two 8 foot high stories will give a satisfactory racquetball court, but it will be only 17 ft. high instead of 20 ft. Indoor trampoline areas also require a two story height.

A SAUNA, HOT TUB or shower can be located within the master bedroom complex. If use by guests is envisioned, then provide secondary access from a nearby changing room or guest bath.

The INDOOR PISTOL/ARCHERY RANGE, if desired, should have a private entrance and should occupy an entire length of the longest basement wall. This particular basement wall would actually be a double wall, sound insulated. The inner wall appears to be the normal basement wall, and has a concealed entrance door somewhere along its length – usually in a closet or storage room. The insulated range occupies the space outside this double insulated wall so as to provide as much sound proofing as possible. Some noise will be heard in the basement or inside the house proper, but the purpose is to

make sure none is audible from outside the house. Care must be taken in labeling these facilities on floor plans so as to avoid revealing their actual purpose. Call it a wood storage hall. This works well with the fact that you will have one end open (to be eventually outfitted as a bullet trap in the soil and then enclosed).

STORAGE ROOMS, for food should be in the basement. Other than cool temperatures, storage requirements are not critical. They can be designed into odd, leftover places in the basement floor plan. The food storage room should, however, have fairly close access to the main staircase for restocking the upstairs pantry. Some dry goods can be stored in attic rooms if they are not sensitive to high temperature.

FUEL STORAGE must meet strict safety requirements that demand that they be away from the house. If this will adversely compromise their security adversely, then they must be buried underground near the house with vent piping reaching above the roof line.

MULTI-PURPOSE HIGH SECURITY VAULT ROOM: This room is the most essential area in any preparedness design. It must be concealed, so it is best placed under the garage slab as a “basement cellar” where no one would normally expect a basement. Because of this placement, the wall separating the main level garage and the house becomes an important wall for installing wiring and other special conduits for electrical and antenna leads coming down from the attic and solar panels. Do not be tempted to leave out this important shelter. It will be critical to your survival during the next war, which will be nuclear in scope. People who sacrifice the shelter make a truly irreversible error that will be very expensive to remedy – even if you have enough warning to retrofit your house when needed (which is doubtful). See chapter 11 for a detailed description of these special multi-purpose shelters.

Chapter

6

Four Sample Remodeling Layouts

Before entering into the specific sections on new construction, I will walk you through four sample remodeling problems and their solutions, presenting various ways to solve typical deficiencies in moderately priced suburban homes. This process will not only help reinforce the design principles we have discussed, but show how to work with various compromises required by existing limitations.

THE DEFICIENCIES OF THE TYPICAL AMERICAN HOME

There are several major weaknesses and numerous minor ones which make the typical city or suburban home vulnerable in an economic, energy, or social crisis. Eight primary failings are:

1. Poor insulation in ceilings, walls, floors, and windows
2. Excessive air infiltration rates
3. Single energy sources for space heating, water heating, and cooking
4. Lack of adequate storage facilities (food, water, equipment, and fuel)
5. Lack of shop and repair facilities
6. Lack of an independent electrical source
7. Lack of an independent food and water source
8. Lack of security (fragile windows, doors, lack of intrusion warning)

Each of these various areas needs specific attention, and will be covered thoroughly throughout the book. Frankly, it would not be prudent nor economically sound to try to remedy all of these deficiencies in an urban setting. The specific location of the home and how much land or privacy is associated with it will determine if we can actually approach high security and self-sufficiency.

SHOULD I REMODEL MY CURRENT RESIDENCE?

Prior to implementing any remedies to the foregoing, it is essential to have a master plan which will determine what the overall potential for improvement is, and within what cost parameters you are capable of operating. This is much easier to do when designing a new

home from the ground up, but there is still a lot we can do. The remodeling examples that follow depict a few typical types of homes to work with. None of these will exactly match your situation, but it will give you an idea of how you should proceed.

The primary decision that must first be made is whether or not your existing home is capable of self-sufficiency, assuming that you have determined that the location and neighborhood are acceptable. As discussed previously in the Preliminary Decision Making chapter, to be worth extensive remodeling, the home must be in a location that is outside of major exit or commuting patterns leading in or out of the urban area. You must feel pretty good about the quality of neighbors you have, and must not have any dedicated enemies in the neighborhood. The home needs to be well outside the potential blast areas of nuclear military targets. It must not be on unstable ground or on a slope that is at risk of moving downward in an earthquake or heavy rain storm.

There is one other reason you may consider remodeling, even if the house or location does not meet the foregoing conditions: when you have no other financial choice. This is very important since you do not want to take on more debt when trying to become self-sufficient. Debt puts a cloud over the entire project, especially in tough economic times. I even prefer to have people downsize in housing rather than try and get the perfect place, saddled with lots of debt.

Relative to the structure itself, here are some general criteria and considerations:

1. You need to think in terms of 2,000-3,000 total sq. ft. (including garage) for the average family of five persons, so as to provide sufficient room for the many facilities a preparedness home should have. Some of this room can be found in a high security shelter basement which can located under a new addition, if soil and water conditions permit. If a basement is not possible, you can sometimes extend the footprint of the home or go upward for extra space, adding a second level.

2. Is the house oriented correctly to utilize southern exposures for solar panels, greenhouses, or even a passive solar window? This may not be critical if you are in an area where the winter months are almost always overcast.

3. Is the soil suitable for growing a garden? If not, can soil be brought in economically? Does any portion of the yard get a full day's sunshine? Can you trim or remove trees that may be blocking the sun?

4. Will you be permitted to drill a well if needed (rare nowadays) or do you have sufficient sideyard clearance to get machinery into the backyard to put in a rainwater storage cistern? An underground cistern is optimal, especially since you can fill it with the runoff from your roof, passing through a filter system first – and you need no one's permission to do so.

5. Is the house wiring sufficiently modern to be safe, and can the main panel handle extra circuit breakers and loads? The main panel is fairly easily replaced, but the wiring is not. Often it pays to leave the existing wiring alone (if safe) and use a new subpanel for any additional wiring you may need, especially for an addition.

6. Is the house structurally sound (no sags, major cracks, insect infestation, or moisture rot)? Don't just assume. You must uncover and probe around the foundation and inside a few wall cavities to make sure.
7. If the home lacks insulation in the walls, does the exterior or interior need redoing so as to cover up the insulation changes you will need to make? Most homes built since the 1970's will have adequate insulation.
8. Is plumbing sound? Check with a local plumber to find out if the area is prone to high corrosion of galvanized pipe. If it is, you can plan on major problems eventually. If the plumbing is easily accessible through an unfinished basement or crawl space, replacing major drains may not be too expensive. If everything is covered up, it is usually prohibitive in cost. This is one of the biggest drawbacks of buying older homes – the plumbing and wiring are a mess.
9. If the home has a septic system, have the tank pumped out and use one of the common septic system bacterial additives to help clean out any clogging. If you ever allow the leach field to get totally clogged, then it can't be rejuvenated by bacteria.

If any of the foregoing problems are serious, you must ask yourself if it is going to be financially feasible to remodel as opposed to selling and starting over with a more suitable existing home, or building a new one. It's now time to confront the following personal questions:

1. Do you have any choice financially?
2. Do you want to live where you are now, and are you really comfortable there?
3. Are your chances for continued employment solid – even in an economic crisis? If not, could you find other income working out of this particular home?

If the answer to question number one is yes, and the answer is no for either of the next two, you should not consider a major remodeling that would exceed the general market level of the homes in your neighborhood. Rather, you should limit yourself to stockpiling goods and supplies within the available space in your existing home, and start looking for a better residence or location.

MINIMAL PREPARATIONS

The majority of people are not in the immediate financial position to either remodel or move. In this case, I highly recommend that families begin a regular purchase program using a portion of the monthly budget to begin the acquisition of the minimum storage items in the following areas:

- Food and water
- Portable electrical generation equipment
- Household products and spare parts

- Food preparation equipment
- Clothing and bedding
- Medical supplies and equipment
- Tools and supplies
- Vehicle parts and supplies
- Outdoor survival and camping equipment

The importance of beginning an immediate storage program is that these items represent the end products for survival, while the remodeling only provides more convenient facilities for their use. The former is absolutely essential, while more room may not be as critical – unless, of course, you really don't have any room to store anything. If you must financially choose between stockpiles of essential goods and equipment and a more commodious house, choose the stockpiles and equipment. It's amazing how you can learn to do with less space if you really have to. Naturally, for some, a minimal remodeling for extra storage space will be required in order to house the necessary stockpiles and equipment.

There is an additional advantage in choosing to stockpile before building or remodeling. During times of shortages and social unrest, there is a high probability that a black market and rigid government controls or rationing will emerge, putting you at risk if you have no choice but to deal with such a market. (Black markets are actually totally proper, as they represent the free market's attempt to bypass government-induced rationing.) Having a good supply of end-use productions will help you avoid paying black market prices and thus preserve what wealth you have, while others experience a severe drain in funds. This will be especially true during the periodic shortages which usually precede a permanent crisis. Additionally, many opportunities arise in a crisis to purchase homes and equipment for a fraction of their true value, due to foreclosures or business failures. I do not, however, recommend waiting around for such a risky chance if you have funds available now for facility improvement.

THE REMODELING MASTER PLAN

The remodeling master plan represents the total preparedness design possibilities of a given home in accordance with the owner's wish list. It is divided into a series of progressive additions and modifications, determined by future financial expectations. The main purpose of the master plan is to avoid piecemeal additions which could prohibit other more efficient designs at a later date. All additions should be planned so that a minimum amount of reconstructing of the existing house is required. It is also important that the addition attractively match or blend with existing roof-lines so as to not devalue your house in case you wish to sell later.

To begin with, follow these first four steps as a general guide for the master plan:

I. Survey the environmental factors immediately surrounding your home.

A. Chart the path of maximum sunshine in relation to the orientation of the house. This will correspond to the south portion of the home, since the sun appears to travel from east to west over the southern horizon in North America. If you have significant solar potential, rooms and facilities that need direct solar input must be given priority for location to the southern exposure. All gardens, solar collectors, and greenhouses must be located so that they are not shaded by the house or landscaping.

B. Determine the specific prevailing wind on the home. This will sometimes be affected more by wind channeling effects of houses, streets, hills, and trees than the actual prevailing surface wind for the geographical area, so don't just look on a weather map for the information. This will determine where you place wind-deflecting surfaces in cold climates or wind-channeling surfaces for cooling in warm climates.

C. Determine whether you desire sight or sound shielding from neighbors, busy streets, or unsightly buildings. This is a secondary factor, but nice to keep in mind in the overall plan.

II. Look to finishing off a garage or carport as your first and most economical method of obtaining additional space. If you add a new garage it is best attached to the old one, since it ties in very well function-wise with the general area of the old one. Make sure you have enough room to add a new garage to your remodeled home in accordance with local set-back requirements. If you do not have room for a new garage either to the side or further toward the front of the house, then make sure in the process of converting the existing garage that you do not remove the structural headers that form the garage door openings. This allows you or the subsequent owner to undo the change if necessary. Some may wish to do away with a garage entirely, in preference for living space, but I do not usually recommend that, unless space is absolutely unavailable. Be careful with the local codes and restrictions. Some codes even specify the size and number of covered car spaces required in a given residential area.

III. Search for more basement space – even if you have a basement already. You will need some basement space for secret storage or emergency living facilities. Ideally any addition, including a garage, should have a basement under it, if soil/water conditions allow. This allows you to add concealed space that will not easily be discovered. In fact, this is one of the best reasons for building a new garage – to allow for under-garage concealed storage.

IV. Locate a place for a concrete cistern and/or swimming pool for rain water storage purposes if you lack an independent water supply. Cisterns are much better than pools since they are not treated with chlorine.

FOUR SAMPLE MASTER PLANS

Since I cannot discuss the myriad of different house plans available for every remodeling possibility, I have chosen four typical suburban home plans which are representative of

four types of problems. These designs are admittedly dated, but do represent the types of homes still in use by millions of Americans today. In each, I have given them a complete remodeling based upon security principles. Even if none of the individual plans fit your home precisely, the study will be of excellent value if you concentrate on the specific relationship of one room to another and its proposed addition. This is the basis upon which you will be making decisions in your own home. The four types I will analyze are:

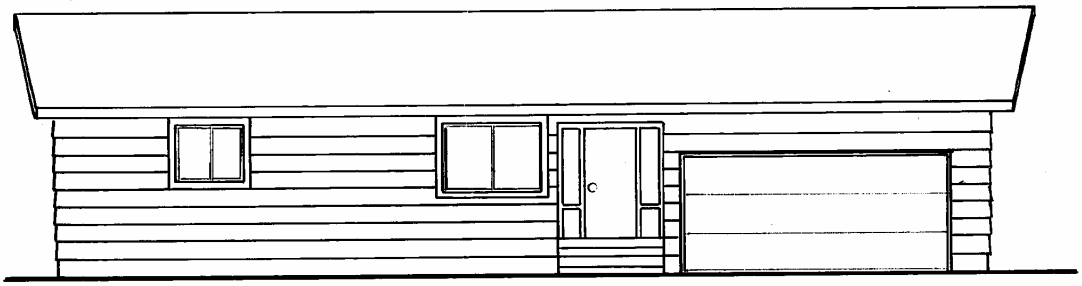
1. A rectangular, TWO BEDROOM tract home without fireplace or basement potential
2. An L-shaped, THREE BEDROOM home with fireplace and basement potential
3. A THREE BEDROOM home with existing basement and fireplace
4. A large, TWO STORY, FOUR BEDROOM, rectangular home with basement potential

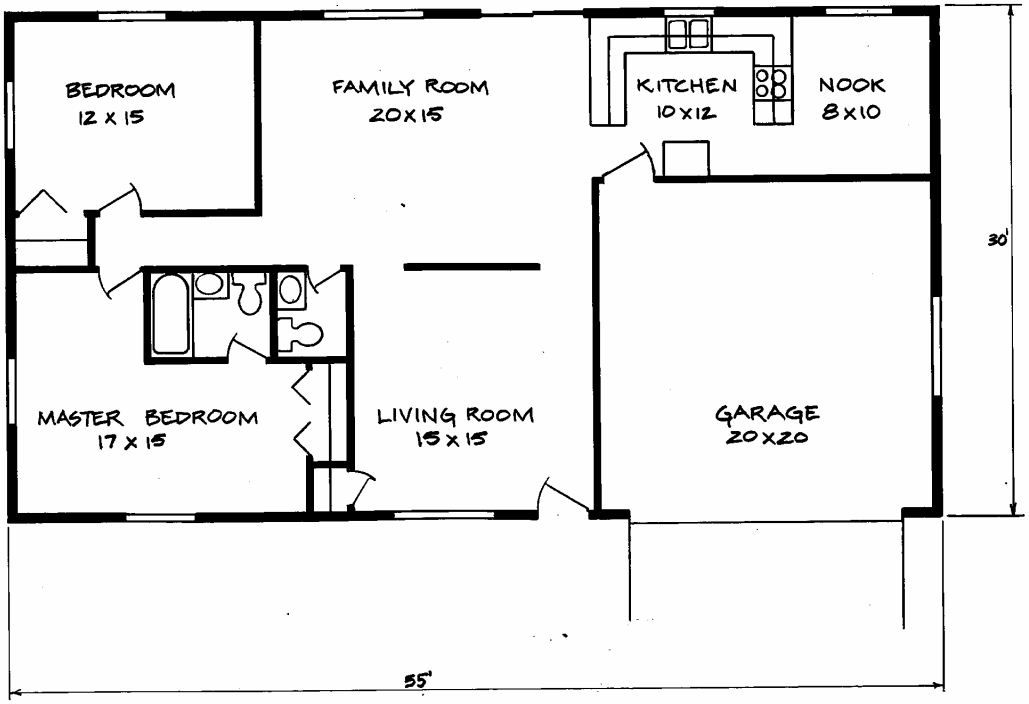
Home #1: Two bedroom home without fireplace or basement potential

(See illustration)

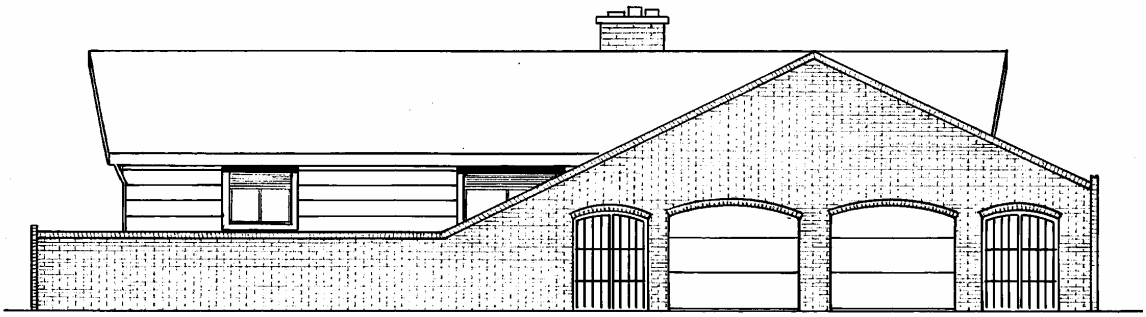
Despite its small size, this home lends itself well to remodeling. Its back yard is oriented to the south, providing a southern exposure for garden and greenhouse. Both the master bedroom and the children's bedroom are sufficiently large. Hall space is kept to a minimum, and the two living areas have good access to a half bath. The kitchen is ample and well placed between the family room and the nook so that food can be served to either area. However, in the typical fashion of the tract home, storage space is almost non-existent. This type of home usually has the automobile sitting in the driveway because of lack of room in the cluttered garage. Total living area is only 1,250 sq. ft., which is minimal for this family of four. Lack of laundry area is unacceptable.

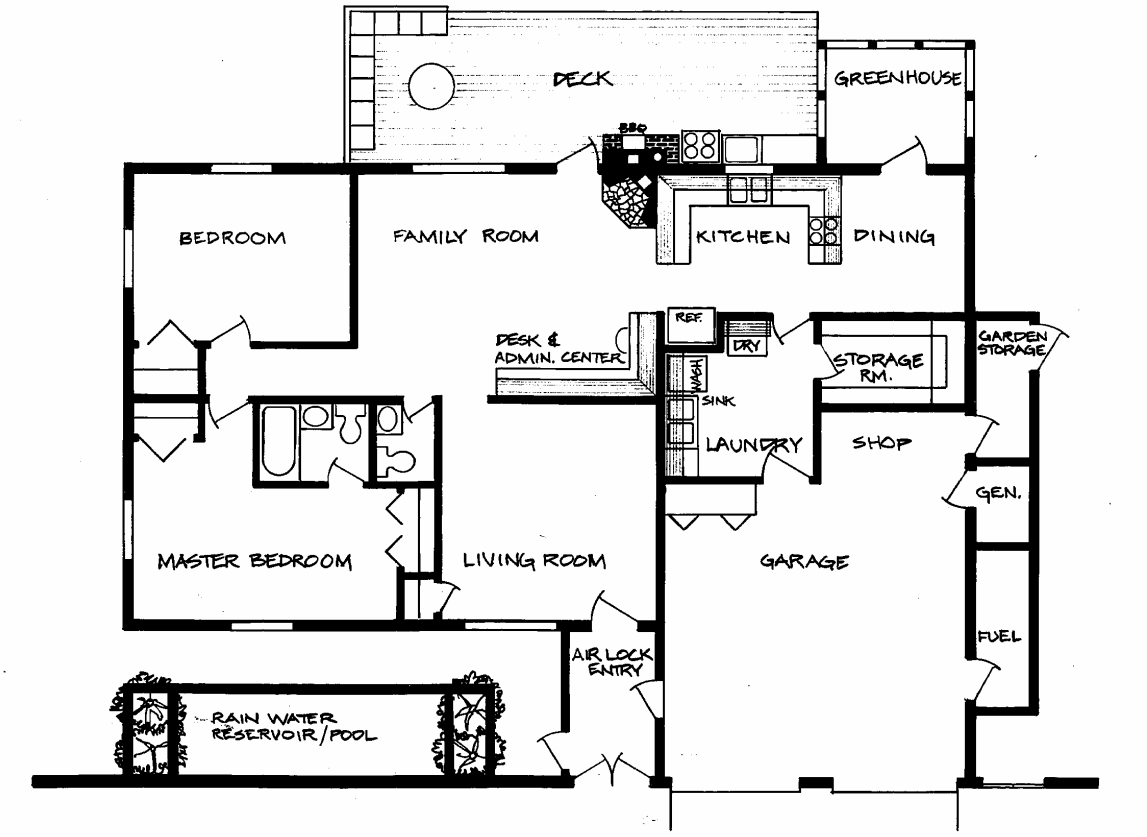
1 2-BEDROOM TRACT HOME





1 REMODEL LAYOUT: NEW FACADE
MAIN FLOOR
ENLARGE GARAGE/UTILITIES





The Remodeling

Attending to some limited food production as the first priority, the small back yard is reserved for a family garden plot. No major rearward remodeling is planned except the long, screened-in solar porch which houses the unique outdoor canning kitchen and barbecue, and the small solar greenhouse. The outdoor porch has been a common item in rural homes of past years. It serves many useful functions ranging from cooking and parties to miscellaneous storage and a quiet rest on the porch swing. An outdoor sink is set into a solid maple/birch laminated, butcher-block counter top – which is ideal for cutting and preparing foods for canning. The sink is located opposite the indoor sink for ease of plumbing connections. Between it and the barbecue is a Monarch brand combination wood/coal/electric range which provides convenient electric heat for canning during good times, and coal or wood burning capability for all cooking in emergencies. Unfortunately, the Monarch line is no longer being produced, but you can still find them in appliance "junkyards" or at garage sales in the Midwest. The solar greenhouse has exposed glass only on the slanted south wall to minimize heat loss at night. Side walls are fully insulated, and plant beds are raised in a stairstep fashion to avoid plant shading and to maximize heat absorption during the day, which keeps the greenhouse warm during a good portion of the night.

In the original house, the refrigerator stuck out into the kitchen area like a sore thumb, causing traffic congestion. Therefore, it is integrated into a portion of the old garage space. The decision to extend the garage ten feet is sufficient to secure additional space for the laundry and shop area. Storage cabinets are added in the shop area, as well as in the garage to avoid cluttering the working space. The laundry has dual stationary tubs, in addition to the washer and dryer, to facilitate hand laundering in an emergency. Cupboard space is provided above sinks (not depicted).

Space under the side eaves is utilized to provide garden tool storage space as well as an enclosed, sound proof room for the generator and a fire-proof room for propane fuel storage (not legal in some areas).

The entire front of the house is given a face lift with a durable brick veneer which is extended all along the front of the house to provide a high degree of security as well as noise shielding from the busy front street. Entrance is provided through decorative, but substantial, wrought iron gates. The main entrance has also been transformed into an air lock entry. The front wrought iron gate has 1/4" clear, acrylic plastic backing which meshes with foam type weather stripping on the inside of the brick to seal out wind, and to be able to see who is at the entrance. The enclosed patio area between the outer wall and the house contains a low, 24" rain reservoir/pool which can be attractively landscaped with a fountain and appropriate vegetation. Additional security is provided by the addition of roll-down metal shutters on all windows, at the cost of approximately $1000 per window. It is far more cost effective, however, to use 1/4" or 3/8" acrylic storm windows The total square footage has been increased from 1,650 to 2,270. This remodeling is quite representative of how much efficiency and space you can squeeze out of a fairly restricted lot without sacrificing livability.

Home #2: Three bedroom home with fireplace and basement potential

(See illustration) This home has only thirty square feet more space than home #1, and yet, it has two full baths, an entry, a porch, and a larger kitchen. This has been achieved through the sacrifice of the family room and by smaller bedrooms all around. Because of its L shape, the house is situated on a larger lot than home #1, which will allow us to expand into the rear. The home has sufficient living space, except in the area of indoor recreation. Laundry facilities are located outside on the patio, which is not ideal. The end result is a total lack of storage space. However, since this site has basement potential, I will show how this home can be remodeled into a nearly optimum suburban preparedness residence.

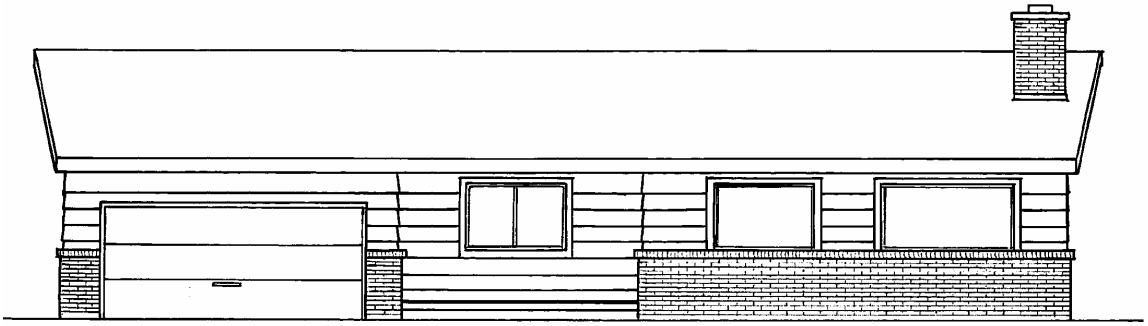
The Remodeling

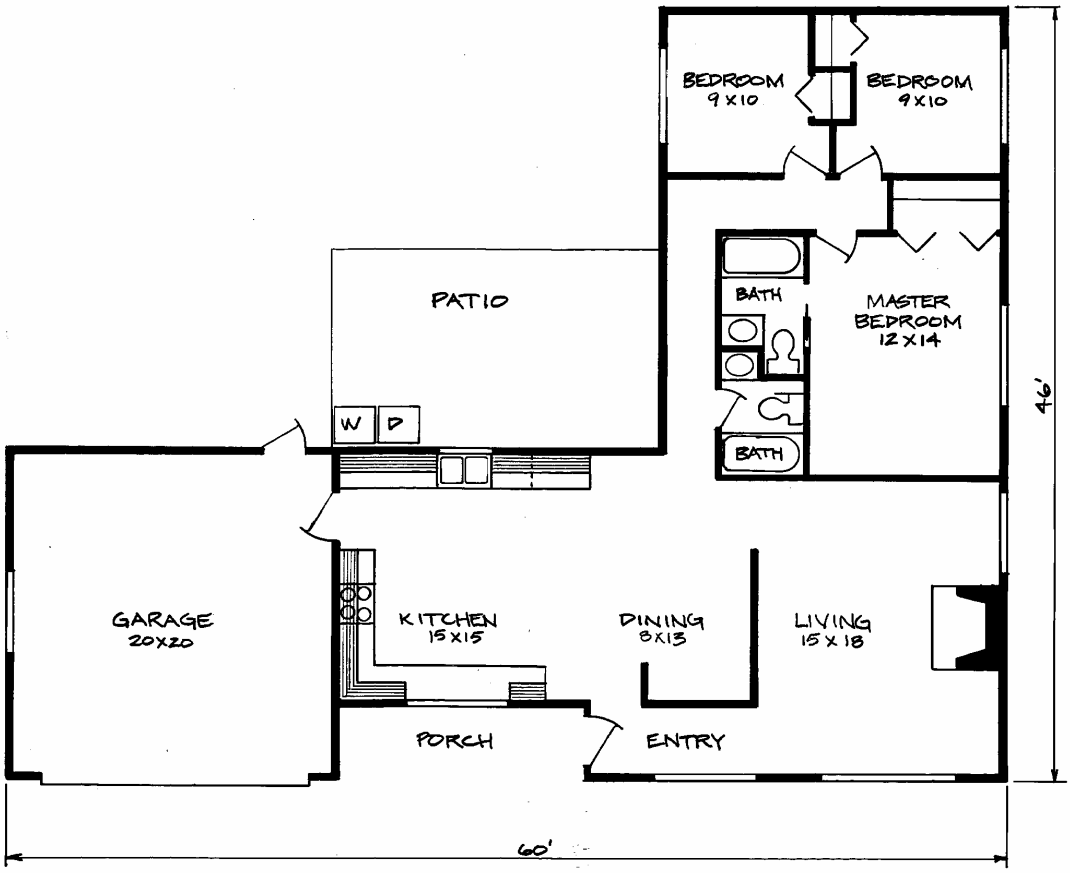
The front of the house faces toward the south, and thus presents some complications for gardening. Obviously, we do not desire to have the garden in the front yard, if at all possible, though a high fence in front can assist in making that a viable alternative in some cases. In this case, I have placed the greenhouse on the front of the house in conjunction with a glassed-in solarium entry, which doubles as the air lock entry in cool winters. The slope of the upper glass front is continued across the front of the house by the installation of movable wood louvers which shade the front windows during the hot summer months. In the winter, the louvers are raised upward and act to deflect cold winter winds up over the house, helping to further insulate the large glass area. Since a strong southwest wind prevails on this home, a large wind deflecting fence has been erected on the west side of the driveway. Louvered wind deflectors join the fence top with the eaves on the west side of the house as well. This total wind deflection system is extremely valuable in high wind areas such as the Central plains states.

The entry of the home is both aesthetically and functionally enhanced with the addition of a coat closet in the air lock entry and an administration center as part of the entry hall. A small portion of the dining “L” has been taken to provide for a small administration desk, which is central to all major living areas. Items that need to be remembered can be placed on this counter where they are most likely to be seen prior to leaving. This also provides a place for placement of packages, books, and/or papers prior to sorting for permanent storage (providing it doesn't become a cluttered, “catch-all” area).

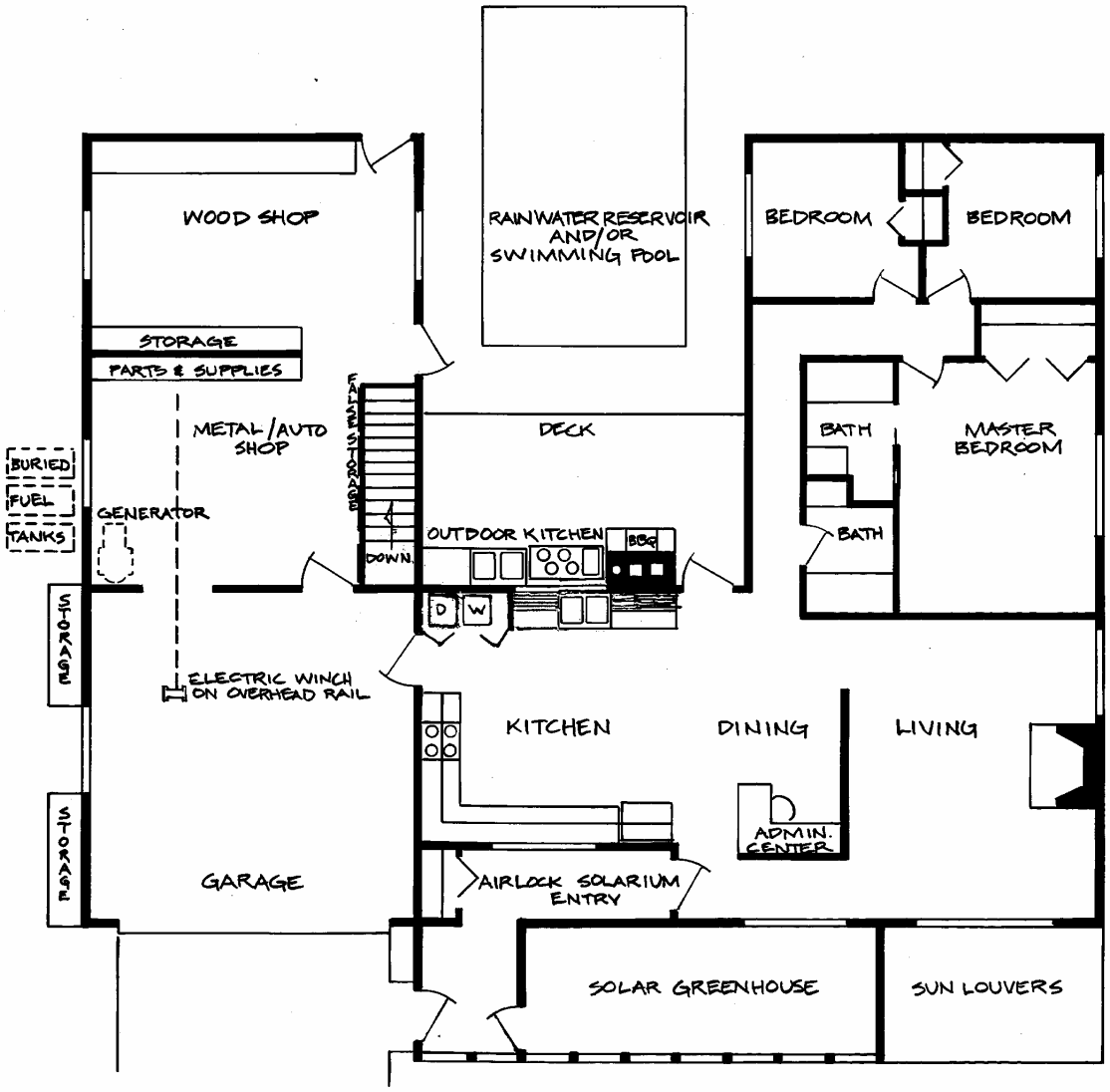
The major remodeling involves the addition of a waterproof deck and 560 square feet of enclosed shop and storage space, all built over a private, basement emergency living center. The principle demonstrated here is that in most situations it is better to put a basement under a new addition than attempt to dig one out from under the house, shoring up as you go. All excavations for the main basement and pool are done at the same time. The floor plan of the private basement includes a common living/dining area with heat venting fireplace and wood supply. A small wood/coal burning stove is tied into the chimney system as well, for cooking. A kitchen sink is tied in with the emergency water supply tank in the attic. Hot water comes through the wood stove for heating. A full bath with shower is tucked in under the stairwell.

2 3-BEDROOM L-SHAPED HOUSE





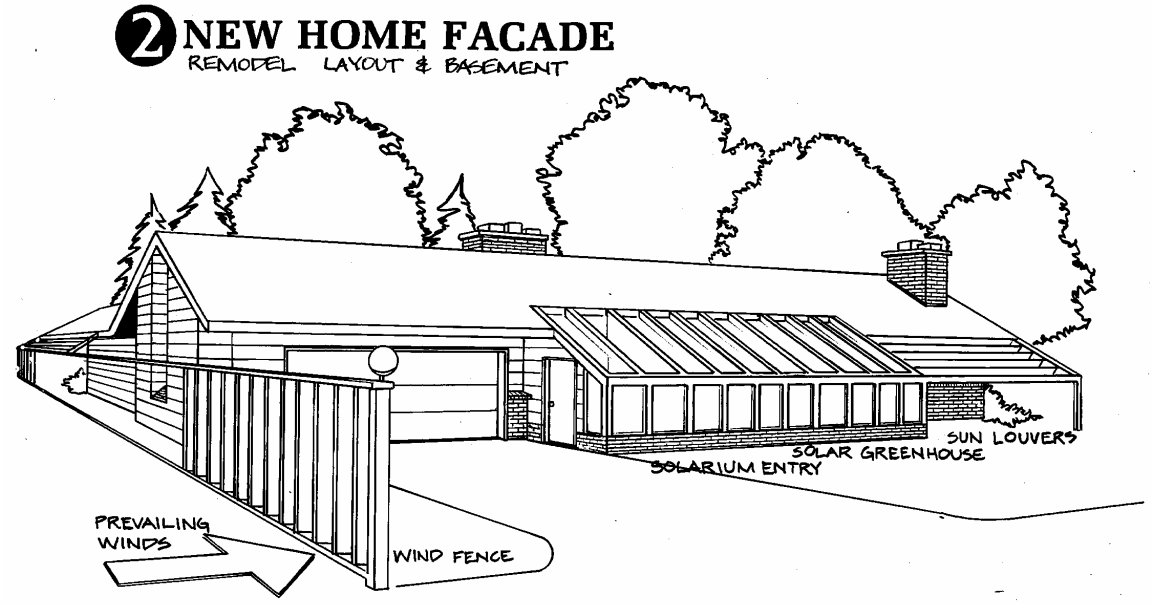
2 REMODEL LAYOUT: MAIN FLOOR

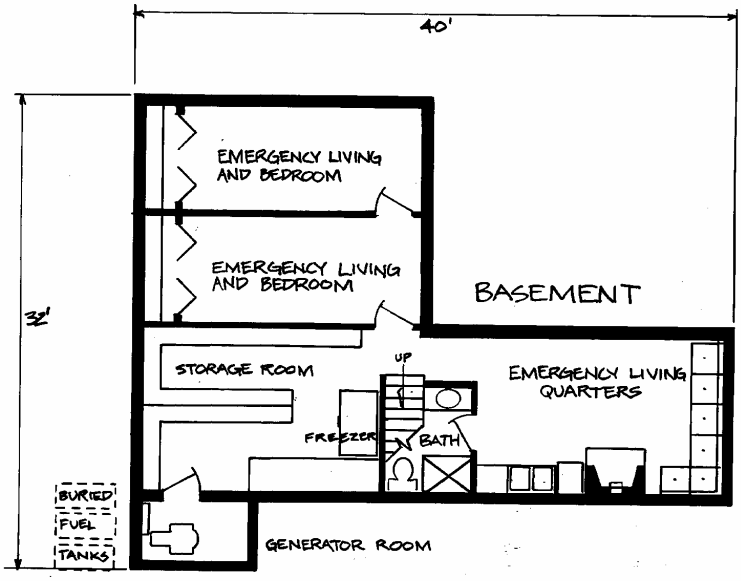


Access to the sound-proofed emergency generator is through the storage room. The generator room is excavated under the garage floor for maximum sound deadening and located so that air intake and exhausts, as well as all fuel vents, extend up through the garage/shop wall to the roof so as to appear as normal plumbing vents. The generator is fitted with extensive muffling, both in the generator room and in the attic. Storage of electrical energy is provided by DC storage batteries. All emergency lights run off these batteries directly (this can be done with either 12 volt or 24 volt fixtures). All 110 volt AC appliances can run through an electronic inverter to obtain 60 cycle alternating current. This hybrid generator/battery/inverter system schedules the generator to only run once a day at full power until the batteries are charged. Thus, the generator's fuel supply is maximized since the genset only runs at near full load capacity. Details on how to implement all of these alternative energy systems will be found in later chapters.

Access to the private basement is through a series of partially false cabinets over the stairs. The ground level additions consist of a combination metal working and auto shop, a wood shop, and a dry goods storage room.

The metal shop has access into the garage through large double doors. It has a ceiling-mounted hoist on a rail for engine removal, etc. Parts and small supplies for both shops are stored in the joint storage cabinets between them. The laundry facilities are brought inside to the kitchen area and hidden behind louvered doors. Wives will surely think this house is heavy on the shop facilities and short on laundry/utility room. This is true. To balance things out, we could easily extend the garage more to the front (like the solarium entrance) and put in a medium sized laundry-mudroom entrance in the garage area just as it enters into the kitchen. With so many shops, having such a clean-up facility might well be mandatory. Another option would be to enclose the outdoor canning kitchen area and keep the laundry equipment out in this area. The total square footage added, is 1000 square feet in the basement and 800 square feet in shops on the main level.


2 NEW HOME FACADE
REMODEL LAYOUT & BASEMENT
SUN LOUVERS
SOLAR GREENHOUSE
SOLARIUM ENTRY
PREVAILING WINDS
WIND FENCE


40'
32'
EMERGENCY LIVING AND BEDROOM
EMERGENCY LIVING AND BEDROOM
BASEMENT
STORAGE ROOM
UP
EMERGENCY LIVING QUARTERS
FREEZER
BATH
BURIED FUEL TANKS
GENERATOR ROOM

Home #3: Three bedroom home with basement and fireplace

(See illustration)

This home has an initial advantage over the other previous homes with its additional 1,050 square feet of floor space in the basement. This gives it 2,100 square feet to start with. It should be obvious by this example that homes with existing basements provide nearly all of the space requirements to make a minimal secure/preparedness residence. This particular plan has some storage space (a small closet in the main hall) and about ten feet of storage cabinets in the garage. Otherwise it is a fairly standard, three bedroom, two bath home. The dining room is nicely situated to serve as both an informal nook and a formal dining room. The fireplace is conveniently located and serves as a wall as well. The split-level terrain makes the basement accessible to full daylight on the southwest side.

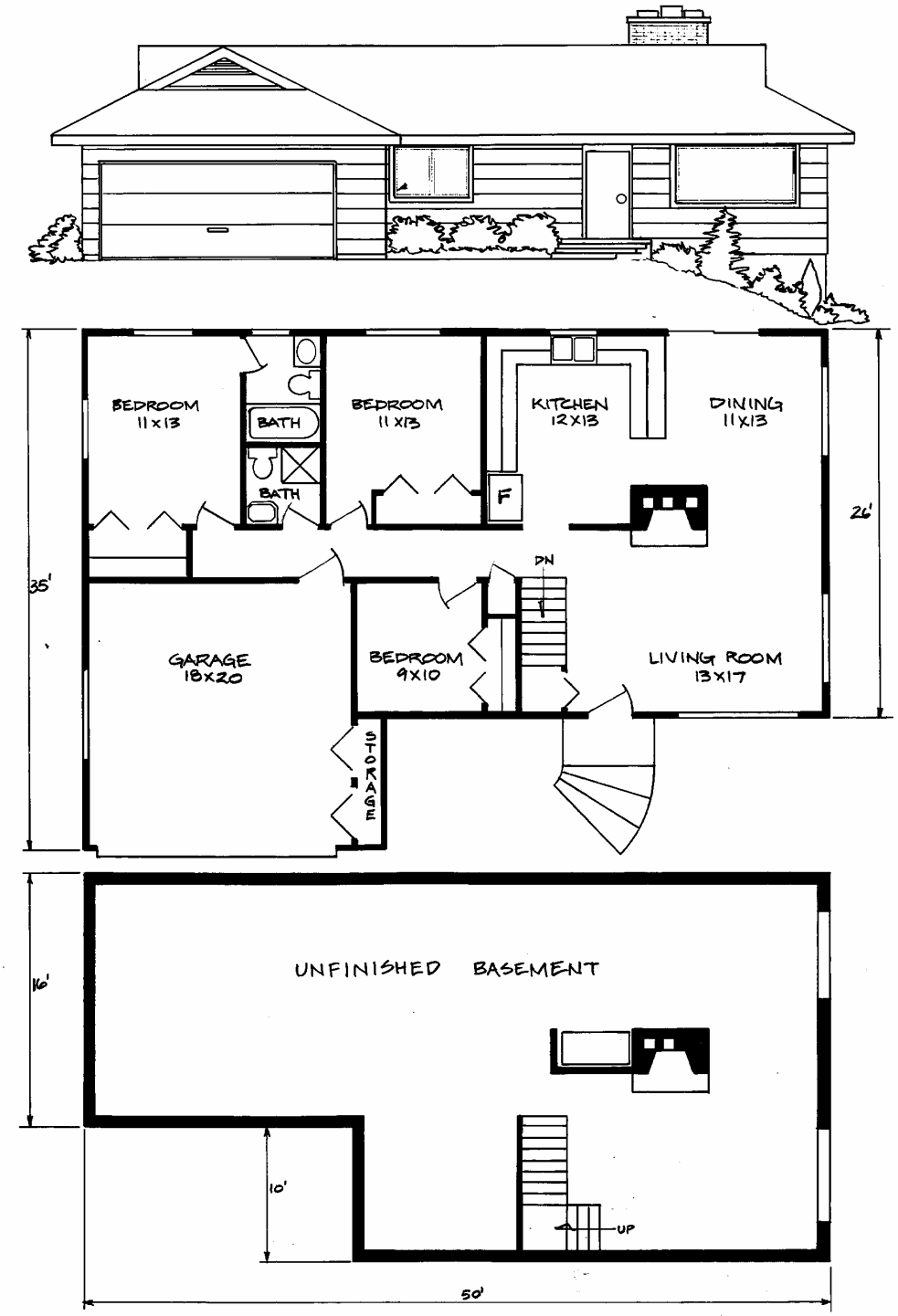
The Remodeling

Main floor changes are limited to the addition of a deck,/balcony, and an air-lock entry for the main door. Virtually no roof changes are necessary, which makes for a very inexpensive remodeling. The deck and balconies are of waterproof construction to provide a covering for the private cellar under the deck and the greenhouse under the balcony. This is achieved by using the new latex or butyl rubber membrane type of waterproofing over a flat wood deck/floor construction. Redwood 1x4 lumber is laid down, without nailing, over redwood 2x2's on 12" centers, running perpendicular to the decking. This keeps water from pooling around the decking and increases usable life substantially.

Efficient use is made of the vacant space next to the brick fireplace by adding a wood cook range, and tying the flue pipe into the existing fireplace. Additionally, a heat venting, slip-in fireplace unit or wood stove insert is specified for the conventional (and inefficient) masonry fireplace. An air-lock security entrance is provided for the front door area. The outer door is a reinforced metal door in a metal jamb to inhibit forced entry. The rear sliding glass door entry into the dining area is remodeled to accept a rolling security shutter (see the Security chapter for details). All other windows have acrylic storm windows install on the exterior side, to prevent forced entry.

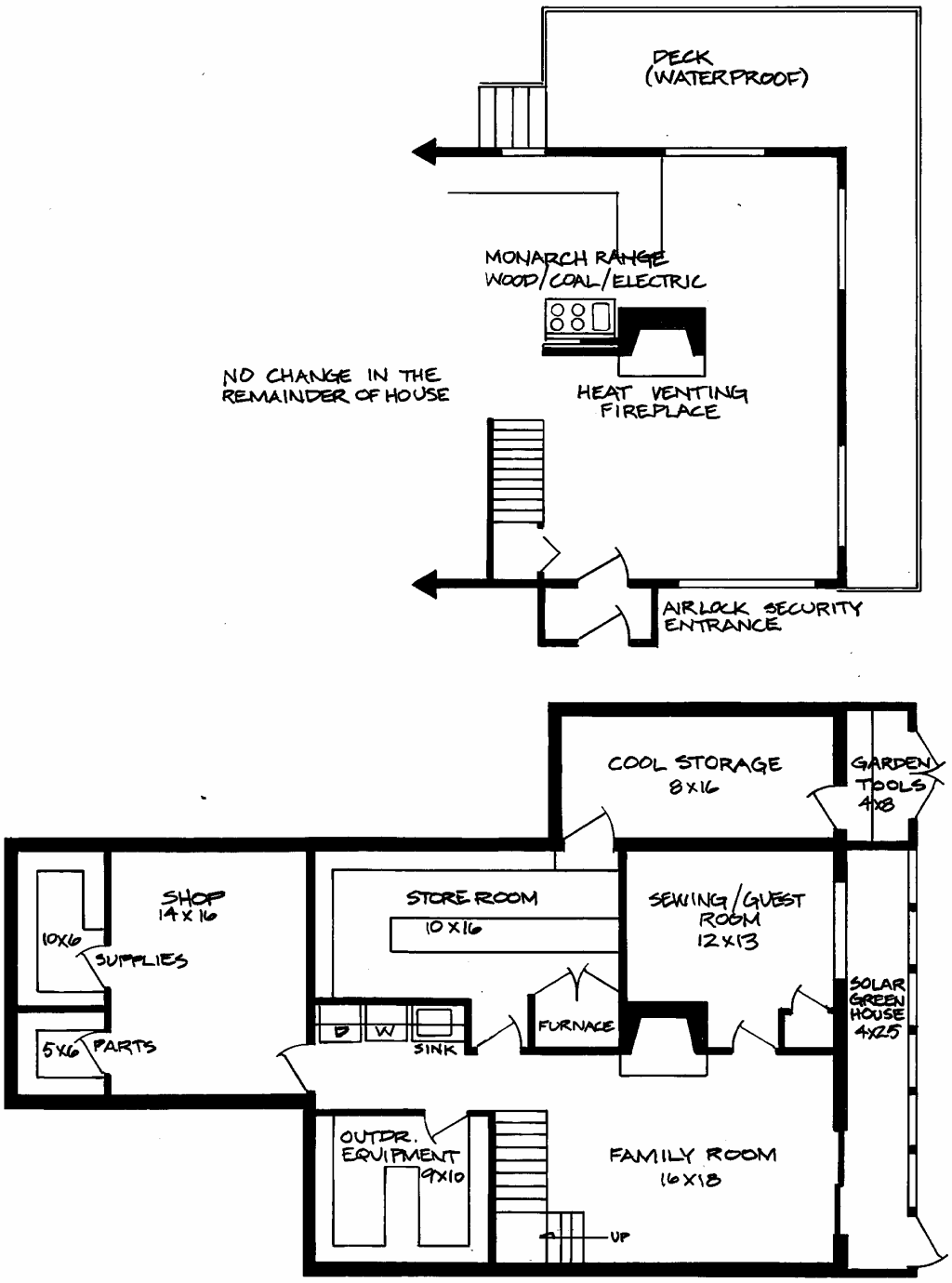
The unfinished basement is fitted with a shop, a couple of storerooms, plus a family room and guest room.. There is room for a small generator system and/or solar panels and battery banks within the solar greenhouse area. Excavation is necessary on the back side of the basement for the cellar/fallout shelter under the new deck. Access to the new basement shelter is through concealed cabinets in the store room. Additionally, the furnace is sealed with insulated doors to keep the storeroom cool and provided with an outside air vent so that combustion air is not taken from the heated household air. The lower solarium is glazed with Lexan Twinwall glazing due to its insulation properties as well as its security against forced entry and breakage. This entire solarium provides an additional layer of security for the daylight basement portion of the addition. Total square footage added to the basement area is only 250 sq. ft.

3 3-BEDROOM FLOOR PLAN WITH BASEMENT



3 REMODEL LAYOUT:

MAIN FLOOR
BASEMENT



Home #4: Two story, four bedroom home with basement potential

(See illustration)

This home has 2,200 square feet and will house a medium-sized family adequately. The second level bedroom areas are quite efficient in design and will require no changes. The main floor has an oversized living room but lacks a family room, which would be very advantageous for a large family. Fortunately, there is a den or guest room off the entry which provides some separation from the noise of a large household. As discussed previously, this principle of separation for privacy is particularly necessary in times of crisis when emergency accommodation of friends or relatives is sometimes necessary.

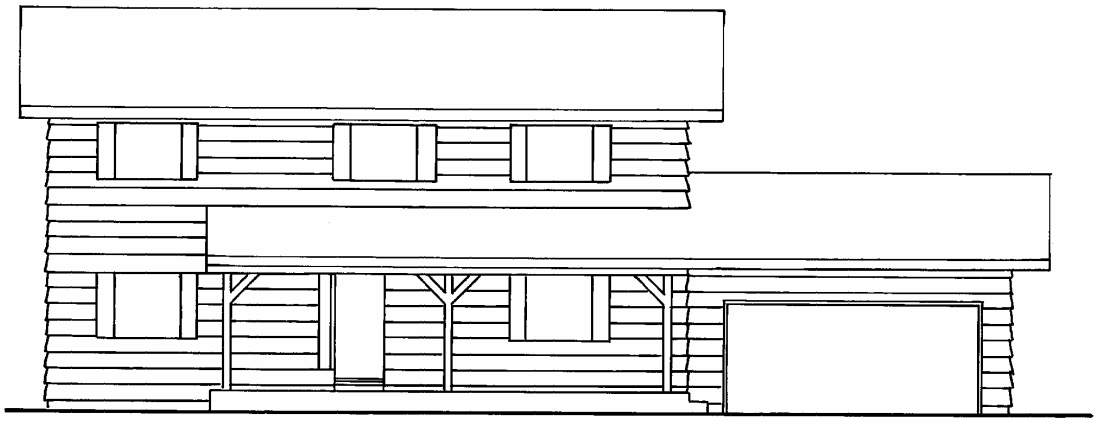
The Remodeling

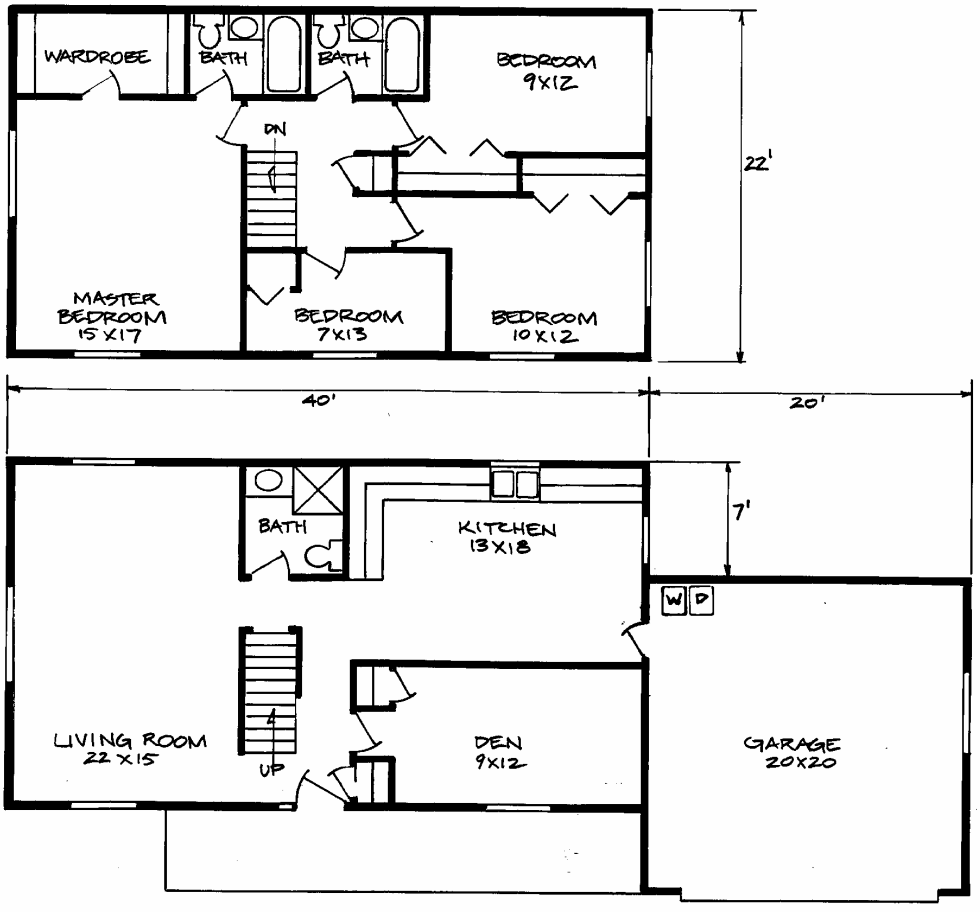
Since the rear of the home is oriented toward the sun, a rear addition is designed for the accommodation of a greenhouse, solar porch, and solar panels – mounted on the roof extension. Again, I have added a basement under the new addition for high security storage and a complete concrete fallout shelter system. In any addition, the problems of roof blending are simplified if we continue the existing slope of the present roof downward over the new addition. This provides a walk-in storage attic on top of the addition, which is accessible from the upstairs master bedroom closet. The upper floor is not depicted in the remodeling layout since no other changes were made.

A 4 ft. portion of the kitchen counter is removed to make way for a walkway to allow access to the new family room, which should be a welcome addition. A heat venting fireplace system is added at the corner of the old house consisting of a family room fireplace, a forge for the shop, a wood stove for the kitchen, and a flue for the shelter in the basement. The main storage room is placed in the basement and is unheated for better food preservation. A unique indoor archery or pistol range has been provided, with a concealed entry through the storage room, and is completely soundproof. Access to the under-garage generator room is from the shelter room. The same system of generator air and exhaust venting is provided through the garage shop wall as in previous homes.

The new main level addition includes a 25-foot greenhouse and a solar porch, which doubles as an air lock entry. The new entryway includes two separate storage rooms to make better use of its excessive length. Bench seats have been installed to facilitate putting on boots or taking off shoes. A large sewing room is provided with ample storage space for both sewing supplies and clothing. The family room can also serve as a dining area if the mother desires more room around the new cooking island. The original cooking area has been altered to include a small, narrow wood burning cook stove next to the fireplace flue and an island to provide space for a conventional stovetop. A desk/administration center has also been added in the kitchen area near the entry hall for convenience. The old kitchen eating area has been replaced by a built-in side table next to the administration center. This serves as a small eating nook for breakfast and lunch. A portion of the previous living room is converted to a small guest room, and to provide a main floor bedroom for the parents when they become too elderly to climb stairs. This is optional, of course. Others may wish to retain the large living area.

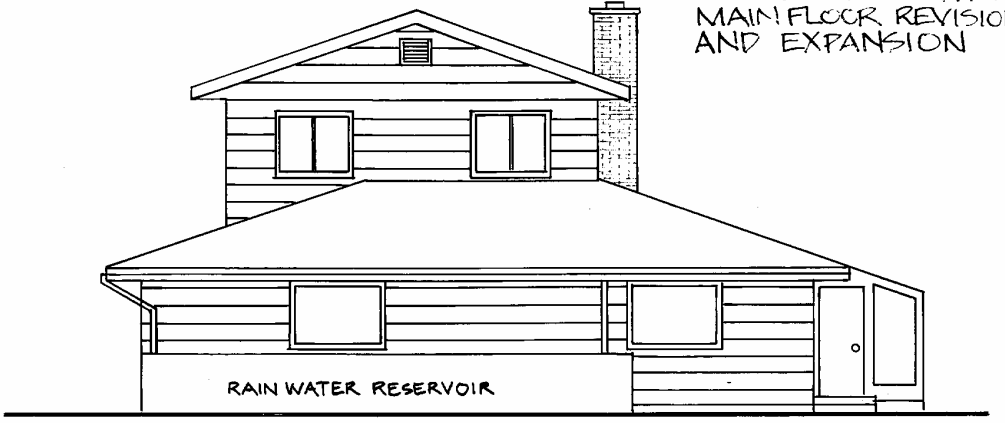
4 4-BEDROOM 2-STORY HOUSE WITHOUT BASEMENT

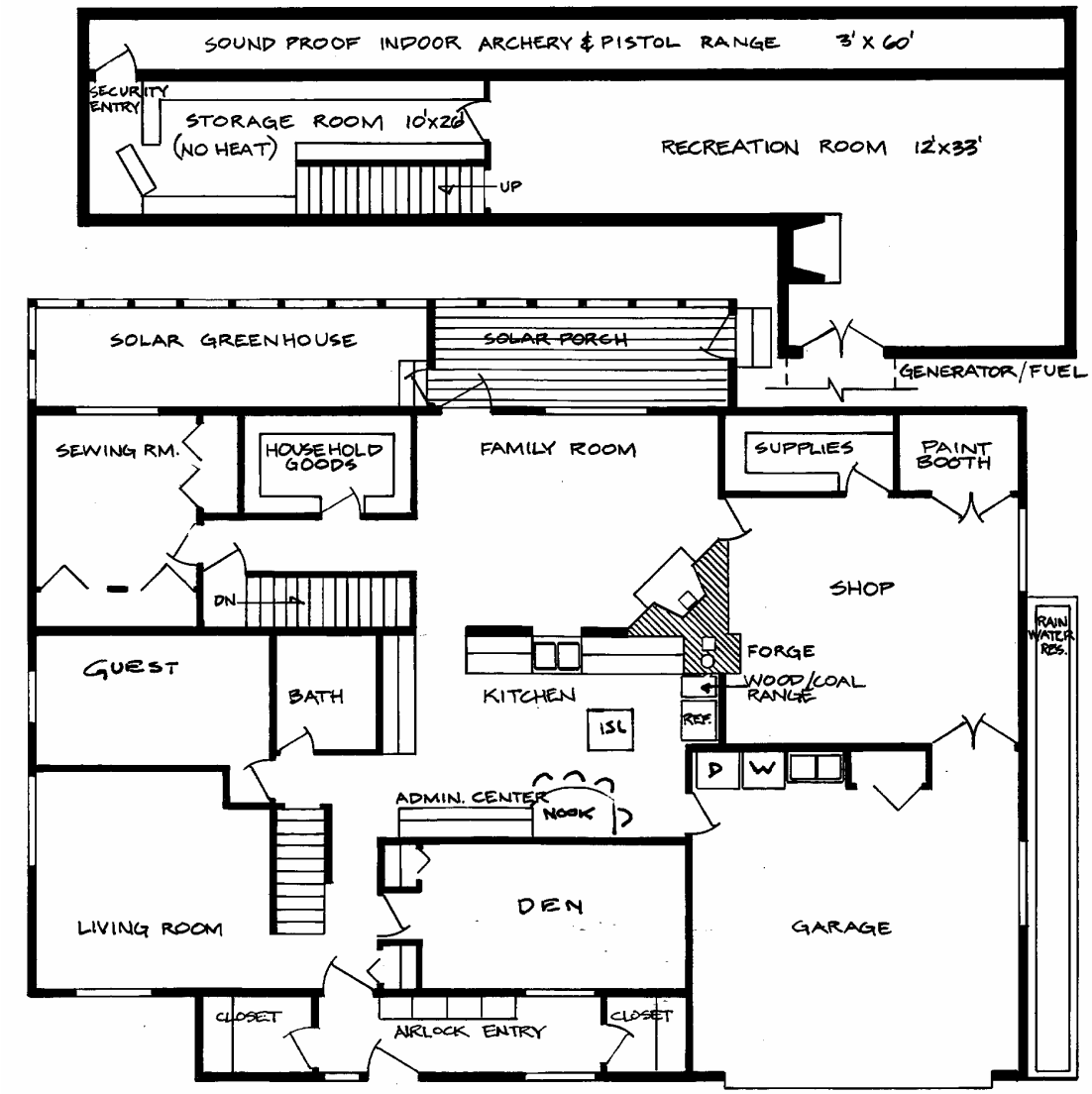




4 REMODEL LAYOUT:

NEW REAR ADDITION
BASEMENT ADDITION
MAIN FLOOR REVISION
AND EXPANSION





The shop is of very ample size and has high daylight windows on the south side over the storage/paint area. Two double doors give the shop access to additional space in the garage if needed. A laundry area has been added to the back wall of the garage to include storage facilities and stationary tubs, plus a manual clothes wringer. Finally, a rain water storage system is depicted, utilizing the narrow side yard with a 3"x 30" concrete reservoir that collects and filters rain water from all roof surfaces.

This home makes maximum use of solar collection power: Passive solar windows in the greenhouse for adding heat to the home, domestic solar hot water collectors over the greenhouse, a solar porch, and photovoltaic solar panels for battery charging. The new square footage stands at 4,000 square feet which is very ample for a medium family. Additionally, less pressure and friction will exist in the home due to greater flexibility and functionality of the living and recreation areas.

Summary

Even though the homes used here are outdated, they are representative of what many middle class people still live in today. Being over 25 years old many owners are in a position to own these homes debt free, which often makes them worth keeping. Although your house may differ significantly from these, hopefully these examples give you some idea of how to proceed. The technical aspects of implementing all of the security, self-sufficiency, and multi-fuel capabilities will be explained in greater detail in the "Recommended Equipment and Sources" section. Many of the equipment and installation guidelines for new construction shown in the sections that follow will also be applicable to this remodeling section. At this point, I will describe some of the basic construction techniques involved in remodeling.

CONSTRUCTION DETAILS FOR REMODELING

The descriptions and illustrations that follow are meant to give you some general ideas about how to connect new addition framing to the existing house structure. They not meant to be constitute a course in carpentry or house building. Each type of connection described here is labeled "A" through "K". The location of each detail is depicted on the first illustration showing a typical small home. I will describe each of these details separately as follows:

A. **Adding onto the end of a house, forming a longer side wall**. There are two factors involved in this connection: (1) the structural framing, and (2) blending the exterior siding. First the siding has to be removed back far enough to expose the sheathing (which covers the framing). To the old corner of the house, we have to add another 2x4 member directly up against and flush with the old corner. This 2x4 should be glued and nailed to the old corner to ensure a firm connection. Use of lag bolts instead of nails will give a more positive connection. The glue ensures that no air or insects can penetrate the new joint. Assuming the new foundation is poured and is of the same size and height as the old foundation, you would install a new, treated sill plate and the floor structure. Then, frame the new wall section for connection to the 2x4 just added. Why not simply frame a double 2x4 on the end of the new framing and attach it to the old corner? You

could, but your fasteners would have to be 5 inches long, which are hard to find and install. I prefer a tightly attached, single 2x4 as the prime connection to the old wall (since a plywood sheathing joint is going to occur at this juncture), and then nailing the new framed wall end to this existing 2x4. The new sheathing covering the newly framed wall will now project past the new framing by the width of a 2x4 to allow the sheathing to overlap this new connection and be secured to the prime 2x4 attachment. The siding is removed going back to the closest original break or joint – leaving a staggered look on the old siding. When applying new siding, start from each of these staggered old joints and proceed from the old section to the new section until the new section is complete. If, instead, you were to have simply cut back the siding in a clean vertical line, the new and old sections of the home would look obvious and unsightly. This same technique is applicable to brick. Remove brick in a staggered fashion, so the new and old blend together. Matching brick is very difficult since brick is made from natural clays and no single batch is exactly the same as another.

B. **Joining the new footing and foundation** to the old. The key element shown here is the drilling of steel dowels into the old foundation so there is a positive connection between new and old. For #4 R-bar dowels (should be at least 12" long), drill several 1/2 inch diameter holes into the old concrete using an electric hammer drill with a concrete percussion bit. Blow out the dust, dip the steel R-bar dowel into a wet, pasty solution of cement, and drive it into the hole. The hole should be about 6 or 7 inches deep. These dowels will keep the new concrete from shifting up or down relative to the old.

C. **Adding a new door to a wall**. If you can, pick one of the existing framing studs to serve as the starting point for one side of the door. Next to this stud (on the side where the door is going to go), add what we call a "cripple." This is a short 2x4 cut down to 82" which will support one side of the header (that big support board over the top of the door). Headers keep the framing above the door from sagging, which otherwise would cause the door to bind. Next, you have to remove at least one or two studs (depending on the door width) to make way for the new opening. To remove the studs without cutting them, just pound sideways on the stud at the bottom and the nails will give way. When the bottom is free, pull the stud out and remove it from its top nails by pulling downward. Picking the place to install the framing for the other side of the door takes a little calculation. If you are putting in a standard 36-inch wide door, you will add two inches to this and make a *rough opening* (the name of the opening between the left and right 2x4 of the door framing) of 38 inches. That is where the inside of the other cripple stud will go. The next full-sized stud is nailed to the cripple and installed between top and bottom plates. Use a toe-in nailing technique since you won't be able to nail from the bottom or the top plates. The header that goes over the top of the two 82" cripples will be 3 inches longer than the rough opening. Make your headers out of two 2x10 pieces of lumber with a 1/2-inch plywood spacer nailed between them. Redo sheathing and siding as before, using natural-looking staggered joints.

TYPES OF HOUSE MODIFICATION
WALL OPENING DETAILS
WINDOW REDUCTION MODIFICATION
DOOR ADDITION
CONTINUATION OF WALL
EXISTING WALL
EXISTING SILL
DOUBLE TRIMMER
SHIMS
DOUBLE TOP PLATE
DOUBLE PLATE NAILED INTO EXISTING WALL
SIDING
10" LAG BOLTS
PLASTIC MOISTURE BARRIER
GRAVEL
OLD WALL
NEW WALL
WATER PROOF JOINT

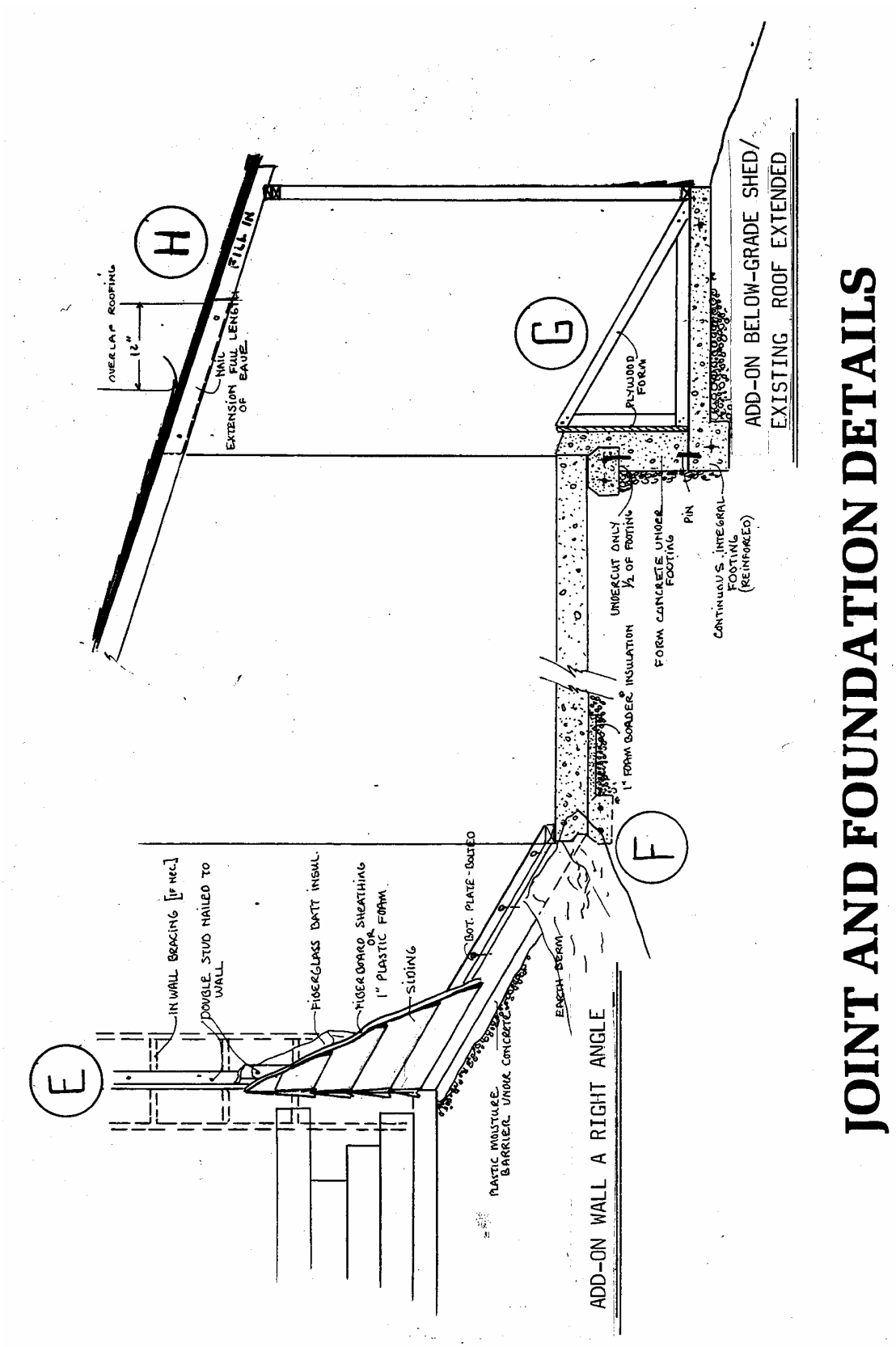
D. **Reducing the size of a window.** This is simple to do – just add framing to match the rough-in opening specified by the window manufacture. Typical rough-in openings give you anywhere from 1/8 to 14 inches between the outside of the window or door and the 2x4 framing. This is important since no framing is ever exactly square or plumb and thus your window or door will still fit, given this rough-in opening leeway. If you are making a hole for a new window, you would follow the same general procedures for the door – using cripples to support a header over the window – but use the rough-in dimensions provided by the window suppliers.

E. **Adding a wall at right angles to an existing wall**. The basic problem is that the old wall is a framed wall, and where you want to connect may not have any 2x4 framing backing the area you need to attach to. Thus, you must take back the siding as before (staggering with the natural joints), open up the sheathing, and add cross bracing of short 2x4's between the existing studs. You could also add vertical studs if you prefer. When using vertical studs, you must make sure that the total nail surface to attach to is 6-1/2 inches wide (for a 2x4 add-on wall). It is not enough to have a matching 2x4 to nail your new wall to. You must have an additional 2x4 for each side in order to have backing for the corners to nail to.

F. **Slab on grade foundation** for a room addition, with foam insulation under the slab. In areas where the ground freezes in the winter, the perimeter foundation must be deeper than the potential frost line. Otherwise, if the ground freezes under your footings, it will swell or expand and cause your foundation to rise and fall with the seasons. This can lead to abnormal cracking of the wall surfaces. This can also happen in areas of the country with deep clay soils. The soil expands and swells when moisture content gets very high. In these clay soils, use a plastic moisture barrier as shown here in detail "E" so as to drain the moisture away from the house and footing area.

G. **Undercutting an existing footing** for a stepped-down shed-roofed addition. The footing in F is undercut about half-way and the new, lower footing and slab is poured. Then an L-shaped concrete wall form is built (one side only) so that the new vertical wall will support the underside of the old footing. Make sure you have R-bar dowels coming up from the bottom slab so that the retaining vertical will not shift outward. It is also beneficial to drill a few short dowel holes into the upper footing you are supporting so that the new wall stays in place at the top as well.

H. **Extending the rafter tails** to make the roof extend out over the shed. Nail new full length rafters along the side, and then add a fill-in piece below so there is no jog in the rafter appearance.

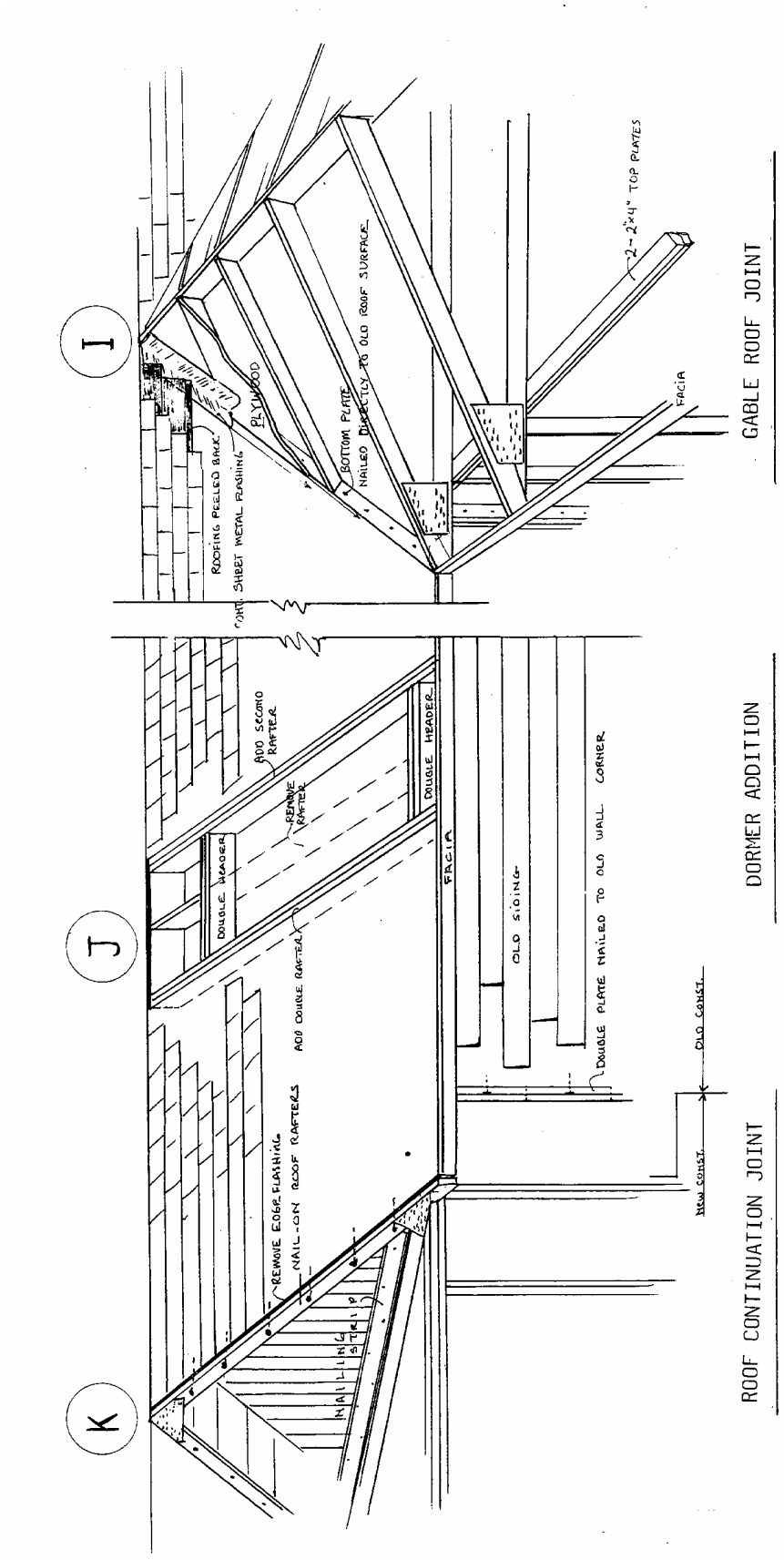


JOINT AND FOUNDATION DETAILS

I. **Adding a gable roof** and connect it to an existing roof. Tear the roofing back till you expose the entire gable connection area – using staggered joints, as with siding removal. Remove the tar paper, and then lay out the gable. To find the bottom point of intersection, mark where new gable eaves intersect with old eaves at the rain gutter area. Find the top by sighting down the peak of the new trusses till you find the point on the old roof where the two roofs will join. Now nail a 2x4 directly to the old roof sheathing as illustrated. You will then have to make special angled cuts (called compound miter cuts) on the rafter bottoms as you build the support structure between the trusses and the old roof. Compound cuts are not difficult once you know how to lay them out. Have an experienced carpenter show you.

J. **Cutting a gable opening in the roof for a window or skylight**. Notice that at least one rafter is removed and replaced by a header at top and bottom. For this header to carry the weight of the roof or gable, you must double up the rafter on either side of the opening, as shown.

K. **Extending the roof** when lengthening the house. It is a simple procedure of adding a second nailer board onto the old facia. Don't forget to use construction adhesive here in order to make sure the joint is tight. Do not set the new 2x4 nailer flush with the old roof sheathing. Set it low enough so that the top of the new sheathing will be flush with the old. If you add a roof that is lower or higher than the old roof, do so with at least 12" of clearance so that you can get in under the overlapping roofs and apply the flashing and roofing. Otherwise, if you have no room to hammer, you will be out of luck. The only way to handle such a small difference in the two roof planes is to cut back the overhang of the original roof to a measly 2 or 3 inches. In this way, all nailing is accessed from the side.



ROOF EXTENSIONS AND GABLES

Chapter

7

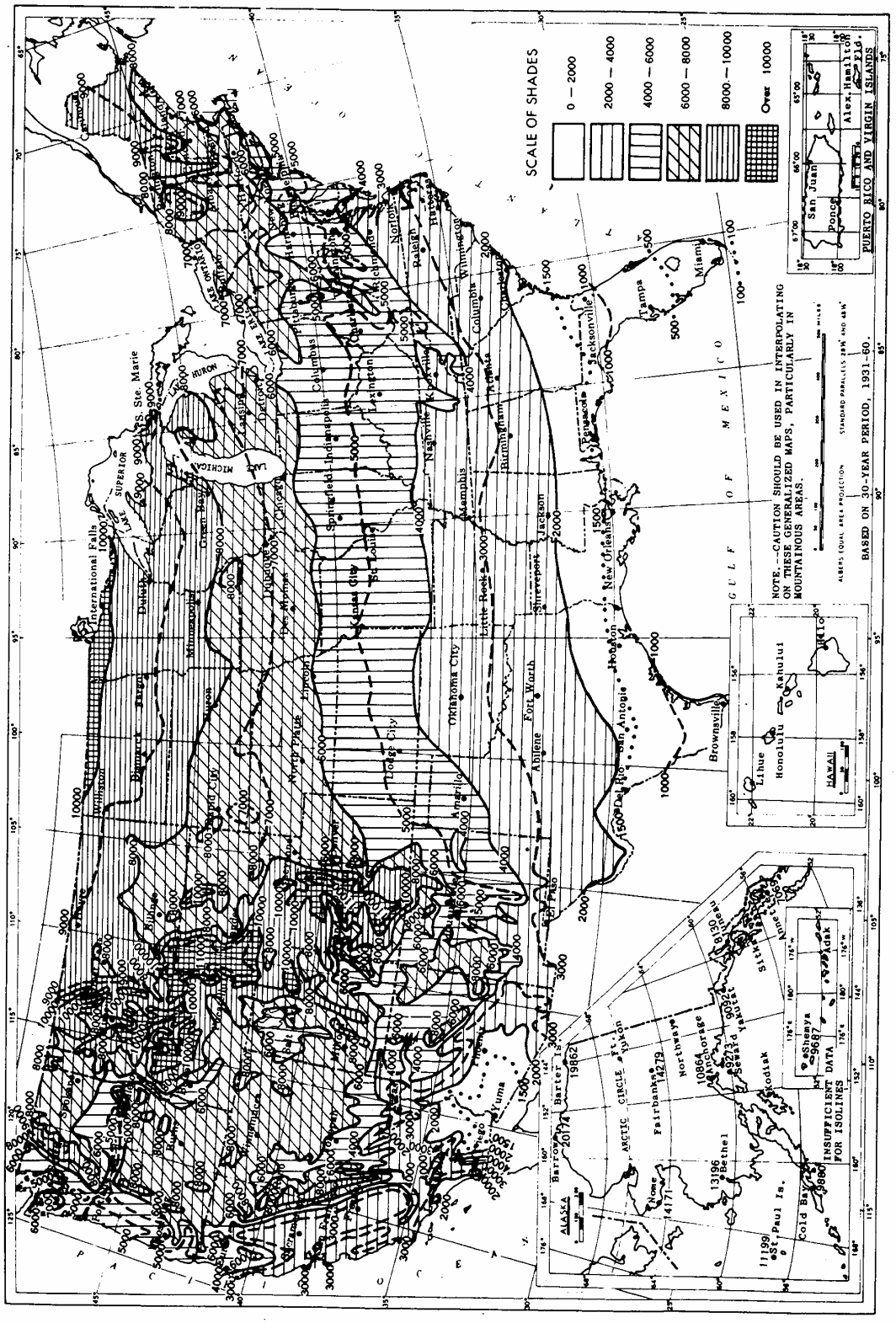
Environmental Control for Various Climate Types

The specific design data presented here will be restricted to the types of construction and materials I recommend for high security or self-sufficient homes. I will be emphasizing the problems of severe heat and cold, as this is the greatest challenge for the designer. In climates where temperature differentials between the home interior and exterior environments exceed 70°F, the types of construction and materials are very critical due to the extreme heat losses involved. Milder climates allow for considerable more leeway in design since the temperature differentials are usually within 20°-30°F. Even in very hot climates, the temperature differential rarely exceeds 35°F.

GENERAL CRITERIA

Generally, if your area requires heating for eight or nine months out of the year, then your home should be cold-climate designed. Areas that have extremely hot weather (95-125 degrees) the majority of the time usually have no winter cold weather at all, and should be hot-climate designed. Ironically, most of the homes in the sun belt of southern portions of California, Arizona, New Mexico, and parts of Texas and Florida use standard American mild-climate construction techniques – fitted with large capacity air-conditioners to make up the difference.

To accurately answer questions pertaining to specific areas, one needs to become familiar with *degree-day* terminology. A degree-day is a 24-hour period where the temperature has remained an average of one degree below 65 degrees. If the temperature were a constant zero degrees (F) for 24 hours, you would accrue 65 degree-days in that one 24-hour period. The calculations become quite complicated since temperatures vary considerably during a day, but charts are now available for the entire country showing the



DEGREE/DAY CHART

total number of degree-days of heating needed for each geographical area. (See illustration.)

If you live in an area where the total number of degree-days of heating is less than 2000, I recommend a strictly **hot climate** designed home. Areas with 2000 to 4000 degree-day requirements are generally hot areas with short, cool or cold winters. These require a **modified hot-climate** home. For those areas of 4000 to 6000 degree-days, that generally experience both equally hot summers and cold winters, I recommend an **all-around climate** home. Areas of 6000 or more degree-days of heating have short, hot summers with long, cold winters. These areas require a strictly **cold climate** home. Each of these types will be covered in this chapter on environmental control.

The fundamental basis for environmental control, as pertaining to people, is to alter our specific environment to stay within the limited range of human survivability. With the application of more expertise and funds, we can narrow this range to the limits of human *comfort*, which is naturally more difficult than designing only for survivability. The actual range of temperature and humidity necessary to provide people with an *indefinite* level of comfort is very narrow: somewhere between 70° and 83°F and 20 to 70% humidity, with minimal air velocity. This temperature range may seem odd, since the body's normal internal temperature is between 98° and 99°F, but it becomes more reasonable with an understanding of the body's thermal control mechanisms. I may give you more detail here than you want, but I have found this information to be an important addition to your survival knowledge base.

THE BODY'S TEMPERATURE CONTROL MECHANISMS

A 15 or 16 degree temperature differential between the body's internal core areas and the outside skin is normal due to heat being lost to the atmosphere. The body must match this rate of thermal loss with its rate of heat production. All metabolic functions of the body normally produce energy in a ratio of twenty percent to muscle energy, cell repair, tissue building, etc., and eighty percent for heat production. If the temperature difference between body core and skin increases, the hypothalamus sends various signals to parts of the body to increase heat production. One of the more obvious reactions to cooling down is the dimpling of the skin ("goose bumps"). This reaction requires considerable energy expenditures which give off heat. If the internal temperature continues to drop, shivering begins. This rapid movement of muscle fibers generates a large amount of heat. Nutrients are now rapidly being consumed by the body and utilized almost exclusively for heat generation. In the metabolism of heat, large amounts of water are produced and eliminated through waste channels which furthers heat loss unless the water it is replenished by hot liquids.

The addition of clothes, as with any type of insulation, only slows the escape of heat. If heat can now be generated faster than it is lost, warming will occur. Eating replenishes the fuel supply, but further lowers the body temperature, if the food consumed is unheated, and also by rerouting much of the blood supply from extremities to the intestinal organs to carry on digestion. Shivering often accompanies eating in a cool environment for these reasons. Although eating provides additional energy to be burned,

it is only effective as long as the body systems can cope with the increase in fatigue. Eventually, the body must have both warmth and rest. Thus we see that with all of its contingency mechanisms, the human body must have suitable shelter which can actually control the environment immediately around it so as to restore the body's critical heat difference between core and skin. When this difference normalizes, we experience what we refer to as comfort.

The concept of comfort is partially psychologically conditioned, however. Within a certain temperature range, the body can adapt to lower or higher comfort ranges, though not simultaneously. That is, the body can somewhat increase its metabolic rate so as to generate a higher percentage of heat, or decrease it so as to generate less heat. These changes, as well as blood composition changes, occur slowly over a few weeks and thus cannot adapt to rapid temperature changes each day. This is one reason why temperature differences between air-conditioned buildings and the outdoors must be kept to a minimum so as not to inhibit the body's natural adaptation. In overcompensating for extreme temperature differences, disease resistance is lowered, in combination with other factors, which increases susceptibility to viral illnesses.

The cooling of the body primarily accomplished by evaporation of water secreted from skin pores, and is therefore highly affected by the level of humidity. Humidity is stated as a percentage of the water saturation capacity of air. Thus, ninety percent humidity means that the air mass already has in suspension ninety percent of its total water-carrying capacity at a given temperature. The actual quantity of water per given air mass depends upon its temperature – hot air holds more water vapor than cold air. Due to the relative effectiveness of the evaporative cooling process, a person can be more comfortable at 90 degrees and forty percent humidity than at 80 degrees and ninety-five percent humidity. It is further interesting to note that at forty percent humidity (fairly low) the percentage of the body's cooling process that occurs by evaporation, as opposed to convection and radiation, changes drastically with temperature:

- At 60° only 10% of cooling comes from evaporation; 90% from convection and radiation.
- At 83° it is about half-and-half.
- At 100°, 98% of cooling is accomplished by evaporation (assuming there is no wind).

In contrast, as the relative humidity increases, the ratio also increases until saturation occurs. At that point, air velocity must now be increased or overheating will begin. In severe cases (heat stroke) dehydration occurs, water secretion stops, and the body is left with only radiation and convection, as a means of cooling. These are so inefficient at temperatures in excess of 100 degrees that death will occur rapidly.

The velocity of the air mass has a considerable effect upon human comfort and the body's ability to control its temperature. Air in motion is the most effective way to offset the stifling effects of high humidity in warm air, but air movement is a disadvantage in cold weather regardless of the humidity. If the air is dry, severe chapping of the skin can occur with wind. If the air is extremely humid, clothing loses much of its insulative value as water vapor conducts heat away from the body more rapidly than dry air.

THE ROLE OF SHELTER AS AN ENVIRONMENTAL SHIELD

All of these air environmental conditions must be effectively controlled by the home. It is not enough to have the ability to restrict or retain certain air conditions. Due to seasonal changes, the home must be able to also reverse these control functions as the situation may dictate.

In addition to the air environment, the home must be able to control other miscellaneous elements of our environment and society as well. Windows must be able to let in light of sufficient quantity to see without artificial illumination, and yet control the angle of incidence of light so as not to be glaring. Window coverings are important, as we prefer to see out more often than we prefer the ability of others to see in. Doors must be functional and numerous enough to allow easy entrance and exit, and yet be secure enough to restrict intrusion. Other control equipment allows for the intake and exhaust of gases involved in burning fuel for heating and other necessary functions. The actual exchange of the internal air must be allowed for as well, to avoid stagnation and odor accumulation.

THE MECHANISMS OF HEAT EXCHANGE

As we proceed to design a home around the person, so as to buffer the external environment, we encounter a few different heat-exchange processes which require a brief explanation. To a certain extent, a house acts like a coat in cold temperatures, with one essential difference. Since the house does not always contact the skin, it insulates the *air mass* within the house rather than the person directly, and it is the air which affects the heat loss from the body. Thus, we have three types of heat exchanges to consider:

1. Body to house (if in direct contact or close enough to feel IR radiation)
2. Body to air (air currents and radiation)
3. Air to house, and house to air (air currents)

These three exchanges are directly tied to *conduction, convection,* and *radiation*.

Conduction

Heat is exchanged by direct physical contact between substances. When walking barefooted on a cold basement floor, you are losing heat by conduction. Some substances are better heat conductors than others. This is generally related to density. The more dense the material, the faster heat will be conducted from its warm surface when contacted by something cold. However, there is a trade-off, generally, between the various densities of building materials. We need high density for strength (foundation and framing) and low density for insulation. Since the floor is the primary source of conduction heat loss in a house, carpet is usually preferable to wood, wood is preferable to concrete, and concrete to steel (in a cold climate). If you live in a hot climate, you may desire just the opposite effect. Additionally, the presence of water in a porous insulator will nearly destroy most of its insulative qualities, due to increased conduction.

Convection

Convection actually begins with the conduction of heat from a solid to a fluid (air in this case). The air is in direct contact with a cold window, for example. The air closest to the window loses its heat, becomes more dense, and starts moving downward. This draws new air in contact with the cold surface which is also cooled. Thus, the movement has permitted more conduction to occur at a faster pace. This explains why a long rectangular window will lose more heat if installed vertically than if placed horizontally. This movement of air toward conductive heat losses is called *convection*. So far, we have only covered the air movement due to gravitational forces. If the air has another source of movement, for example, a fan or external air pressure gradient, the rate of conduction will increase as more air molecules come into contact with the solid surface. This is called *forced convection*.

Humidity plays an important role in convection as the water particles are convected with the air and serve as a more effective transfer medium than the air itself. Water vapor draws heat from the body faster and loses it faster to a colder surface. Thus, the level of humidity in the home must not become too high. Convection losses are most pronounced around windows since they are nearly impossible to heat to room temperature. Draping alone will not reduce convective losses significantly unless the entire window area is boxed in and sealed – top, bottom, and sides. On a cold day, you can feel the heavy, convection air currents if you hold your hand beneath the drapes. Air enters at the top, cools as it passes next to the window and floods the floor area with cold air. Sliding glass doors are notorious for this convective heat loss, and are not recommended in severe cold climates without special insulating drapes. Nor do I recommend floor to ceiling glass windows.

Radiant Heat Loss

All objects radiate some electromagnetic energy. We are concerned here with relatively low-heated objects emitting long infrared (IR) waves. Conduction and convection cannot occur in a vacuum, but radiant heat loss can, through the emission of electromagnetic energy. For this reason, it is essential to design high enough insulation values into walls and ceilings to permit them to come up to air temperature. If they do not or cannot, you will lose substantial body heat just standing near a wall, as the body radiates heat to these colder surfaces. This effect is an advantage only in hot climates. It is a major liability in a cold climate if you have “thermal mass” concrete inner walls directly connected to the foundation. These cold, massive walls act as a constant heat sink and will never warm up fully. Having a small, thin layer of insulation on the inside will help overcome the problem.

Traditional insulation alone is not enough to stop radiant heat loss. One of the most effective anti-radiant treatments is aluminum foil backed insulation, which reflects the infrared waves inward or outward depending on its placement. This measure allows you to heat the wall and ceiling surfaces to room temperature without rapid dissipation of this heat to the insulated cavities behind. Windows are nearly impossible to heat up to room temperatures even with double-paned glazing. An insulated curtain shutter with infrared blocking foil is necessary to further avoid radiant losses in windows.

It is essential to understand which of these heat loss types accounts for the majority of heat loss in a home. As most people wear shoes or slippers inside during the winter, and sit on soft upholstered furniture, there is little contact with the surfaces of the house directly, and hence very little heat lost through direct conduction. Radiant heat losses are no more than moderate, due to the warm temperatures of the home interior surfaces in winter (Radiant heat transfer is a significant factor in hot climates as sun-baked walls begin to radiate large amounts of heat inward-even long after the sun has set).

The largest contributor by far is convection—both passive and forced. One of the reasons for insulating air cavities in the walls and attic is to *immobilize* the air to prohibit convective air currents. Most heating and cooling engineers make the mistake of specifying forced-air systems with excessive air handling capacities. This rush of air to the sides of the room, and especially against windows, causes a rapid heat exchange through forced convection against these cool surfaces. One of the worst, yet common habits, is to place radiators and vent openings directly below a window so as to reduce the effect of the heat loss in this area. This is effective at reducing the *symptom* of the draft under windows, but great amounts of heat energy are thus lost by forcing the hot air from the vents to rise against the window where it is immediately cooled (by trying to warm an unwarmable surface – the window). It is true that air velocity has to be high at the furnace heat exchanger for maximum efficiency, but this high velocity and pressure should be slowed to a minimum before it enters the rooms. This can be done by using larger ductwork and registers and/or by increasing the number of vent openings. If you hear a lot of rushing air noises when your furnace comes on, you have a poorly designed system.

Houses should be shielded by trees and high fences on wind-prone sides to avoid forced convection from the outside, which increases the temperature gradient between inside and out. Convective flows within homes can be minimized by providing self-closing doors at each stairwell to avoid heat rushing upstairs. Most attic vents should be taped and sealed during winters to stabilize trapped air as much as possible, as long as a total interior moisture barrier is installed to avoid moisture condensing in a cold attic. If you have a top ridge vent, it is usually sufficient to close this, leaving the lower soffit vents open during the winter. Convective air flows play an opposite and beneficial role during summer heat spells. The coolest roof designs allow for rapid upflow of air to convect upward under the eaves and out full vents in the apex of the roof. The minuscule vents installed in the standard house today would hardly suffice without a massive air blower installed. It is no wonder that attic temperatures exceed 150 degrees F. This heat source continues to convect and radiate heat downward into the house well into the night. (This delayed effect is often referred to as “heat lag.”)

Air Infiltration

There is one additional form of high heat loss which does not fall into any of the foregoing categories, simply because it is an outright loss – not an exchange. Due to poor construction and poor seals on windows and doors, as well as the occasional opening of doors, nearly 14,000 BTUs of heat are lost per hour from the average home due to *air infiltration.* While it is beneficial to exchange the air periodically in the home to avoid oxygen depletion and odor buildup, the present accepted level of one air

exchange per hour is unnecessarily wasteful of energy. I recommend 1/12th the normal rate, or two air exchanges per day, rather than one per hour. This amounts to a heat savings of 321,000 BTU per day, or 2-3 hours of furnace time saved in a day. This is only possible, however, in non-smoking homes or where the amount of adverse production of body odors and cooking odors are minimal. Installing one of the new high-tech air purifiers (see Section V) will also dramatically reduce the need to refresh the air so often.

Rather than simply calculating the infiltration rate of the home and increasing your furnace size accordingly, I recommend you calculate the heat loss associated with two total air exchanges of the house per day, and add that figure to your structural heat loss for determining furnace size. Then work to seal cracks until the infiltration matches that figure. The following formulas can be used to calculate infiltration loss. (They are only close approximations, however.)

- The heat loss in BTU/hr.=0.018 x (temp. difference between inside and outside air) x infiltration rate.
- In order to calculate the infiltration rate, measure the linear crack perimeters of all windows and doors on the normal, windward sides of the house. These separate window and door lengths in feet are assigned a value based upon calculations found in the ASHRAE handbook of heating engineers. (Check your local library.) Multiply the indicated value for the type of windows in your home times the total crack length for these windows and doors, then total these together, which equals total infiltration rate in cu. ft./hr. Window manufacturers can also provide infiltration rates for each unit.
- An alternate and more effective method, if you have a gas, oil, or separately metered electric furnace, is to calculate the average amount of fuel used during a day in which you have measured the average temperature outside. If your furnace is rated at 80% efficiency, you subtract 20% of the fuel used from the total, which will give you approximately how much fuel value actually went into the house. You can also use your monthly bill, dividing it by the number of billing days. To do this you also have to track temperatures for an entire month and average them to a daily basis as well. Be sure to pick the same month as the fuel bill. Next, multiply the fuel used by the BTU rating given your local unit of fuel divided by the number of days in the billing period. The BTU rating of your fuel should be derived from your fuel company rather than from books, since it will vary from supplier to supplier. This will give you how many total BTUs of heat your home consumed per day for that given temperature differential (between inside and outside air temperatures). You can determine how much of a percentage of that heat loss is infiltration by calculating the normal heat loss of the home through windows and doors using U-values supplied in the ASHRAE handbook for your type of windows, doors, and wall insulation. U-values are the reciprocal of R-values (Resistance to heat loss) which you are more familiar with. If you subtract the total calculated heat loss of the building, walls, ceilings, and floors from the fuel heat used, you will have a large remainder, which is

infiltration, the highest of most home heat losses. This will provide only a general approximation.

- One final technique (the most accurate) is to hire a heat loss specialist in your area to bring pressure-measuring equipment to your home. A fan is placed in a special door blank and set inside your front door. When the fan is turned on, the specialist measures how much pressure builds in the house. The more pressure, the tighter the house. By calculating the surface area of the walls, he can tell almost exactly how much infiltration potential you have.

CONDUCTIVITY AND DENSITY

You also need to be aware of these two characteristics to properly understand how the materials in your home interact with the environment. Density is a measure of the compactness of the molecular structure of a material. The more dense, the more heat a substance can retain in any given moment. However, the rate of heat gain or loss from the substance is a function of its conductivity. That is, if you have two walls, one of a container of water and the other of concrete, they will react quite differently when exposed to direct sunlight. The surface of the concrete wall will heat up rapidly and absorb heat slowly into the interior of the wall. Much of the heat is re-radiated from the hot concrete wall surface to the air because the conductivity of the wall is only moderate. A water storage wall, on the other hand, will not get hot on its sunlit surface because the conductivity is so high. It stores the heat nearly as fast as it warms the surface of the container. This high conductivity is additionally aided by convection currents within the tank which automatically circulate the warm water to the cooler areas of the tank. High density combined with high conductivity relates to efficient heat storage, but also to a poor ability to retain this heat if subjected to cold temperatures at night. Concrete, though slower in absorption, is also slower to give up its heat at night.

These concepts also help to explain why solid insulation loses some of its R-value as the temperature of the insulation decreases. Solid materials have a higher conductivity and begin to act more like a conductor of heat than an insulator as the temperature drops. Rigid foam, for example, has many trapped air cells which have low density, hence high insulation value. However, as the temperature decreases, the conductivity of the cell walls becomes higher (as the molecules contract), and the heat begins to more effectively bypass the air bubbles by traveling through the cell walls. This is also why it does no good to insulate the voids of concrete block. The heat simply goes around them through the rigid cement pathways.

CONSTRUCTION DESIGN FOR ENVIRONMENTAL CONTROL

This portion of the environmental control section deals with four general home construction designs corresponding to four different, general climate types:

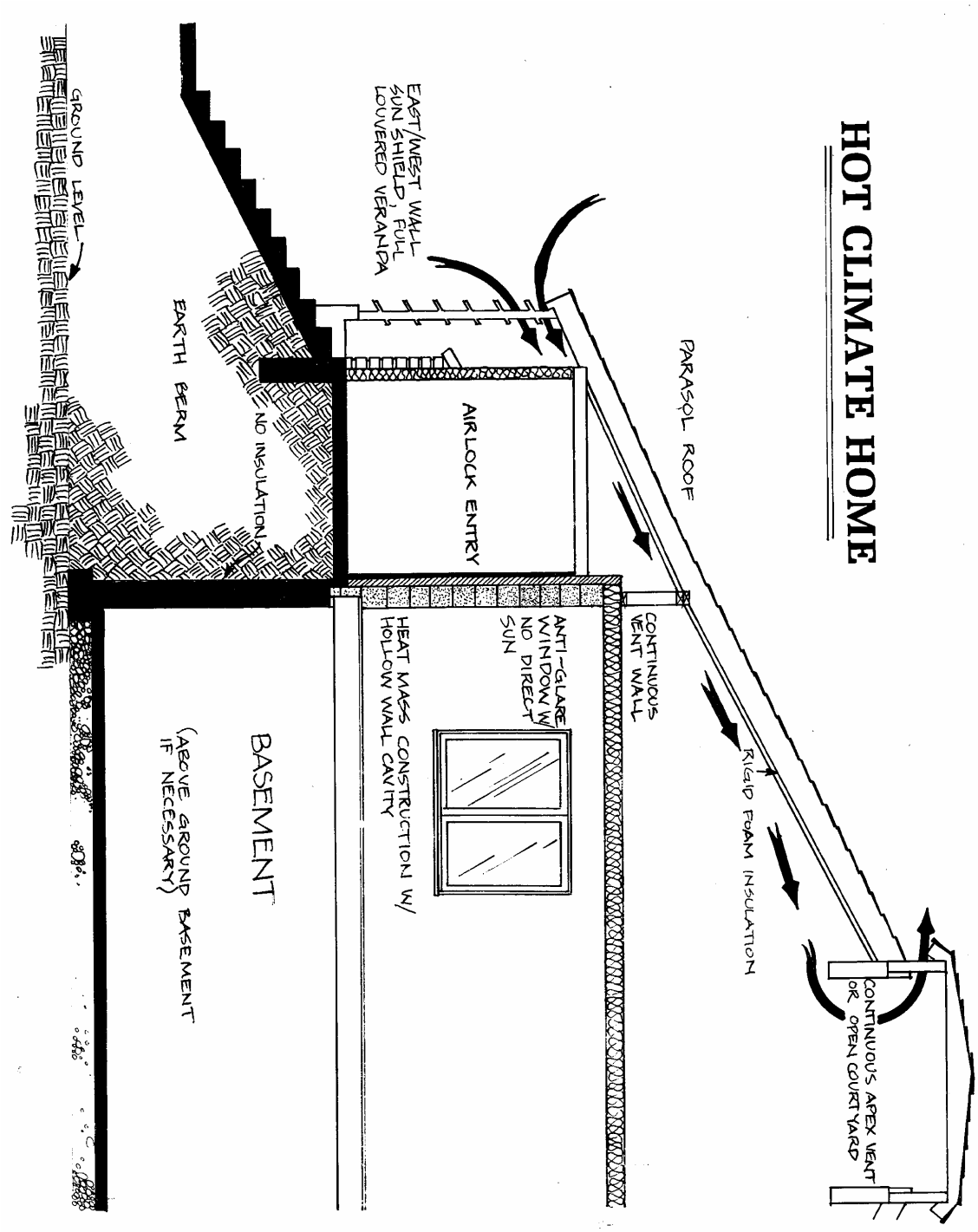
- HOT: 0-2000 degree-days of heating required; long, hot summers; warm winters; dry or humid air.
- MODIFIED HOT: 2000-4000 degree-days of heating required; long, hot summers; short, cold winters; air is humid.
- MODIFIED COLD: 4000-6000 degree-days of heating required; equal seasons all around.
- COLD: 6000 and above degree-days of heating required; short, warm summers; long, extremely cold, dry winters. Ground freezes to depths over 6 inches.

Hot Climate Home

(See illustration) In a scorching, desert-like climate free from cold winters, or in a hot tropical climate, our primary design goal is to eliminate the need for electric air conditioning by maximizing the use of free, convection cooling and heat absorbing, natural materials linked to the heat sink effect of subterranean soils. I am not suggesting you eliminate air conditioning as part of your normal design – especially in humid climates where no natural cooling method is fully effective. What we are trying to achieve is a home that will still be livable when the electric air conditioning ceases to function.

Construction design must provide an effective shield from the sun over the entire home to eliminate the conduction effects of roof and wall temperatures, which often exceed 200 degrees Fahrenheit. Thus, wide verandahs and porches are indicated. Additionally, walls must be constructed out of dense, heat absorbing masonry or adobe materials which are insulated on the *outside* of the masonry. This provides a huge *heat mass* of material capable of absorbing large amounts of heat on the inside. These walls should be sitting on top of a basement foundation to ensure the footings go deep into the earth so as to provide a heat sink to the cooler ground underneath. This heat sink will continually remove heat picked up by the walls.

One of the problems with insulating the outside of a heat mass wall is that once the masonry heat mass warms up on the inside, the insulation on the outside keeps it from cooling off at night. Old adobe construction was *uninsulated* and relied upon its sheer thickness to deter heat from reaching the inside. By being uninsulated, the hot outer portions of the walls would radiate some of that heat back outside during the night. However, building 2 foot thick walls has its disadvantages in today's construction (cost and taking up so much space). One can get the advantage of both insulation and heat mass by using a standard 8" or 12" thick masonry wall (using either stack block construction or regular mortar joints) and then building an insulated 6" wall on the


HOT CLIMATE HOME
GROUND LEVEL
EAST/WEST WALL SUN SHIELD, FULL LOUVERED VERANDA
PARASOL ROOF
EARTH BERM
NO INSULATION
AIR LOCK ENTRY
ANTI-GLARE WINDOW W/ NO DIRECT SUN
CONTINUOUS VENT WALL
RIGID FOAM INSULATION
HEAT MASS CONSTRUCTION W/ HOLLOW WALL CAVITY
CONTINUOUS APEX VENT OR OPEN COURTYARD
BASEMENT
(ABOVE GROUND BASEMENT IF NECESSARY)

outside, a 2" air gap in between, and vents on the top and bottom. The insulated wall slows down the heat transfer, and then the air gap allows what heat does comes through the insulation to vent upward and outside. The addition of a thin layer of insulation with a heat reflective foil backing to the masonry side of the air gap (facing the air gap) will even double the effectiveness of this system.

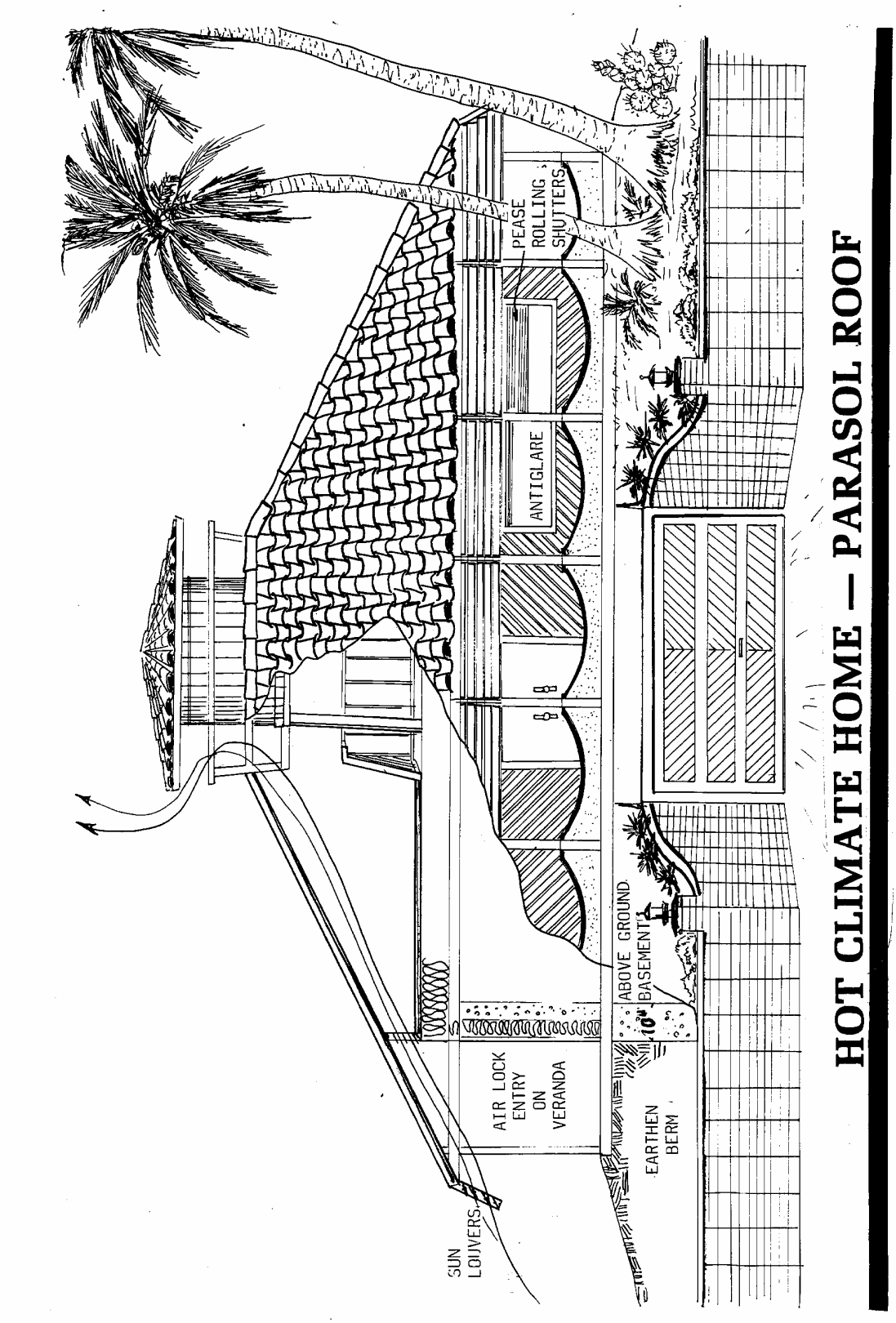
Air infiltration into the interior of the home must be halted due to the high temperature of daytime, desert winds. At the same time, openable window space must allow for interior ventilation during periods when the air cools off at night. In high desert areas, this occurs almost every night.

Parasol Roof

A **parasol roof** (see illustration) is one which acts as an umbrella over a house, contacting it in as few places as possible, with a minimum air space of twelve inches between the closest points of contact. The pitch of the roof should be at least 6/12 (about 22.5 degrees) to facilitate the rapid rise of hot convection air, which must be sufficiently swift to counter the radiant heat waves emanating from the warm underside of the roof. The entire apex of the roof must be designed as a vent to handle the large volume of convective air, and the roof surfacing material should be light in color to reflect the maximum amount of light energy. The eaves should extend out far enough to prohibit the sun's contact with wall surfaces. This is not possible on east and west sides, except with louvered shade walls.

Verandah Porch

The beneficial side result of an extended eave is the creation of the old verandah style porch, which in this case, surrounds the entire house. Portions of the verandah should be closed off from the rest to form double door, air-lock entries at the entrances of the home most frequently used. Normally, such entries are designed into cold climate homes, but they are equally useful whenever the temperature gradient between inside and outside exceeds thirty degrees. Even without wind, the opening of a normal, single door entrance can cause the loss of 32 cubic feet of cool air per second for the first ten seconds of door opening. When temperature differences are minimal, one of the doors to the air-lock can be removed to eliminate the bother of opening both doors when the need does not exist. The modern demise of the double door entry and the verandah did not come about due to improved construction design, but rather, due to the notion that energy is cheaper than building materials. Thus, they were removed to economize on construction costs or to save space



HOT CLIMATE HOME — PARASOL ROOF

Floors and Berms

An additional entry feature in hot climates is to lower the floor level two to three feet below the level of the entrance. As one descends the few stairs, a distinct cooling feeling is felt as the coolest air is trapped and unable to flow out the door opening. Desert floors are often made up of “hard pan” or some type of rock formation making the inclusion of a basement difficult and expensive. However, the benefits that earth berming provides in terms of consistent temperatures and cooling is enough to warrant the basement as a standard feature, even if it has to be constructed partially above ground. The best alternative to an underground basement is to construct one on top of the hard formation and berm up large quantities of earth to a six foot height. Earth must be bermed up in sufficient quantities over a wide area to provide the appearance that the home is sitting on a small rise, rather than being a two-story home, with dirt pushed up against the walls.

Windows

In desert areas, windows should have anti-glare treatment (factory applied) to alleviate the problem of excessive light reflection from various surfaces. East and west sides of verandahs should have outside louvers or roll-down blinds to avoid excessive reflection.

Wood-burning Stove

If a wood-burning fireplace or stove is desired, it should be constructed as an integral part of an exterior wall to dissipate as much heat as possible if ever used for cooking in hot weather. An enclosed portion of the verandah may also lend itself well to non-electric cooking since it separates the home from cooking heat and odor.

Walls

For wall construction in hot climates, including all interior walls, I prefer heavy masonry for maximum heat absorption and dissipation to the underground surfaces. Naturally all exterior walls should have insulation applied to the outside surface and a vented air space between exterior siding and the insulation if the wall will receive direct sunlight. A one or two-inch air space should also separate adobe or brick veneers from the hollow cavity of 2x4 or 2x6 stud walls, if used. This air space, as previously described, in combination with the hollow cavity of the stud walls, can be used to convect hot air up into the parasol roof area before it can heat the inner wall surface. In cooler seasons, when wall warmth may be desirable, the flap-type door at the top of the hollow cavity wall can be closed so that warm air is retained. This treatment is usually necessary on a wall which is exposed to the sun, and allows the resident considerably more control over temperature than a straight adobe or brick wall.

In the case of solid adobe or masonry construction, some pre-construction testing has to be done to determine the heat transfer rate of the wall material which, in turn, determines the width necessary to achieve an average interior wall temperature. Figures are fairly accurate for all commercial materials, but adobe clay varies considerably depending upon the makeup and quality of the clay mixture. Adobe is one of the best insulators among masonry products, and therefore also has poor conductivity, which inhibits its heat storing capacity. For this reason, it performs well in its natural role of isolating the

interior of homes from extreme heat in the Southwest. However, its low conductivity makes it only a fair heat sink for taking advantage of coolness in the ground.

Modified Hot Climate Home

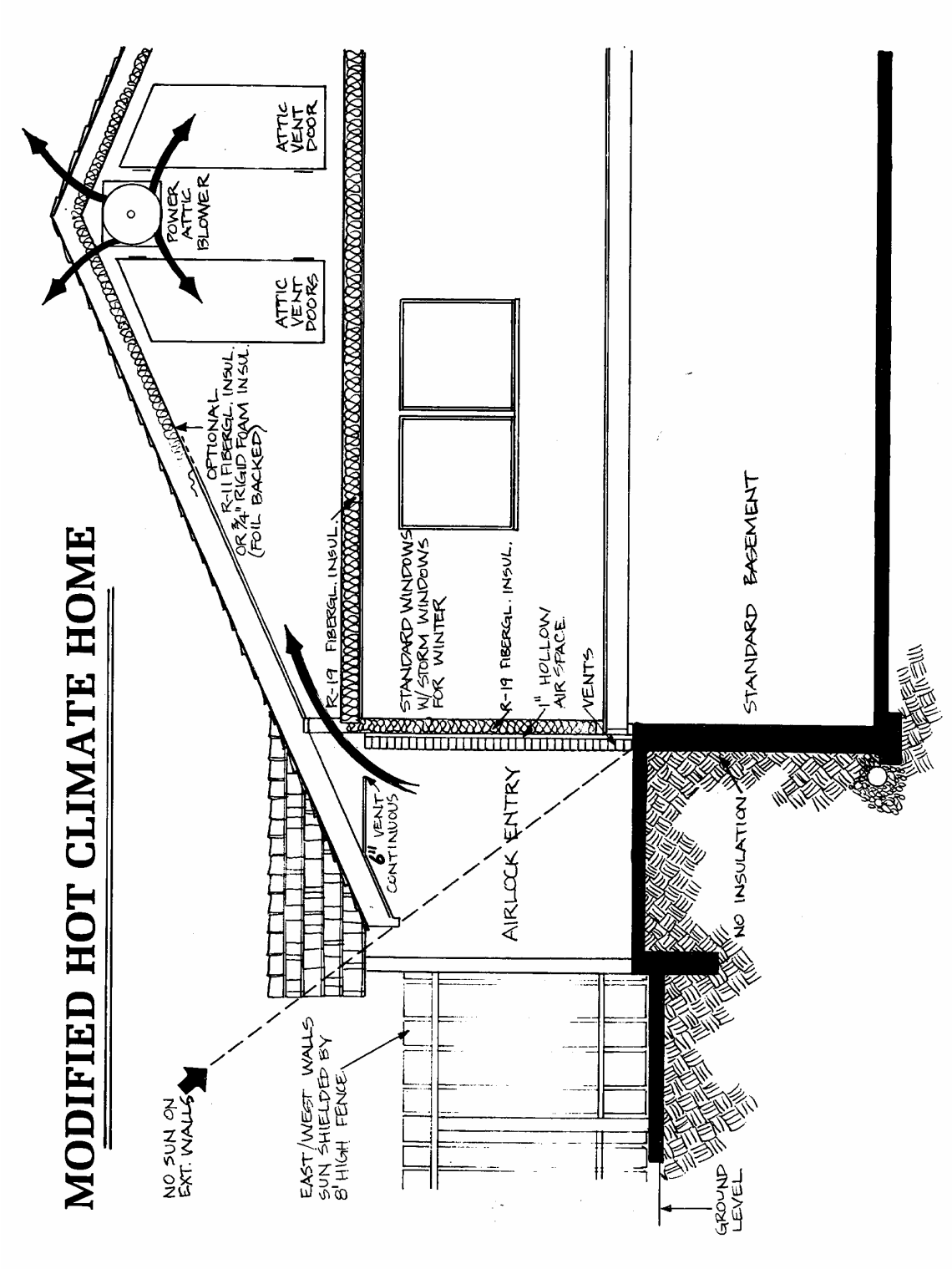
(See illustration.) Due to some significant, though short, cold winter weather, the modified hot climate home must have some provisions for insulation and heat retention.

Roof

The parasol roof would not be appropriate in this climate since it has no insulating effect of any magnitude. The roof style illustrated here, is a modified conventional roof that is double insulated and designed with a much larger heat-venting capability. The R-30 ceiling insulation (9-1/2 inch fiberglass batts) is sufficient for the cool winter, but does not provide enough protection against an excessively hot attic during the long hot months. There are modern insulation products on the market that provide multiple, foil lined channels of air. With this foil pleated insulation stapled in between roof rafters and connected to low and high air vents, virtually 90% of all heat coming through the roof will be dissipated out the apex vent. This is much more effective than the additional R-l1 insulation (either foam or fiberglass batts) in the rafters that I used to recommend. If a non-parasol roof is used in a hot climate home (as previously discussed), *multi-layered foil insulation* should be used under all roof surfaces. This must be used in concert with a very large ridge-venting system to handle the tremendous amount of heat being dissipated.

Roofing materials should be light colored in this climate. Additionally, two electric attic blowers are installed (one at each end of the apex of the attic wails) to duct out air at temperatures above 95 or 100 degrees. Normal, two-inch continuous soffit vents would not be sufficient for this volume of air venting. Thus, a large six-inch screened, continuous soffit vent is specified with a hinged flap so that it can be sealed shut during winter months when venting would be undesirable (this is only possible when complete moisture barrier protection is installed on the inner wall surface, prohibiting moisture condensation problems on attic structural members). In cases of power outage, or when cooling equipment is installed in the attic, additional venting is provided in the design of two large, attic wall doors on opposite sides of the house which open outward to deflect summer breezes inward.

One of the biggest problems I have is designing enough ventilation into small attic areas. Low-pitched trussed roofs all have this problem, and summer heat inside these small attics is truly excessive. The next illustration details several unique ways to really open up attic side walls to let this heat out. Three venting schemes are illustrated. One is the attic forced air ventilation fan. This is a very high volume fan that is very effective at removing hot air. Another less effective, passive ventilator is the wind-driven turbine. Rising heat will turn it and extract more heat, or outside winds will spin the turbine. The last alternative provides two very large doors in the side walls of the attic. These are opened all summer long allowing copious amounts of air to circulate in and out of the attic. Naturally the openings are screened to deter bugs from entering the attic.


MODIFIED HOT CLIMATE HOME
ATTIC VENT DOOR
POWER ATTIC BLOWER
ATTIC VENT DOORS
OPTIONAL R-11 FIBERGL. INSUL. OR ¾" RIGID FOAM INSUL. (FOIL BACKED)
R-19 FIBERGL. INSUL.
STANDARD WINDOWS W/ STORM WINDOWS FOR WINTER
R-19 FIBERGL. INSUL.
1" HOLLOW AIR SPACE
VENTS
STANDARD BASEMENT
6" VENT CONTINUOUS
AIRLOCK ENTRY
NO INSULATION
NO SUN ON EXT. WALLS
EAST/WEST WALLS SUN SHIELDED BY 8' HIGH FENCE
GROUND LEVEL

Walls

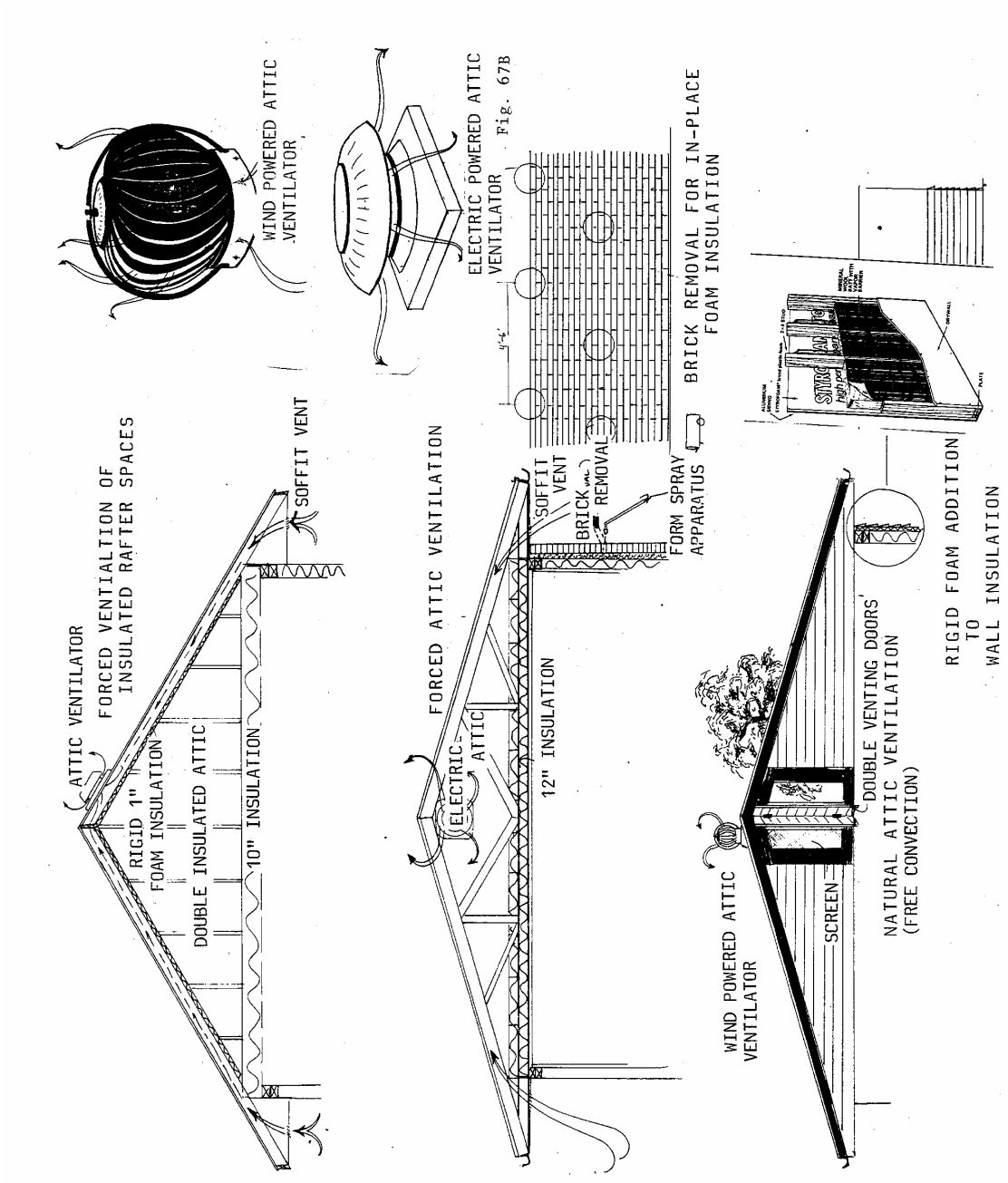
Roof overhangs assure substantial shading for windows and walls. Additional venting of walls is provided in the one-inch air space between brick and 2x4 insulated walls. Slotted bricks at the base of walls allow air to rise upward and out attic vents (see previous illustration). A small seal is specified to close this venting process during cold weather. During construction, brick masons must be instructed to strike off excess mortar behind walls to maintain a clear air passage. In **modified hot climate** design, I prefer the use of masonry exterior walls with interior insulation within stick framed 2x4 walls. To prevent the outside brick walls from radiating heat into or past the interior insulation, the wood framing of the house should have a special 1/2 inch of foil-covered rigid insulation board facing the brick, with a one inch vented airspace. This is most critical on the south and west sides of the house where heat radiation from the hot brick walls is particularly acute. The heat absorption qualities of brick are excellent and usually preclude the need for air conditioning as long as the nights occasionally cool off to restore the coolness in the walls. In areas where the nights do not cool off, the outside wall construction should be reversed – high conductivity brick (brick w/magnesium additive) on the inside coupled with a deep foundation or basement and a wood insulated wall on the outside.

Basement

Basements can normally be constructed below ground level in these areas and are constructed to conventional specifications. Exterior basement insulation should not be installed – only a dry layer of gravel next to the water-sealed concrete wall to eliminate damp earth heat conduction during a wet period. Ample roof overhangs in combination with sloping earth away from the home will diminish most wet weather effects.

Windows and Doors

Windows can be standard single-paned if storm windows or plastic are available for installation during the short winter months. Double door airlock entries are specified here as well, for both winter and summer periods. During mild, humid periods, one or both doors can be changed to screen doors as an added restriction to insect infiltration.


WIND POWERED ATTIC VENTILATOR
ELECTRIC POWERED ATTIC VENTILATOR
Fig. 67B
ATTIC VENTILATOR
FORCED VENTIALTION OF INSULATED RAFTER SPACES
SOFFIT VENT
RIGID 1" FOAM INSULATION
DOUBLE INSULATED ATTIC
10" INSULATION
FORCED ATTIC VENTILATION
ELECTRIC ATTIC
SOFFIT VENT
BRICK REMOVAL
FORM SPRAY APPARATUS
12" INSULATION
BRICK REMOVAL FOR IN-PLACE FOAM INSULATION
WIND POWERED ATTIC VENTILATOR
SCREEN
NATURAL ATTIC VENTILATION (FREE CONVECTION)
DOUBLE VENTING DOORS
RIGID FOAM ADDITION TO WALL INSULATION

Modified Cold Climate Home

(See illustration.) The modified cold climate home varies significantly from the previous types. It is designed for areas with longer, colder, wet seasons during most of the year combined with short, hot, and humid summers.

Roof

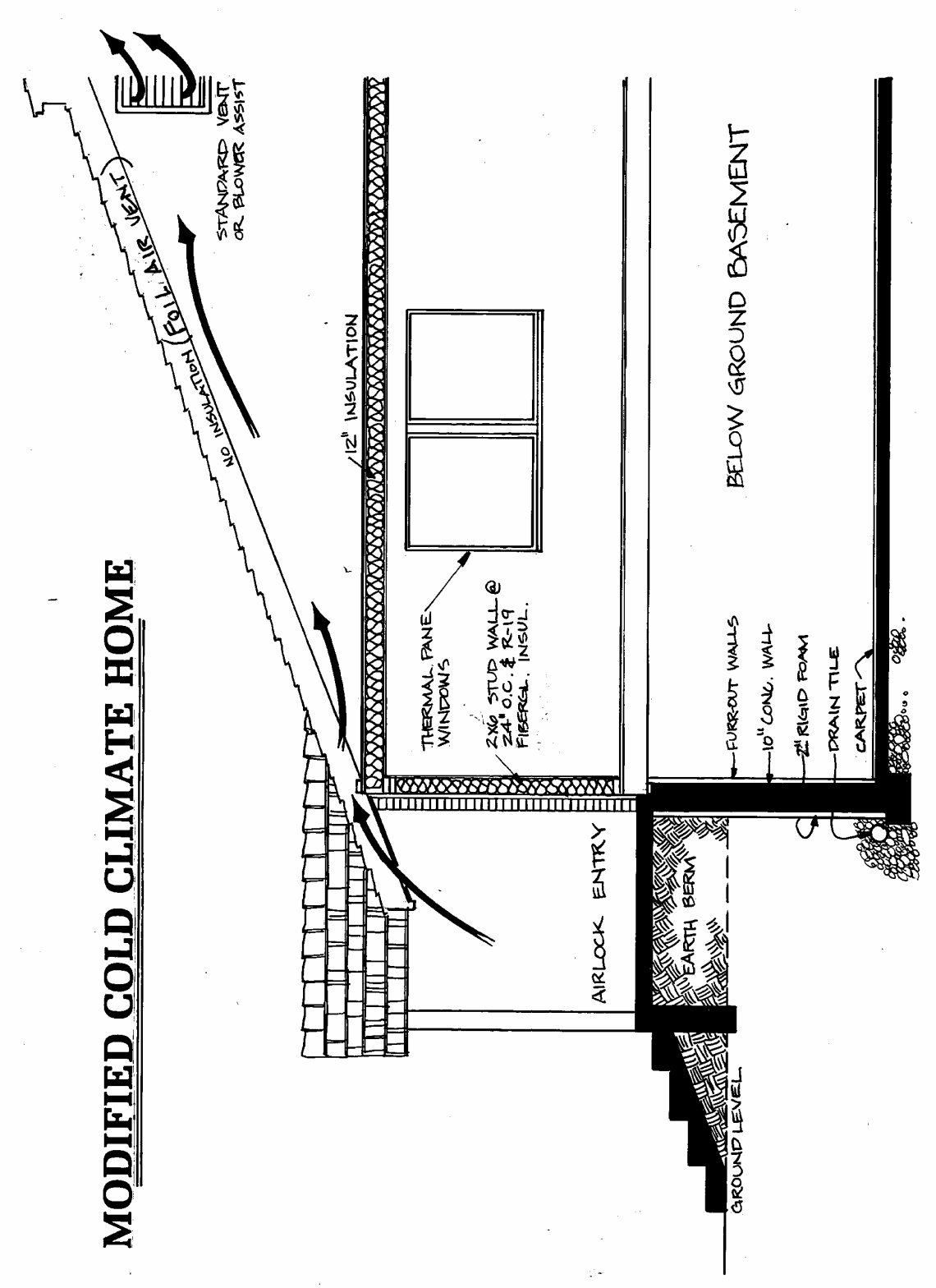
A conventional roof is applicable here as are all colors and styles of waterproof materials. However, I recommend that ceiling insulation be increased to 12" of fiberglass batting (R-38). Multi-layer foil insulation should be placed between rafters to combat short summer heat gain. This added roof insulation eliminates the need for an attic blower (if you have a ridge vent, which is preferred in most cases) since temperatures will remain below 120° in this climate. Air vent space must be allowed where the roof meets the ceiling to permit air to rise from the soffit vent. Both **modified hot** and **modified cold** climate homes must be designed with the flexibility to accommodate varying degrees of hot and cold weather. The correct combination of insulation and free convection air control, is essential to balancing nature's temperature changes. The insulating of ceiling and attic rafters allows additional, future flexibility for the storage of material goods or the installation of special water storage tanks. If rafter insulation is eliminated, a single attic blower should be installed in the middle of the roof near the apex, or one on each end.

Walls

In any cold climate, walls must be given increased attention due to high heat loss associated with winter winds and high temperature differentials. Stud walls should be constructed from 2x4 lumber on 16" centers with 1" of rigid foam on the exterior under the siding. This method effectively cuts the heat loss through the wall framing and is nearly comparable to 2x6 wall construction. If you want to put foam sheathing on a 2x6 wall, you approach super insulation standards. However, you must understand that given any amount of large window area in the house, the walls will contribute little to heat loss as compared to air infiltration and window losses. The problem is analogous to insulating a carport ceiling without enclosing the walls. Overinsulating any one portion, without the ability to halt heat loss in another area is usually not cost effective and ceases to pay any dividends past a certain point.

Windows

Windows can be single-glazed if storm windows are in use during the winter months. For purposes of cutting air infiltration, it is beneficial to specify storm windows year round – especially if windows have metal frames which act as a heat sink for the glass. Cold climate homes optimally should have wood or plastic framed windows to avoid water and ice forming on the frames (as always occurs with aluminum framing). The most expensive wood windows are clad in a plastic molded covering to prevent deterioration in wet climates where indoor condensation is a problem.


MODIFIED COLD CLIMATE HOME
STANDARD VENT OR BLOWER ASSIST
NO INSULATION (FOIL AIR VENT)
12" INSULATION
THERMAL PANE WINDOWS
2X6 STUD WALL @ 24" O.C. & R-19 FIBERGL. INSUL.
BELOW GROUND BASEMENT
FURROUT WALLS
10" CONC. WALL
2" RIGID FOAM
DRAIN TILE
CARPET
AIRLOCK ENTRY
EARTH BERM
GROUND LEVEL

Basement

Modified cold climate homes also require special basement treatments not necessary in warmer climates. The wet weather associated with these cold, humid areas usually equates to a fairly high water table, sometimes within one or two feet of the surface. Where a high water table prevents a basement, you should look elsewhere to build or implement a raised basement with bermed earth to raise the surrounding ground level. The basement wall must be effectively waterproofed and kept insulated from the surrounding soil as water content increases heat dissipation dramatically. One-inch polystyrene rigid foam insulation surrounding the basement wall will increase its R-value by about five points.

Loose, dry gravel or one of the *plastic mesh filter/drain materials* should be placed between the insulation and the moist soil to provide proper drainage, should water run-off become excessive. Gutters should be used on all roof slopes to route excess rain water away from the perimeter foundation. Basement floors should be carpeted over foam padding to provide insulation. Additionally, plastic sheeting should be installed around the home perimeter 6" to 12" under the surface at an angle sloping away from the house, extending outward at least six feet to keep water drainage away from the basement.

Cold Climate Home

(See illustration) Simply stated, the cold climate home must concentrate on conserving as much heat as possible.

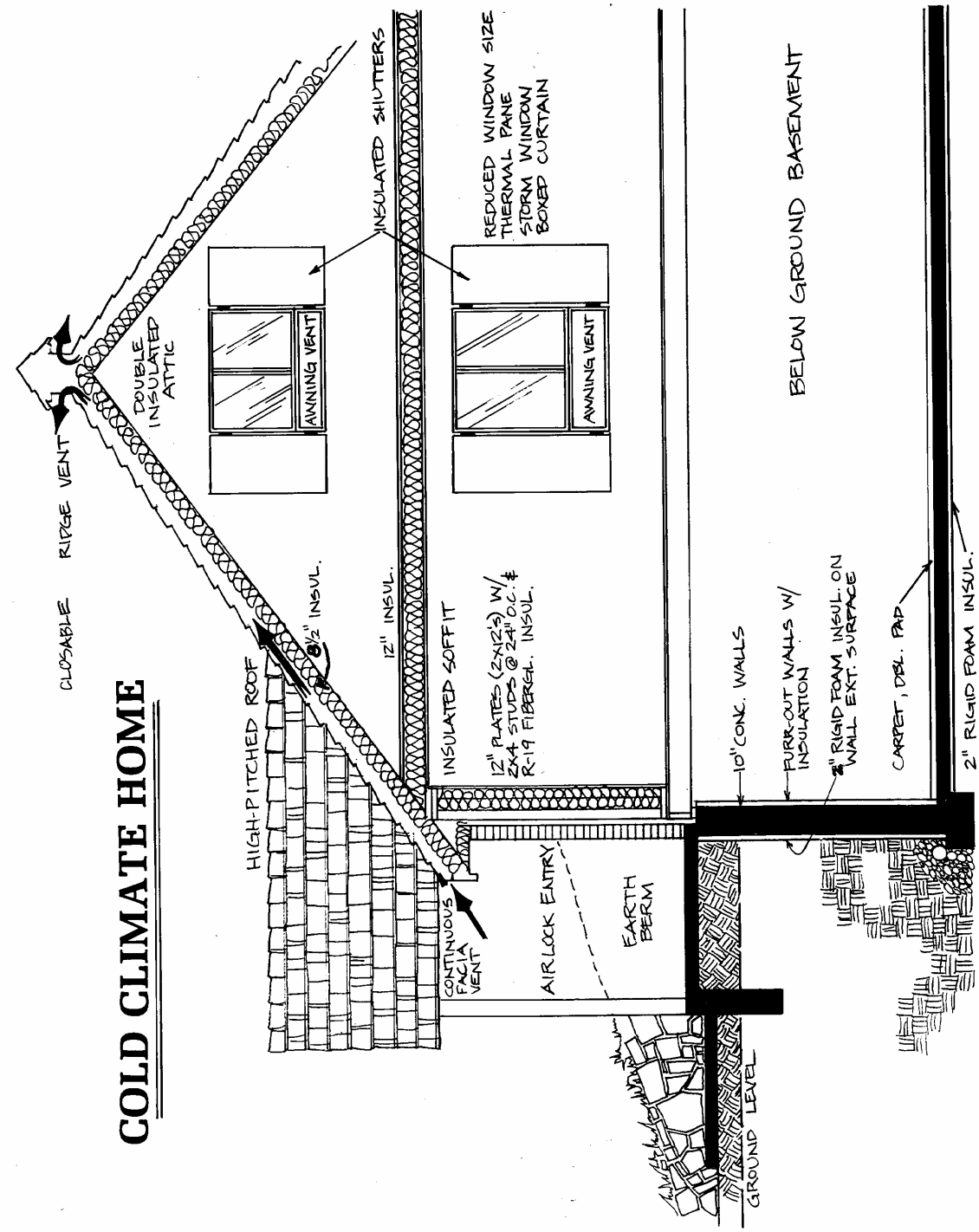
Roof

The roof has a higher pitch (in excess of 8/12) to accommodate higher snowfall in these regions. Larger sized rafters are used both to accommodate the added weight and to allow room for double R-19 (6" fiberglass batts) insulation. With a 12" rafter or wood truss joist, this provides 10" of insulation plus a 2" nominal air gap between top of insulation and roof sheeting. Roof overhangs may be extended to 2-4 feet (chalet style) to keep spring snowmelt away from the house. I sometimes use short stub walls under a roof with large overhangs, which elevate the roof enough to keep the long eave from blocking sunlight from windows. This additionally provides more usable attic space for living or storage. The ceiling insulation remains at R-36.

Walls

Walls should be heavily insulated 2x6 walls with an R-28 rating – achieved by the addition of 1" of polystyrene or urethane rigid foam insulation between exterior sheathing and the 2x6 inch insulated stud wall. This provides several insulation advantages. Initially, the number of cold spots normally associated with solid lumber in stud walls is reduced. This is because the added stiffness of 2x6 studs allows for studs to be placed at 24" intervals instead of 16" centers as with 2x4 construction. The wall cavity is enlarged to accommodate 6 inch batts with a R-19 rating instead of R-11 batts for 2x4 walls. The wider 2x6 wall studs are more expensive per piece, but since there are less of them

(at


COLD CLIMATE HOME
CLOSABLE RIDGE VENT
DOUBLE INSULATED ATTIC
ANNING VENT
INSULATED SHUTTERS
REDUCED WINDOW SIZE
THERMAL PANE
STORM WINDOW
BOXED CURTAIN
ANNING VENT
BELOW GROUND BASEMENT
HIGH-PITCHED ROOF
9½" INSUL.
12" INSUL.
INSULATED SOFFIT
12" PLATES (2X12'S) W/
2X4 STUDS @ 24" O.C.
R-19 FIBERGL. INSUL.
10" CONC. WALLS
FURR-OUT WALLS W/
INSULATION
2" RIGID FOAM INSUL. ON
WALL EXT. SURFACE
CARPET, DBL. PAD
2" RIGID FOAM INSUL.
CONTINUOUS
FACIA
VENT
AIR LOCK ENTRY
EARTH
BERM
GROUND LEVEL

24” on center), the cost is only a little higher. Foil backed, rigid foam sheathing should still be applied to the outside of 2x6 walls to eliminate the insulation bypass phenomenon. This is where the warm sheetrock dissipates its heat to the studs, which if directly connected to the exterior siding, pass the heat to the cold siding, partially bypassing the insulation. The rigid foam not only stops this process, but provides a continuous air infiltration seal around the house before the siding goes on. I recommend caulking around windows before siding is in place not only to hide the caulking, but to make a better weather seal. Use of a complete air barrier wrap (like Tyvek brand) is now required by many building codes.

The use of thermal “heat mass” masonry construction can be effective in cold climates only if you ensure by design that the heat sink effect into the ground is stopped. Otherwise, you will find it difficult to ever warm up the masonry interior walls. While some may argue that by leaving the heat sink effect intact you provide a smaller temperature differential as compared to the outside air, they fail to fully consider that the heat sink effect to the ground is so great in cold climates that it can absorb almost a constant flow of heat away from the building. Recent research on thermal mass homes in actual operation confirms that the most common error in northern climates is providing too much heat mass, which always remains cool. The remedy is simple. Always install a small amount of insulated interior wall material to the masonry in addition to the heavy insulation on the outside. Sometimes even 1/2 inch of rigid foam insulation is enough to temper the effect.. Once the interior insulation is warmed up, the masonry wall behind that insulation is isolated. Now the small temperature differential can work to your advantage. The masonry sandwiched between two layers of insulation acts with a dampening effect so that large temperature swings on the outside are not allowed to transfer their affects indoors.

This technique is used only in cold climate homes. In warm weather areas we do not want to insulate on the inside as it would destroy much of the wall’s ability to absorb the excess heat from interior air. If you have a large bank of south-facing windows in an area that has a lot of sun in the winter, you should not need interior wall insulation over the masonry. Copious amounts of sun will overheat a solar home even in winter, and you will want the excess heat to be absorbed by the exposed interior masonry.

Now, let’s address the **heat sink effect of the masonry wall to the footings**. In cold climates, it is far more practical to insulate on the interior than to try to break the heat sink contact between the footings and the ground. Insulating materials cannot be safely installed under footings without being compressed by the heavy weight of the structure. However, one can put several layers of plastic over the footings before pouring the walls on top of them. Plastic will cut about 30% of the direct heat transfer from walls to footing.

Another way to make a break in the thermal heat sink is to ensure that the footings and foundation basement walls are surrounded by very dry gravel – to keep the cement from picking up excess moisture. This is also the purposes in specifying that foundation French drains be below the footing rather than at the same height, and in requiring the use of anti-percolation barriers just under the surface of the ground surrounding the

home. This heavy duty plastic extending outward from the building for 6 feet (6” to 12” under the soil) effectively keeps water away from the basement walls.

Basement

Basement foundation footings must penetrate the frost line depth so that frost heaving of the soil will not affect home stability. Two inch rigid foam insulation is applied to basement walls and one inch foam is installed under concrete floors as well. New, foam forming concrete techniques leave a permanent foam insulated wall on both sides of the basement. In addition, exterior and interior finish materials can be applied to the plastic ties on the wall forming system which eliminates the need to provide furring strips on the walls.

Doors and Windows

Double door, airlock entries are specified on all entrances in cold climate homes. Double-glazed windows, interior insulating window coverings, and storm windows on the outside are also specified. For security reasons, as explained later, I will usually recommend that storm windows have acrylic plastic panes rather than glass. Not only are they better insulators, but they are unbreakable. Alternatives to storm windows are exterior rolling shutters, which provide equal or better security, albeit at much higher expense. Windows satisfy most of the ventilation requirements which arise during the short, mild summer months. However, most people provide some form of air conditioning since the summer air is usually too humid in many locations to allow for pleasant natural ventilation.

You can usually avoid the expense of rolling interior insulated (quilted fabric) shutters for heat loss reduction if you use a combination of double-glazed windows and acrylic storm windows. Even higher R-values can be achieved by installing windows with the high-tech low-emissivity (Low E) coatings. Earth-berming can be used on waterproof treated exterior walls up to the four foot level on the main floor, as illustrated.

Fireplaces and Stoves

Fireplaces and alternate energy stoves must be centrally placed so as to minimize heat loss that occurs when placed on exterior walls.

GENERAL PRINCIPLES FOR ENVIRONMENTAL CONTROL

Temperature Control

In an ideal control system we would virtually stop conduction and convection currents of heat transfer by surrounding the home in a vacuum. Then we would only have to contend with infrared radiation (heat waves) which can penetrate a vacuum. These can be blocked with an infrared shield. While infrared shields (such as foil or metalized glazing) are already in use today, the vacuum is not, and never will be economically feasible (except in such things as solar water heaters).

Insulation

The primary method in use today for temperature control is insulation. This effectively *slows* the rate of heat transfer between a temperature differential. Remember that insulation does not block heat transfer completely. Given enough time, temperature differentials will eventually equalize themselves even in the presence of insulation, unless some external input or extraction of heat takes place.

There are certain conditions that control the effectiveness of insulation. The general principle is to trap air in tiny pockets so that convection currents cannot flow. But remember that insulation also has to deal with conduction. You can trap lots of air in concrete or even steel and the material still will not be a good insulator because the heat transfer travels around the air spaces via the solid material that is trapping the air. This is the reason why wood is only a fair insulator, having approximately one R-value per inch. It traps some air in its hollow cells, but the cell walls, being rigid, pass heat via conduction. This will help you understand some of the latest test data that has been released showing that certain rigid types of insulation decrease in effectiveness as the temperature decreases. Rigid foam has rigid cell walls that are directly connected to other cells. As the temperature drops, the solid portions of cellular foam plastic begin to act more like conductors than insulators. The increase in conduction offsets some of the insulative value of the air bubbles trapped inside. Conversely, blown-in cellulose fiber (ground up newspapers) is a very consistent insulator at all temperatures. There is little direct contact between the individual fibers. This type of insulation has a structural drawback, of course, which prohibits its use where excessive settling or compression under stress would occur. These principles also explain why it is relatively useless to put vermiculite insulation in the voids of concrete blocks. The heat simply travels around it.

One of the most important concepts to keep in mind about insulation is that, like security, it is only as good as its weakest link. Don’t be too impressed by R-value statistics alone. The factory-tested resistance to heat transfer (R-value) is not the only critical factor. Most heat is lost or gained through gaps and heat sinks that penetrate the insulation or go around it. These we call insulation bypasses. Just as heat travels along the cell walls of concrete block to bypass the insulation in the voids, so heat will bypass insulation traveling from the drywall to the studs and out to the siding. Even nails penetrating a solid roof to attach the shingles will help heat to bypass insulation. Metal conducts heat about 1000 times better than most forms of insulation. A study at Princeton University showed that attic bypasses reduce the overall insulative R-value up to 25% of what is being claimed in factory tests (assuming a perfect installation job). That means that 4 inches of rigid foam glued onto a deck with no bypasses would be as effective as 6 inches of batts installed between rafters. That is why it is somewhat a waste of money to use superinsulated walls when most of the wall area is taken up by large picture windows. The overall wall insulation is hardly affected by the superinsulation because of the higher predominance of the window losses.

Blocking Insulation Bypasses

Under constant heat gain situations, such as a west wall of a house with the afternoon sun beating down constantly, any normal amount of insulation will be heat saturated after a

few hours and will begin to let heat pass into the interior (about the time you are ready to go to bed. In such cases, it is not enough to use trapped-air type insulation. You must combine regular insulation with radiation reflectors, such as foil backing facing the hot side of the wall, with an inch airspace in between to allow hot air to escape upward to a vented slot. This allows the heat to move upward and out before it penetrates the insulation. This latter technique is called heat venting and has not been sufficiently utilized in modern day construction – mostly because of fire codes which prohibit interior venting chambers unless all surfaces are fireproof. West walls that are not sun shielded should have an air venting cavity with infrared radiation reflector shields between the exterior wall and the interior insulation. This is more easily accomplished by the multiple layered foil products previously discussed that provide an accordion-like set of air channels in the insulation area. Care must now be exercised to block heat transfer through conduction via the studs or other support structures around the insulation. Using double walls (with few connections) or rigid foam between studs and exterior sheathing makes an effect conduction barrier. If this complicated insulation scheme is impractical in your case, you can fall back to the old standard practices of shading the west wall with roofs, awnings, louvers, or even plantings.

Insulation Techniques for Thermal Mass Walls

Perhaps the biggest drawback of exterior insulation techniques has been the lack of an easy fastening system from foam to masonry, and the exterior surface to the foam. New super adhesives are now available that make it possible to glue almost anything to masonry walls. However, great care must be exercised in using these adhesives to ensure that a firm grip is attained. Setting up a rig to apply pressure to the materials while they are bonding is not difficult, but it must be done right every time or panels can come loose by the warping effects of sun and moisture. For this reason, the use of mechanical anchors will probably always be preferable. They are more time consuming and costly, but they are absolutely sure. Using construction adhesive in combination with mechanical fasteners, especially at the edges, can help you get away with fewer fasteners and less perfection in glue application. While I would personally have confidence in these methods if I were supervising every application, I don't think I would feel good about turning the job over to a standard carpentry crew.

Mechanical Attachments Systems

These systems range in complexity from the simple expansion anchors (lead or plastic) that require pre-drilled holes, to the more modern anchors that are driven in with electric or explosive cartridges. These anchors, placed every 24 inches, and used in combination with glue-in-place insulation with integral backing materials (for attachment ease), will provide a solid nailing surface for any type of siding from stucco to wood. In extremely hot climates, use 1-1/2" furring strips, 24" on center, under the plywood siding or stucco backing board as an air vent to assist the insulation in stopping heat gain – especially on west walls. Isocyanurate rigid foam yields about R-7 per inch, which is the best of the rigid foams. A thick layer of stucco adds another unit of R-value to the total. To counter heat gain, the air vent wall just described will add another R-10 to your values against heat, but only an R-1.5 against cold, or perhaps even a negative insulation value if the walls are allowed to vent in the winter.

Besides sand/cement-based stucco (which has made tremendous improvements against cracking in the past 10 years), there are epoxy-based systems such as “Dryvit” and “Pleko” that are commercially available (and more costly).

Humidity Control

Your need to control humidity will depend upon two primary factors: the external environment contributing to the excess moisture or lack of moisture, and your skin tolerance for dryness or humidity. People with an abundance of natural oils in their skin can tolerate far drier climates than can those with dry skin. There isn’t much you can do about the external moisture environment once you have built your home, except to let your house be a shield from the outside air. If your house effectively blocks most air infiltration, then you can control the humidity mechanically through your central air conditioning or heating system. Actually, only dehumidification must occur via central equipment. You can add excess moisture to your home using a variety of portable products on the market today. You can also simply allow certain household moistures (like shower steam, cooking steam, and clothes drying vapor) to accumulate rather than be ducted outside. Allowing these to stay in the home, as long as they are not confined to one area, is usually sufficient for many dry climates. The moisture accumulation is naturally counteracted by window condensation, which acts as a dehumidifier. If your windows are constantly producing pools of water, you have too much humidity in the home.. If your humidity is between 40 and 60 percent, you should probably not attempt any external input or extraction. In addition, you might also keep in mind the pleasant effect that household plants can bring towards adding freshness and moisture to the home

Wind Control

Wind control can be a challenging and rewarding experience. If you effectively control wind, throughout the range of changing conditions, you can select the amount you want. During high humidity periods, you may want to increase wind flows to your outdoor activities, and perhaps block its entrance into the house altogether. During hot dry spells, you may want to block all heavy winds around the house and just allow enough for effective evaporation of moisture, without excessive drying or chapping of the skin.

Control of wind outside the home can be done in a variety of ways, none of which are inexpensive. If your winds are seasonal, as most are, deciduous trees (the type that drop their leaves in winter) and shrubs can be planted in strategic areas. The vegetation lets enough wind through for freshness but blocks the strong gusts and steady irritation. Fences must be designed with care. They should cut across the wind direction at an angle of at least 30 degrees or the winds will hit them broadside and burble over the tops causing erratic and unpredictable eddies and whirlpool-type currents. Louvers, though the most expensive type of fence or blind, are very effective in channeling what wind escapes other filtration and blocking means. Louvers should be adjustable if your winds are variable in their direction.

If the terrain of your home allows, some of the most effective wind control can be accomplished by using a earthen berm to cause the wind to “skip” over the home.

Landscaping, once fully mature, can also provide a skip effect if you use progressively higher vegetation approaching the home.

Sun Control

Most of the factors relating to the sun's heat (infrared radiation) were covered under the temperature control section. High heat radiation must be rejected from the home by shielding (trees, parasol roof, metalized coatings), and what does penetrate the initial shield must be convected away. Insulation is a final backup to slow the transfer of any residual radiation. Heat that passes through insulation must then be removed by the heat sink process of absorption into deep earth or mechanical extraction via air conditioning and cooling.

Excessive brightness can be controlled indirectly by nonreflective surfaces and vegetation outside the windows, and directly by metalized reflective coatings on windows or the use of rolling shades or external louvers. Keep in mind that if you use internal shades or blinds to stop glare, they will not stop infrared penetration unless they have a reflective surface that effectively bounces the rays back out the windows. Most heat-absorbing blinds will allow the heat to be generated inside the window area where the heat will rise and flow into the room. This allows almost the same heat gain as if no blinds were present at all. However, the technique of letting the blinds absorb the heat inside the home while cutting the direct sunlight to the carpets and furniture is useful for passive solar techniques where you desire to keep sun fading to a minimum.

Pest Control

Pest control in its most obvious form is a matter of a tight home. However, every home develops some cracks and fissures after years of use and minor settling of the foundation. Ground based termites and other insects can penetrate during these conditions. If your area has a history of ground-based insect infestations, you should chemically treat the soil of the home prior to and during the backfilling around the foundation. After the fact, chemical applications under the foundation can be costly depending on whether you have a crawl space or a basement. Since most survival homes have basements or concrete slabs, it usually involves core drilling and pumping chemicals under the slab and then filling the holes. In termite areas, care should be taken during swarming season to avoid penetration of flying termites into the inner structure of the home. Attics can be infested if screening around vents has deteriorated. Check these each year. Most other types of insects can be controlled with the topical application of safe, natural chemicals – either by spraying or through aerosol bombs. The best of the natural remedies for long-term freedom from pests is to sprinkle *diatomaceous earth* in the walls during construction. These minute particles of calcified sea life scrape the soft underbellies or are ingested by insects and block their internal functions. It is very effective and environmentally safe. It's also very cheap. Swimming pool supply houses have large quantities for sale since it is used as a filter media.

Water Control

Ground water control will be covered more extensively in the Underground Homes section of the Construction Types and Techniques chapter. The essentials are:

1. Stay out of the water table. Building in a "swimming pool" means having a specialty drainage system designed within the concrete basement to siphon off and eject water by a sump pump. The basement walls slow the passage of the water table so that the sump pump can handle the flow. It does no good to try to pump out a water table externally to the basement walls. The water flow will exceed your pumping capabilities. You should never take a chance by building in a water table problem area unless you have a gravity drain of sufficient size to lower the entire water table around your house. I once designed a basement in violation of these recommendations, but we had to use a continuous heavy duty rubberized membrane below the entire structure, including the footings. Thus, the finished unit was built almost like a swimming pool – to keep the water out.
2. Always build a perimeter drain, even if you don't think you will need one. Even heavy rains can temporarily raise a water table enough to do significant damage. Make sure the drainage system runs downhill and away from the home.
3. If you go to the trouble to waterproof the exterior of a basement, do it right. Pay special attention to the joints where the vertical walls meet the footings and where the inside slab is laid. Make sure you have enough coatings of flexible material to withstand the expansion of surface cracks.
4. In rainy country, always provide anti-percolation barriers around the perimeter to keep the ground around the basement from being rain-soaked next to the foundation.

Noise Control

Sound waves require a medium in which to travel. In this case I shall only mention briefly its effects in air. In the human environment we are primarily concerned with controlling noise through blocking or absorbing sound waves. Blocking involves using high density, heavy materials such as concrete walls to block the passage of the waves. Since concrete has a low vibration and compressibility factor, it will not transmit the vibrations of low frequency sound effectively. However, since concrete is fairly rigid and nonplastic, it will transmit certain high frequency sounds. Basement walls that have backfilled earth against one side are almost completely soundproof. It is always best to place some small amount of sound absorption material on the inside of the walls, in the room where the sound is coming from. Sound absorption material has many projections on it which deflect and absorb the waves coming from different directions, causing the wave to self-destruct in conflicting patterns. Soft, uniform material tends to cushion the shock of the incoming sound wave, thereby absorbing most of its shape. Thus, in its optimum form, soundproofing involves a dense masonry structure lined with soft foam-like material, covered with an irregular shaped surface for maximum sound absorption. Carpeting is such a surface. While this is not practical for most residential installations, it is the technique I would use for a pistol range or special security room requiring silencing.

Rarely is full soundproofing necessary for other residential functions. Privacy and freedom from the noises of children or music practice can be achieved by more modest noise reduction means. Having a good, plush carpet in the room is the best start. Carpeting can also be used as an accent wall covering for excellent sound absorption. Sound absorbing ceiling tiles are available for use on the ceiling as well, though they are not very attractive.

The main sound reduction technique is used in the construction of walls and ceilings. For walls, it is essential to use two different thicknesses of drywall material on either side of the wall. This reduces the sound resonance that occurs when one wall starts to vibrate at a frequency in unison with the other. For exterior walls, you can use double layers of sheetrock – one 5/8" layer followed by a 1/2" layer. This technique is very effective for interior partition walls as well. Using double stud construction in walls is a more costly but effective way of sound reduction. The studs are staggered on a wide bottom and top plate so that one wall of sheetrock is not attached to the same studs as the wall on the other side. Carpet foam can be woven between the studs or they can be filled with blown-in insulation for maximum sound deadening.

Remember that it does little good to go to the expense of building soundproof walls if you use a flimsy, hollow core door between the rooms. Use a solid wood door, and it must be fit tightly at the bottom with weather stripping for maximum sound trapping. Often this won't work if you have a forced air furnace system, since the air coming into each room needs an exit – usually under a wide gap in the door. At some extra expense, you usually can provide a return air duct inside any room you are planning to soundproof. Make sure that the furnace man uses sound-insulated ductwork throughout. Otherwise a person can be several rooms away and hear the sound from your room traveling through the ducts, like a microwave transmission tube.

Ceilings are more difficult to sound insulate since double ceiling construction techniques are very costly. Normally, I specify heavy padding and carpet on the floor above with double sheetrock on the ceiling below the floor, filling the joists with batts of insulation. A soft, resilient ceiling tile can also be applied on the ceiling of the room below to absorb sound, with the addition of a few sound absorption wall decorations to stop echoes. Shop noises in a basement are the hardest to handle. In addition to the foregoing, shop areas should have an insulated dropped ceiling below the regular ceiling.

Chapter

8

Construction Types and Techniques

In this section I will attempt to present the various choices available to you in building techniques and materials which will assist you in matching your secure design to the specific climate, terrain, and purpose of your structure. I will cover the following types:

- Solid wood construction (log, laminated wood)
- Standard wood frame construction
- Post and beam framework construction
- Masonry construction (brick, stone, formed concrete, cement block, hybrid types)

This particular section on types and techniques of construction covers the first series of design decisions you will have to make. I will primarily cover those construction types which I feel are most applicable in the residential context. Others which have been promoted as having great self-sufficiency utility, but which do not meet preparedness criteria or which may be too costly, will be covered in some detail as well.

My criteria for choice of construction design definitely has some leeway involved, primarily because some desirable aspects of design are partially contradictory of others. I will be using the following criteria:

- SURVIVABILITY (strength, endurance, indestructibility)
- UTILITY (keeps you warm in winter, cool in summer, shields from the elements)
- ECONOMY (ease of construction and maintenance, moderate cost of labor and materials)
- AVAILABILITY (Can you get to it? Is it convenient? Will the law allow it?)
- ENVIRONMENTALLY AESTHETIC (Does it fit the surroundings and your design preferences?)

Some of the conflicts inherent in these ideals are very obvious: The strongest construction may not be very economical or may be such a poor insulator that it can be almost unlivable. Highly aesthetic wood homes with high insulation may not be secure

against forced entry or projectile damage, and are very susceptible to destruction by fire. The earth-bermed or underground home may be environmentally friendly, but may present numerous waterproofing problems and design limitations inherent with subterranean design. Lastly, the most secure construction is rarely affordable except for the very wealthy. Don't be discouraged, however. There are suitable compromises to fit most people's situation and budget.

I will discuss the various types of construction in relation to these criteria, but more importantly, I will share with you some unique combinations of materials and techniques that can effectively overcome many of these conflicts.

SOLID WOOD CONSTRUCTION

Benefits

This type is perhaps the favorite of many preparedness people. Wood logs or laminated material is aesthetically beautiful, readily available, economical, and very strong. It is also relatively easy to work with for semi-skilled labor. But there are trade-offs and a few drawbacks about all solid wood homes which we should discuss.

Liabilities

First, and most importantly, wood is only a FAIR insulator (about one R-factor per inch of solid, dry, lightweight wood). One inch of rigid foam by comparison has an R-factor ranging from 5 to 7. Thus, log or laminated wood homes usually have R-values ranging from R-6 to R-12. Even an uninsulated wood framed house has an R-factor of 4. However, in actual practice, it has been my experience that there is considerable divergence between stated or calculated R-values and actual performance. A 4" laminated cedar-walled home will be much warmer than a non-insulated 4" framed home. This is because the hollow cavity with a 2x4 uninsulated wall will set up a flow of air inside the wall which reduces the still air R-value (4) down to less than R-2. In practice, the 4" solid or laminated cedar wall will perform very much like a 2x4 insulated frame house (about average).

Second, wood is flammable – but only moderately so in solid wood construction. Solid wood will ignite on the outside surface, but it takes a long time to burn through the interior portion. This is best exemplified by fire-resistance tests done on various beams, comparing wood and steel. In every case, the wood beams over 6" thick outperformed steel in a fire. The wood would char on the outside but still have enough protected wood inside to resist collapse. The steel beams simply sagged and gave way in the heat. Thus, solid wood is flammable, but resistant to a fast burn – allowing time to put the fire out.

Third, solid wood is highly resilient to stress, but is quite vulnerable to being cut with tools. It can be chopped, sawed, drilled, split, and generally penetrated with relative ease – taking more time as the thickness increases. A person with a chain saw can cut through a 4" solid wall with relative ease. Thus massive thickness, though formidable, is not a

completely foolproof deterrent to forced entry – and cost increases proportionally with thicker solid wood walls.

Fourth, some solid wood construction leaves much to be desired in the area of air infiltration. Splits in logs as they cure, cracks, and the weaknesses of both primitive and modern caulking compounds allow heat loss rates which may exceed the R-ratings of the actual members. It must be said, however, that all of the *laminated* wood homes have excellent quality control. Wooden members are milled so tightly that air infiltration is not a problem. The cracking and settling of green or air-dried logs in log homes continues to be a problem, although modern caulking compounds can seal up any cracks as they develop.

Fifth, and most problematic, is that it is difficult to internalize plumbing and wiring within the construction of solid wall homes. Although each manufacturer has designed new and improved methods to tackle this problem, there is still less flexibility and more labor involved in these types of construction. Most designers try to avoid using the outside walls for plumbing – either by putting all plumbing on the interior walls or by building plumbing into false walls inside of the exterior logs, covered by kitchen or laundry cabinets.

Do-it-Yourself Primitive Log Cabins

This pioneer construction method is chosen for some of the following reasons:

- Availability: the owner has land with an abundance of straight trees
- Economy: the owner has little money and the cabin can be built with his own labor
- Environmentally aesthetic: the owner likes the rustic look and wants to blend in
- Survivability: log cabin construction is massive and strong
- Privacy: a primitive log cabin can be built with relative secrecy, if necessary

Recommended Innovations for the Primitive Builder

If you want to do something almost totally with native materials, follow the basic pioneer formula. Dig a cellar and line it with stone. Build the stone walls in a tapering fashion, with double or triple stones at the base, rising to single or double wide stones at the top. Backfill and tamp with damp sand in the joints (between stones) as you go up, or if you can haul in and hand mix mortar, set the stones in mortar. After the stone wall is about 2 feet high, backfill and tamp with moist earth in layers on the outside of the stone, no deeper than 8” at a time. Pipe your spring or well into the cellar somewhere in the bottom half of the wall. If you hand dig a well, do it in the cellar, if possible. Bring the cellar walls above ground level at least 12” before laying down the split log floor, flat side up. Custom cut the bottom side as well where it lays on the stone foundation so that it fits solidly within the angles of the stone.

Build a separate fireplace foundation inside the log walls (to preserve the heat). You will have to use high temperature mortar and firebrick if you want it to last and not smoke.

Use matching stonework around the outside. Make sure there is both a layer of 2" firebrick and a layer of stone on the back wall where it contacts the logs. Don't fill the airspace or gaps between this log wall and the fireplace stone with mortar – let the air between logs and stone escape for cooling.

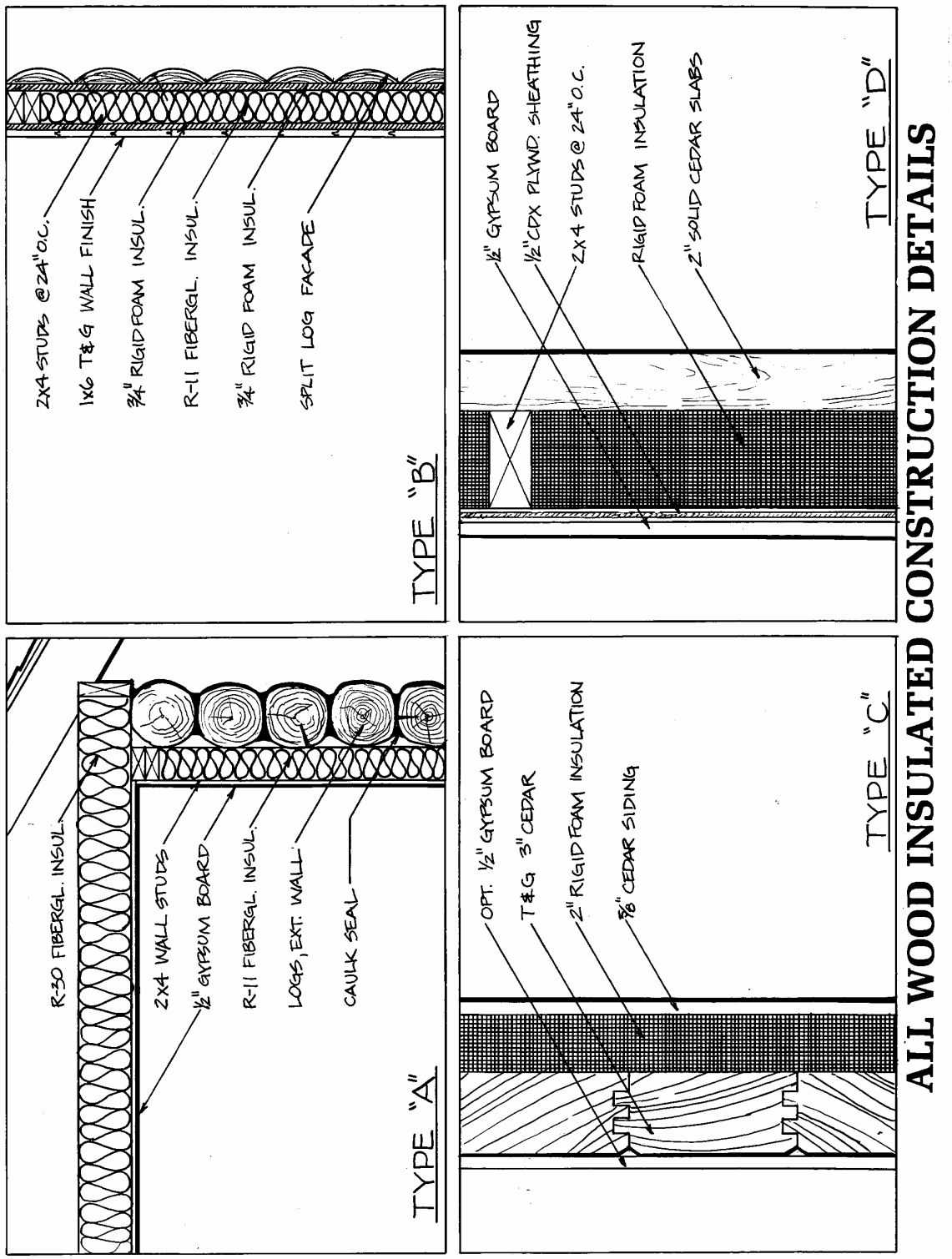
If you want a concealed cellar, you can either do a concealed trap door in your wood floor, or for a completely secret basement, build a log ceiling and support it on a stone ledge inside the overall stone foundation – but a little lower than the outside, visible stones. Chink the logs with stringy bark or dry moss mixed with mud. Let dry and then cover the log floor with dry sand and cover with flat stones set into the sand to make it look like there is no cellar at all. Make sure you place sufficient posts and beams below so that the stone-over-log floor will not bounce when you walk on it. Place your hidden trap entrance in a large closet or pantry.

If you leave this rustic cabin unattended for long periods, store all supplies and housewares down in the cellar, and either board up the cabin or leave it wide open. If you close it up, use acrylic window panes so they won't be broken out. If windows are vulnerable to being shot out anyway, hinge windows at the top, and swing them up and out of the way, attached to the ceiling, so that it appears as if the cabin is simply a rustic hunter's cabin without windows. Leave the door open and simply clean up any mess left by others when you come back.

Design Concepts for Modern, Factory Cut Log Homes

First, you need a basement for security and secrecy of certain storage items. Always plan on building a basement for your foundation if the ground conditions permit. When all the aspects are compared, I'd opt for a poured concrete basement, except where you might not have access to mixed concrete. In this case, I'd opt for block construction, or the treated wood foundation. One can build a basement from treated wood (usually 2x6 or 2x8 treated studs covered with 3/4 inch treated plywood). One must use only the best waterproofing membrane systems, which are not cheap. This type of basement is especially useful if you are contemplating a secret retreat, inaccessible by heavy equipment, and where you must haul water for construction. The all-wood foundation requires no water for construction, with the exception of the footings.

Second, we must improve the insulation factor for log homes that will be built in severe cold climate areas and which use logs less than 12" in diameter. Logs larger than 12" in diameter have sufficient insulation for moderately cold climates or for places where the



ALL WOOD INSULATED CONSTRUCTION DETAILS

winter cold rarely goes below 10 degrees Fahrenheit. Unfortunately, short of a split log construction system, either the exterior or interior rustic look has to be sacrificed for the sake of insulation. I prefer the interior in this case, since I like the fire-resistance of the gypsum wall surface inside. If we want the wood look inside, we can install T&G (tongue and groove) cedar or wood paneling or even log siding over the sheetrock.

As illustrated in detail A, the most efficient way to achieve "superinsulation" in a log home is to build a separate interior stud wall of either 2x2 or 2x4 material (depending on how much insulated space your climate requires). This method will produce walls with R-values in excess of R-20. What's more, the solid logs on the outside of the insulation barrier diminish the conduction of cold and act as a heat sink barrier during warm weather.

Type B is a nearly conventional type wall with rigid insulation on the outside covered with log slabs, like siding. This offers a log look but at much cheaper cost than full logs, and better insulation, too. Log purists would revolt at such an idea, but it is practical. Tongue and groove cedar can be used as the inside paneling for a beautiful effect. Its only advantage over type A is cost since the log slabs serve the identical purpose as siding.

Type C (severe cold climate modification) is the modern tongue and groove (T&G) or laminated cedar home that is very popular for vacation cabins and homes. This details the addition of extra insulation on the exterior for severe cold climates. Air infiltration is usually not too much of a problem with a nicely milled cedar T&G home, but it is with some of the rough sawn, poor quality slabs. Where the joints are not airtight, you must use an adhesive to seal each joint as the walls is being built up, or you must install large 4x8 rigid foam panels to the interiors or exterior in cold climates to improve insulation and air sealing (see type D). Interior paneling can then be nailed through the insulation into the slabs, or onto 2x4 framing on 24 inch centers. The sheetrock noted on the interior side of the cedar walls is only an option necessary for fireproofing in certain areas of the home. Usually, you would not cover up the beauty of a cedar interior wall in this manner. Use additional insulation of 3" rigid foam on the roof under shingles. Do not accept the conventional fiberboard insulation normally used on solid decking roofs. The R-value is only about half that of rigid foam. There are special foam insulation panels with integral OSB sheathing that are the best to use on roofs requiring solid foam insulation.

Third, design walls with system concealment in mind. Log homes and cedar homes share the same difficulties involved with the installation of plumbing and heating. The walls aren't hollow or thick enough to conceal a 4" plumbing vent/drain. Heating ducts cannot be run between rafters, and the electrical wiring has to be run either in pre-drilled holes or internally along baseboards.

All this places some limits on the designer, since the preparedness home has many security and heating features that require a lot of low and high voltage wiring. Cedar home stock plan designers usually place most of the facilities in such a way that the wiring and plumbing run inside interior walls. While this is perfectly acceptable in the conventional home, it does present a few more difficulties in a complex, self-sufficiency home which has multiple mechanical and electrical facilities.

Conclusions

By the time we are through "survivalizing" the all-wood home, the economical factor is usually not as great as solid wood home builders claim. This isn't their fault – we simply need a higher level of environmental control and must pay extra to get it. There is no one type of construction that will magically provide all the features and savings you need in the preparedness context. Quality and strength are never cheap. This is not to say that one type doesn't have advantages over another. But in terms of cost, the best all-around construction is a LAYERED CONSTRUCTION, using the best of different types – not any single material by itself. I hope you will become adjusted to, and convinced of, the correctness of this concept as we continue to analyze other construction types.

WOOD FRAME CONSTRUCTION

Overview

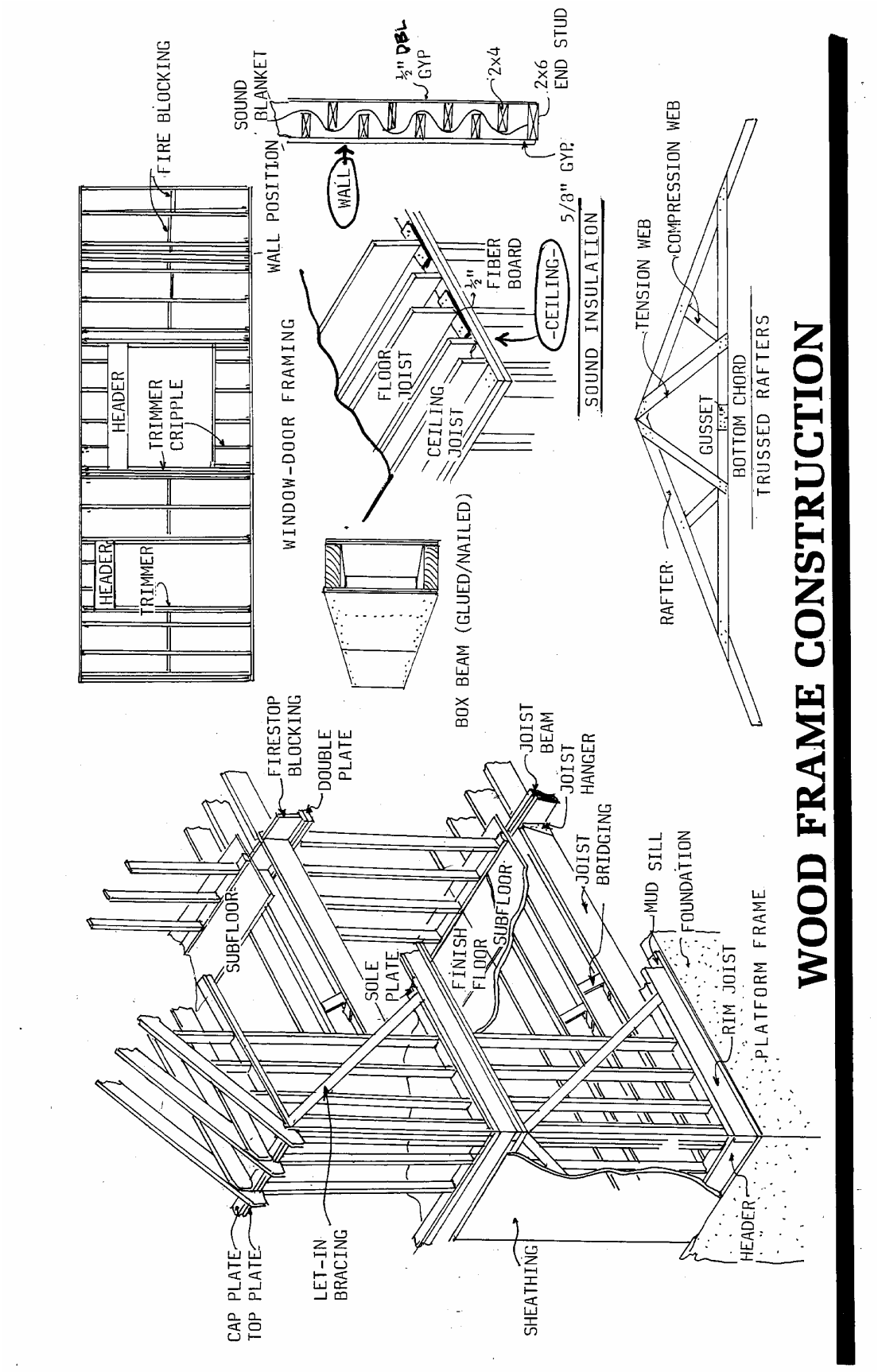
Conventional wood frame construction consists of 2x4 or 2x6 dimensional lumber on 16" or 24" centers forming a skeleton framework on which all interior and exterior materials are attached. It was primarily developed to conserve the quantity of wood necessary to build a home and thereby decrease its cost. I heartily endorse this conservation, although we must realize that frame construction has inherent security weaknesses. But all things considered, this type is the most easily adaptable to insulation, concealed plumbing, heating, and wiring with only minor changes.

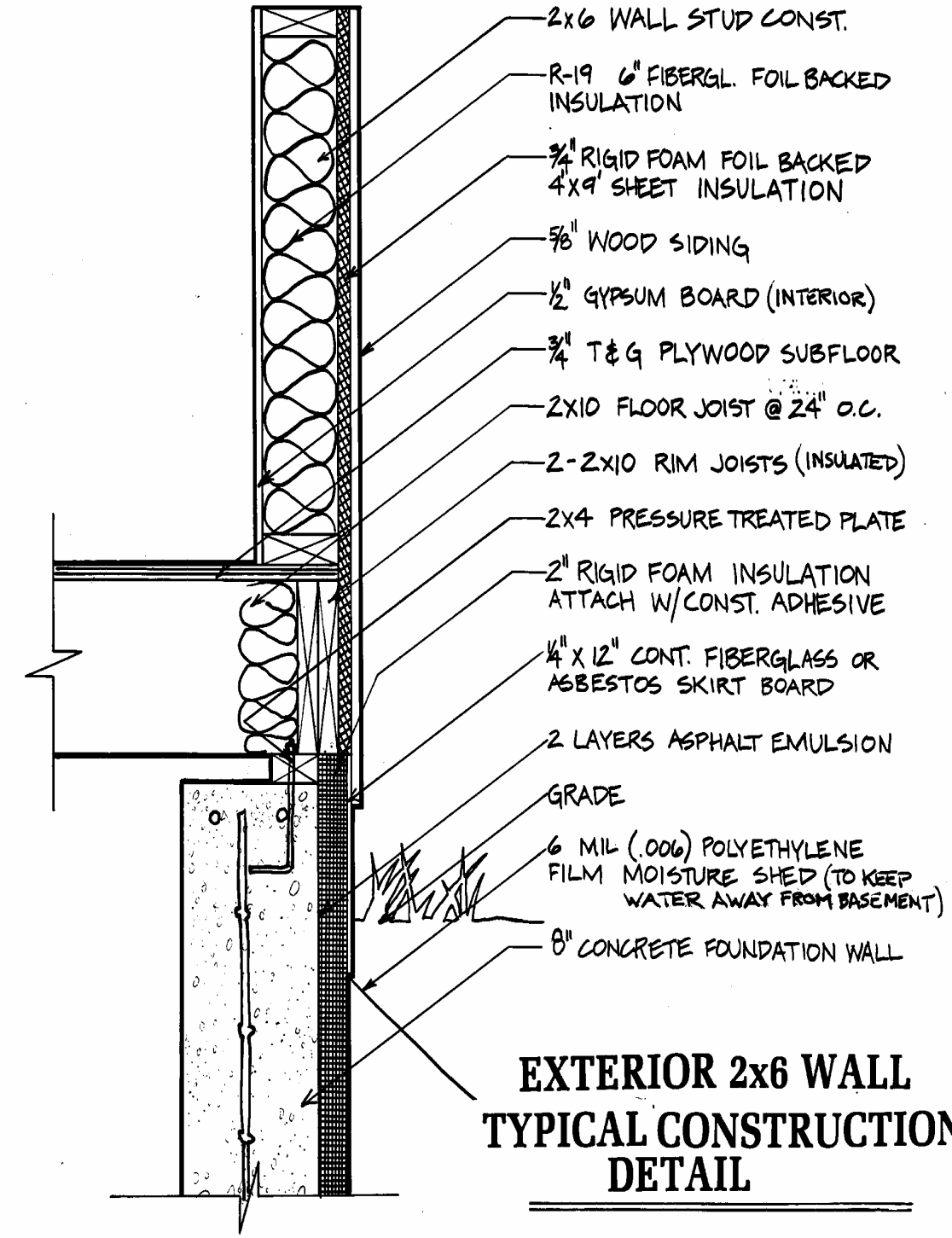
Benefits

Frame construction is lightweight and flexible, which lends itself to surviving an earthquake better than most other construction types. It has many hollow cavities for improved insulation. Even without insulation, each enclosed space of air offers another R-factor to your total heat transfer resistance. This type of construction is also very cost effective for either the do-it-yourself owner/builder or the professional to build. It is adaptable to almost every conceivable type of interior and exterior wall treatment. It is also the easiest to conceal plumbing and electrical materials.

Liabilities

Frame construction is only moderate in strength. It is highly subject to flexing under lateral stresses, which is a benefit in an earthquake, but only as long as the shear forces do not exceed the attachment limits. The stress limits are fairly low in wood, so under severe quaking, they will begin to fall apart. Framed structures have many joints, leading to air infiltration problems if not sealed. Most framing materials are only moderately durable and have only moderate heat retention capacity.


WOOD FRAME CONSTRUCTION
FIRE BLOCKING
HEADER
TRIMMER CRIPPLE
HEADER
TRIMMER
WINDOW-DOOR FRAMING
SOUND BLANKET
WALL POSITION
WALL
½" DBL GYP
2x4
2x6 END STUD
5/8" GYP
SOUND INSULATION
CEILING
½" FIBER BOARD
FLOOR JOIST
CEILING JOIST
BOX BEAM (GLUED/NAILED)
TENSION WEB
COMPRESSION WEB
RAFTER
GUSSET
BOTTOM CHORD
TRUSSED RAFTERS
FIRESTOP BLOCKING
DOUBLE PLATE
JOIST BEAM
JOIST HANGER
JOIST BRIDGING
SUBFLOOR
SOLE PLATE
FINISH FLOOR
SUBFLOOR
MUD SILL
FOUNDATION
RIM JOIST
PLATFORM FRAME
CAP PLATE
TOP PLATE
LET-IN BRACING
SHEATHING
HEADER



EXTERIOR 2x6 WALL TYPICAL CONSTRUCTION DETAIL

Recommended Improvements and Innovations

2X6 CONSTRUCTION PLUS RIGID FOAM INSULATION: In most cold climate homes using single wall construction, I recommend that 2x6 dimensional lumber be used on 24 inch centers rather than 2x4 on 16 inch centers. The reasoning is simple. Since wood is only a fair insulator, each wall stud (as the vertical framing members are called) prohibits proper insulation of the space it is occupying, however small. Infrared photography (film exposed to heat rather than light) of conventional framed homes reveals the position of every framing member, indicating the heat loss emanating from these areas. By using larger, stronger lumber, the number of studs can be reduced through wider spacing. Additionally, thicker insulation can be used in a 2x6 wall (5-1/2" fiberglass batts with an R-19 rating).

But the wider spacing only solves about 10% of the stud leakage problem. The studs, being relatively solid conductors of heat, act like a "heat sink" drawing heat from the gypsum board, *bypassing the insulation,* and radiating it to the exterior siding. A total thermal break between studs and exterior siding is therefore needed to solve the problem. Thus, I recommend that 1" of rigid foam insulation be stapled over the entire framework before applying the outer paneling. In fact, 2x4 walls with exterior foam sheathing will out-perform 2x6 stud insulated walls without the foam. Multiple metal sway bracing is necessary when using rigid foam since the foam board does not have the attachment rigidity of plywood sheathing. Simpson metal strapping on all exterior walls is the easiest and most effective way to solve the problem. However, in earthquake-rated areas, I recommend full plywood sheathing be attached to the studs, followed by the foam board (see illustration).

Earthquake Design

While I am not in favor of earthquake codes mandated by government, I am in favor of voluntary encouragement of earthquake resistant design. Serious structural reinforcement does cost money, so I will recommend a few measures that I feel are the most cost effective for the strength derived. I recommend that every home be built with earthquake strapping embedded into the foundation around the house. These straps, made by Simpson and others, are placed in the concrete as the basement or foundation slab is poured. They protrude from the foundation walls on the outside edge and are thus in position to be attached with numerous shear proof nails to the outside of the wood-framed structure. They only cost about $10 each, so use them every 10 or 12 feet around the house. They are much more effective than foundation bolts for holding power.

In addition, I will recommend two other very effective techniques. First, have your builder put on sheathing that overlaps from one floor to another. This will keep a multi-story home from separating in a quake or tornado. In addition, have him strap the home with kevlar webbing. This new material (also used in bulletproof vests) is many times stronger than steel. When used to bind the house from foundation, over the roof in several places, and back down to the foundation straps, the house is permanently anchored. In addition, several cross straps should be nailed diagonally around the house to keep sway under control. See the "Equipment and Sources" section for details.

Super Insulation vs. the Envelope Home

Frame construction lends itself best to superinsulation, when no thermal mass is used. As illustrated in the Double Wall construction detail, superinsulation is achieved by completely separate interior and exterior support walls. This development was in some ways a “fix” for the much touted “envelope” homes which had earth or solar heated air circulating around the double walled shell of the home. There were some serious liabilities with the air space, one of which was fire danger. The building codes got involved and required fire dampers be installed at considerable cost, or that both interior surfaces of the air chamber had to be covered with type X gypsum board at even greater expense. Suddenly the inexpensive proposal became too high priced – thanks to regulation.

For all the benefits of air circulation, the same results in energy conservation were finally achieved by simply filling the whole cavity with fluffy, loose-fill insulation. Other combinations in fiberglass and foam insulation are possible for filling the void as well.

Insulated Headers

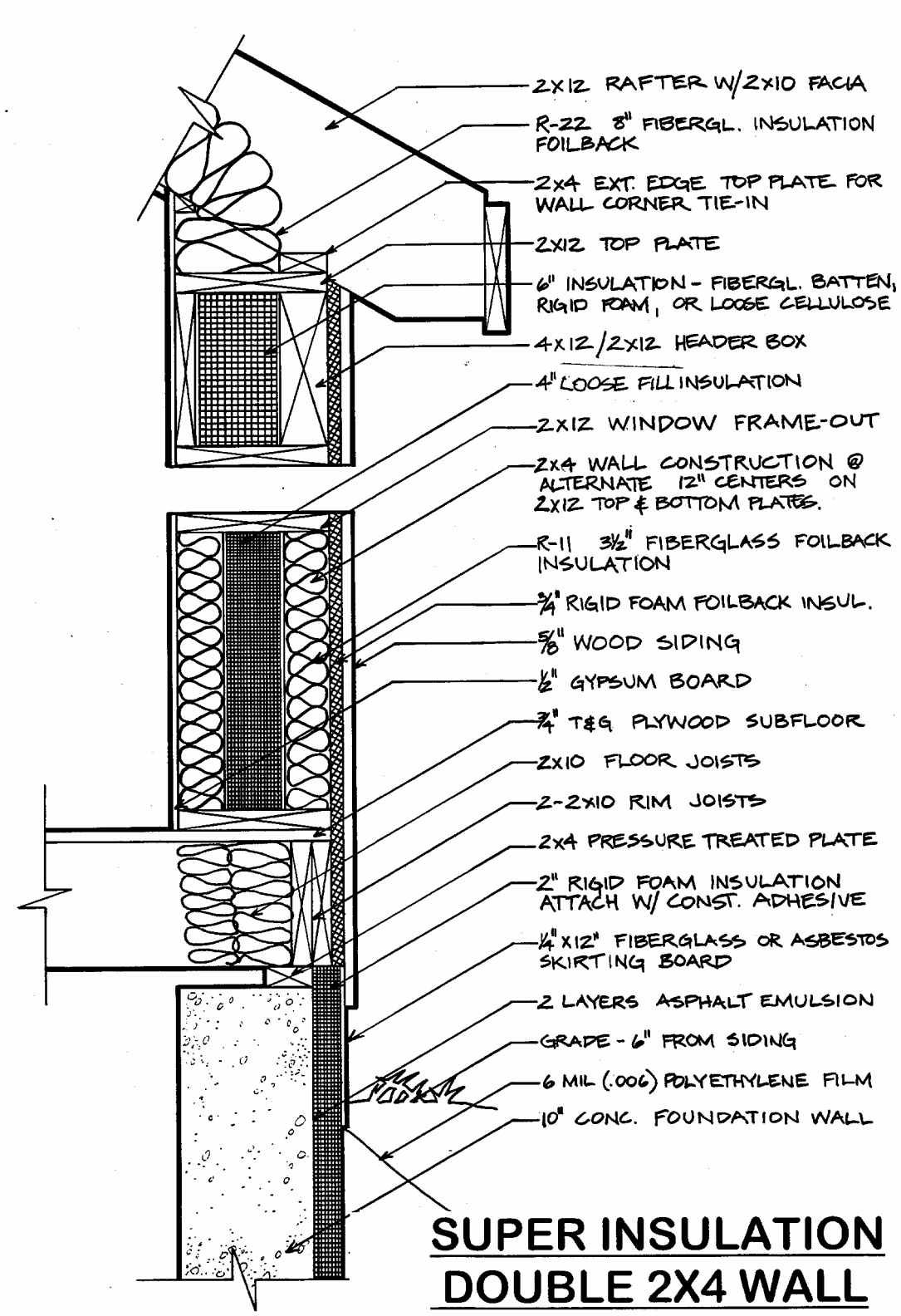
Frame construction, whether conventional or super-insulated, requires “headers” over windows and doors, which are 2x6, 2x8, or 2x10 lumber set on edge in order to support the extra roof weight above windows and doors. Most builders now use short sections of glulam beams, cut to size. These headers, when made of solid wood, allow some loss of heat and should be redesigned as a “box beam” (see Double Wall detail) so they can be insulated properly. In areas where restrictive building codes prohibit box beams (usually caused by somebody building one improperly) you should use 2x6 construction which will allow you about an inch for insulation between the two pieces of 2x6 header members. A 12 inch wide super-insulated wall provides at least 8 inches of insulated space in the headers.

Better Utility Placement

All electrical wiring should be drilled and passed through the bottom of each stud instead of the indiscriminate middle placement as usual. In this way, when fiberglass batts are placed in the cavities, they are not compressed by bulky wiring, which would cause them to loose some of their insulative value. A conscientious installer will deal with mid-placed wiring by cutting through half of the insulation so that the wire can be worked into the middle. Plumbing vents and drains should always be located in 2x6 inch walls so that it can be sound deadened with solid foam or tightly packed fiberglass batts.

Vapor Barriers Throughout

To inhibit moisture penetration of interior walls, you should always plan on covering these framed walls with a complete film of plastic (on the inside) to keep moist, indoor air from condensing onto the structural members of the home. Also plan on covering the


2X12 RAFTER W/2X10 FACIA
R-22 8" FIBERGL. INSULATION FOILBACK
2X4 EXT. EDGE TOP PLATE FOR WALL CORNER TIE-IN
2X12 TOP PLATE
6" INSULATION - FIBERGL. BATTEN, RIGID FOAM, OR LOOSE CELLULOSE
4X12/2X12 HEADER BOX
4" LOOSE FILL INSULATION
2X12 WINDOW FRAME-OUT
2X4 WALL CONSTRUCTION @ ALTERNATE 12" CENTERS ON 2X12 TOP & BOTTOM PLATES.
R-11 3½" FIBERGLASS FOILBACK INSULATION
¾" RIGID FOAM FOILBACK INSUL.
⅝" WOOD SIDING
½" GYPSUM BOARD
¾" T&G PLYWOOD SUBFLOOR
2X10 FLOOR JOISTS
2-2X10 RIM JOISTS
2X4 PRESSURE TREATED PLATE
2" RIGID FOAM INSULATION ATTACH W/ CONST. ADHESIVE
¼" X12" FIBERGLASS OR ASBESTOS SKIRTING BOARD
2 LAYERS ASPHALT EMULSION
GRADE - 6" FROM SIDING
6 MIL (.006) POLYETHYLENE FILM
10" CONC. FOUNDATION WALL
SUPER INSULATION
DOUBLE 2X4 WALL

total interior (excluding floor) with gypsum wall board (sheetrock) to make the interior fire-resistant. Vapor barrier sheetrock is also available. If you do not want the sheetrock look, panel over the gypsum with cedar strips, wood paneling, or even stucco in combination with other materials.

Fire Resistant Construction

In a fire, furnishings can burn to ashes without causing the rest of the home to catch on fire if the room is walled with Type X sheetrock. It isn't completely fireproof, but it has a "sloughing action" which keeps the fire away from the wood framing for as long as an hour – a considerable safety margin even when fire equipment may be many miles away.

Even when using paneling and interior wood finishes, I recommend installing drywall first for fire protection. The sheetrock only requires an initial taping and thus is not of significant additional expense. Make sure wood-framed chases for metal chimneys are lined with sheetrock as well, in case the metal lining should deteriorate or become overheated.

There is also a relatively new type of plaster that has been developed that is totally fireproof. It is applied with fireproof insulated panels and covered with a Stucco-like coating. If you want a conventional and smooth surface interior wall, nail up the fireproof panels and then cover them with sheetrock. See the "Equipment and Sources" section for details.

Soffit Design to House Shutter Mechanism

(See illustrations on rolling shutters, pages 286-289, in the Security chapter.) Rolling shutters are currently made in both metal and PVC plastic. Both are expensive, costing over $1000 per window, counting installation. They can be driven electrically or by manual chain or woven straps. None of the rolling shutters provide bulletproofing, but they do make it very difficult to break, damage, or enter windows that are so protected.

Shutters take up considerable space when rolled up. The storage area for the rolled up shutter can be accommodated inside or outside the wall, either in a metal enclosure or within a soffit. Soffits are the exterior visible coverings connecting the eaves to the house structure. We can make use of the hollow cavities between soffit and rafters by applying screened vents for roof ventilation and also to house concealed shutters as illustrated. The shutter roll size depends upon the size of window that is being protected. If you decide to use shutters to protect windows, make sure that the soffit will accommodate the size of shutter you will install (the manufacturer's specifications will have the information you require).

Shutters are the features that clients most often fail to install because of their expense. While this is an acceptable, temporary compromise, do not make the irreversible error of not having big enough eaves for future shutter placement. All shutter manufacturers provide ready-made metal covers for the external mounting of shutters, such as on walls without an eave overhead. These are quite attractive, but not as secure as placement in the soffit chambers. Some contemporary styles will allow us to design small

architectural eyebrows over windows to serve as sun shields and also to house shutter rolls.

Sound Insulation

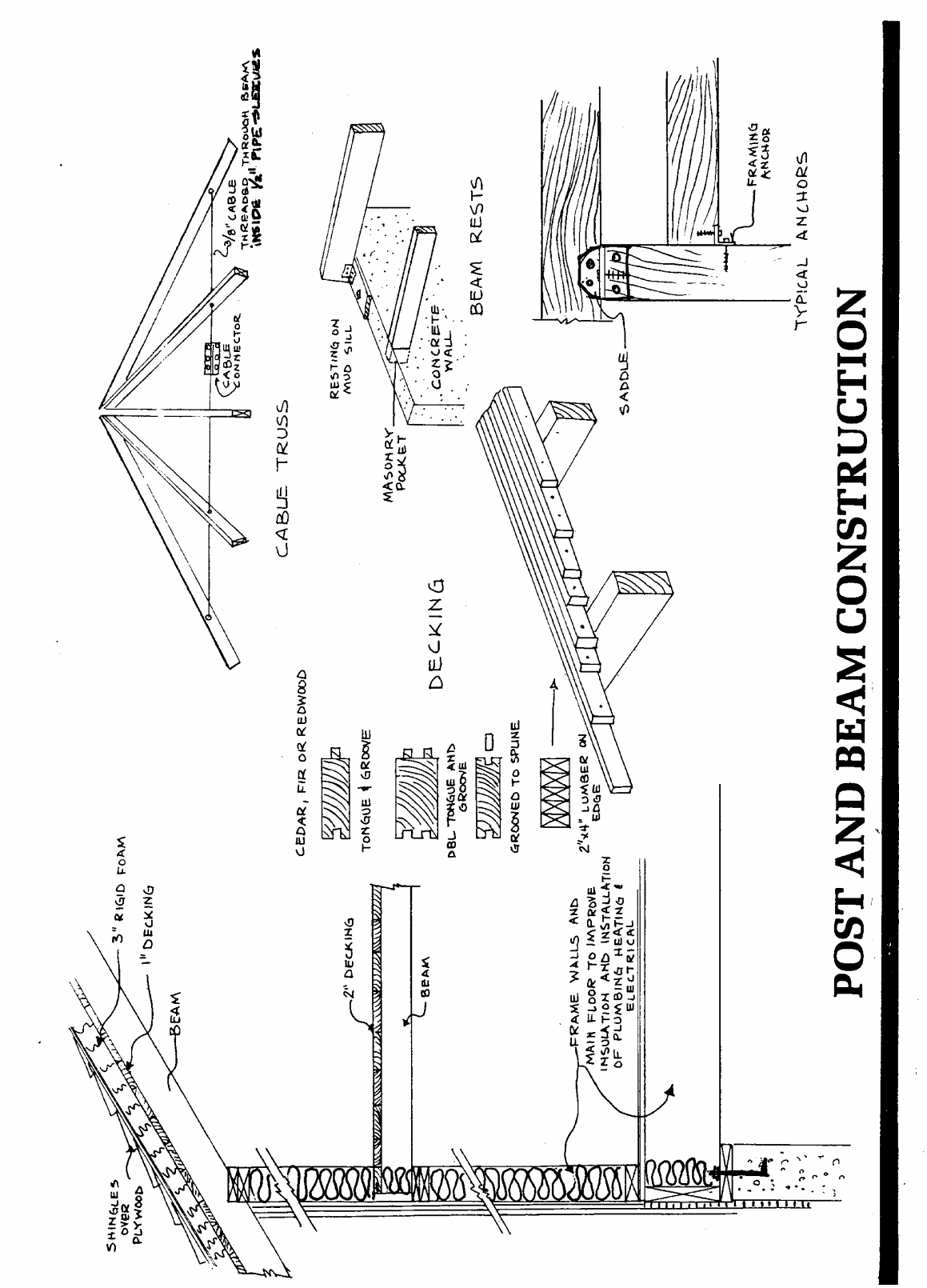
Sound insulation is achieved on interior frame walls by a variety of methods. One of the most effective is to make sure that the interior and exterior wall surfaces are not touching the same framing studs. This can be done by installing 2x4 studs on a 6 inch plate. The vertical studs are placed on alternating sides of the 2x6 plate at 12" on center (shown on the previous Wood Framing drawing). The end result is that each side of the wall has only one half of the total number of studs to attach to – at 24 inches on center. This leaves approximately a 1-1/2 inch space around one side of each stud. The wall then acts as two separate walls when sheetrock is applied to each side. For extra sound insulation (almost soundproof) one should use different thickness of sheetrock on opposing sides of the wall, or even use double sheetrock. For example, on one side you can put 5/8" sheetrock and then on the other side two layers of 1/2" sheetrock. These different thickness stop resonant vibrations from passing from one wall to another. Additional soundproofing can be achieved by threading fiberglass insulation or heavy carpet foam padding between these separated walls. The ceiling should have fiberglass insulation batts in the cavity, then a layer of fiberboard attached first to each joist (to cushion the vibration of the sound resonating in the ceiling gypsum board). Acoustical tile can be added to the gypsum board if it fits the decor. Interior sound absorption can be added to the room by carpeting a wall, which is particularly effective on high frequency sounds.

POST, BEAM, AND DECKING DESIGN

Posts and Beams

Post and Beam construction allows you to achieve a very rustic look when leaving the large posts and beams exposed. Most commonly, Tongue and Groove (T&G) decking is used on all floors and ceilings leaving a woodsy plank look. Vertical walls between posts are walled in with either framed wall sections or some of the modern pre-fabricated insulated panels. The new breed of pre-fabricated panelized house is pre-cut and comes to the site ready to assemble.

The minimum size support post is normally a 4x4, though the actual size is determined by a combination of the size of beam it is supporting, the weight of the load, and the height of the post (thickness to length ratio). For aesthetics in a house with post and beam construction, the minimal post size will be 6x6; 4x4 posts are not appropriate for placing within walls. Normally the width of the post should be equal to the width of the beam it supports. Where the joint of two beams rests on a single post, you should allow for at least two inches of post end surface for each beam end. The bearing area of the post can be increased by adding a bearing block on the top or sides of the post. Appropriate metal ties, straps, and anchors should be used to prevent slipping when normal shrinkage occurs, and during possible earthquakes.


POST AND BEAM CONSTRUCTION
CABLE TRUSS
3/8" CABLE THREADED THROUGH BEAM INSIDE 1/2" PIPE SLEEVES
CABLE CONNECTOR
BEAM RESTS
RESTING ON MUD SILL
CONCRETE WALL
MASONRY POCKET
SADDLE
FRAMING ANCHOR
TYPICAL ANCHORS
DECKING
CEDAR, FIR OR REDWOOD
TONGUE & GROOVE
DBL TONGUE AND GROOVE
GROOVED TO SPLINE
2"x4" LUMBER ON EDGE
3" RIGID FOAM
1" DECKING
BEAM
SHINGLES OVER PLYWOOD
2" DECKING
BEAM
FRAME WALLS AND MAIN FLOOR TO IMPROVE INSULATION AND INSTALLATION OF PLUMBING HEATING & ELECTRICAL

When setting beams into masonry walls which have had special pockets formed to hold them, it is imperative to keep the wood from directly contacting the masonry to avoid picking up moisture and inducing dry rot. A metal or treated wood insulating sill over building paper is normally used to protect the beam. Beams resting on wood can be made immobile by inserting simply a double-punched piece of sheet metal in between, or by using a side-mounted metal connector plate. The metal protrusions on either side of the nail plate effectively prohibit slippage between the two members. The size of posts in building codes is controlled by the slenderness ratio which is the length of the post divided by its smallest width. This ratio should be no more than 30. For example, a 4x4 would be permitted to be 10' long (120") with a ratio of 30. The spacing of the post is determined by the length of the allowable span of the beam which will be resting on the post. The spacing of the beams will be determined by the allowable span of the decking or floor system placed upon it, plus the calculated load to be carried by the floor or roof.

Now, all of this may sound like it is going to get complicated, but it isn't. The technical calculations have all been worked out over many years of testing. Even architects and engineers do not usually perform calculations, unless the materials they plan to use are new or not listed in the appropriate reference works. The bibliography lists the books which you will need to consult to find the various design factors. These are called "load tables" or "span tables" and are readily available in all large public libraries under the engineering science or building codes reference sections. There are various tables contained therein which will tell you the maximum spans for beams and decking.

Structural Loads Design Terminology

There is some terminology which you should be familiar with in order to choose the correct data. The loads imposed on these spans are either "live" or "dead" loads as to their effect on stress. *Dead loads* refer to the actual weight of the materials constituting the supporting structure. *Live loads* refer to the additional weight supported by the structural members such as people, snow, or high winds. Live and dead loads must be added together to give you the total load to use on the span table or loading tables. These live loads may be either *uniform* or *non-uniform*. A uniform load is one which is evenly distributed over the entire support surface. This is the optimum situation and allows for a higher length of spans. The heavy loads may be partially above a beam or might be fully loaded on decking between two beams. Due to live load uncertainty (such loads are never constant), lower span values are given to provide for a safety factor. These loads are usually given in units of 20, 30, or 40 PSF (pounds per square foot) and constitute the maximum design load. In most cases engineers always use the higher numbers on the tables, so as to be on the safe side. You probably should as well, except where it is going to make a big difference in cost of the structural members. The tables also give you substitution choices (such as size, spacing, and type of lumber – fir, cedar, hemlock, or pine – the common dimensional woods).

For example, if you have a floor span that is pushing the limits of the span tables where the joists are on 24" centers, you can stiffen the floor's resistance to the bounce (*deflection*) by going to 16" centers or even 12" centers. Or you can switch to fir members instead of pine, since fir is stiffer and stronger. This is often very useful when you are faced with the possibility of having to use a deeper floor joist over a particularly

long span, and this will cause the floor in this area to be different from the rest of the floor. So instead of choosing a deeper floor joist, just put the regular-sized joists closer together and you can satisfy the beam table without having to deal with the complexity of different joist depths.

Beam tables will give you choices of solid beams of various woods and laminated beams of mostly fir. Other specialty beams such as web beams (TJI), wood metal truss beams, and others have now become the standard in even residential construction, and tables are available to help you design floors and roof structures with them.

Tongue and groove decking (T&G) is usually available in either fir or western red cedar. I prefer cedar as to resiliency, strength, and insulation value, but it is about 20% more expensive than fir. Most decking comes with tongue and groove edge joints, which helps the individual boards act as a single wood structure even when you use boards that don't extend all the way to the cross supports (you must stagger the joints so that two of the decking joints are at least 3 feet away from each other). Variations of this are double tongue and groove or the groove and spline. Homemade decking may be made from 2x4 material by nailing it together flat side to flat side. Care should be taken, as in all decking, to stagger the joints so that weak spots are avoided.

Benefits and Liabilities

Post and beam construction substitutes the strength of fewer but larger sized timbers for the close spacing of numerous supporting studs found in frame construction. This allows for far more beauty when structural members are left exposed. For this reason, you must not simply order materials and leave it up to the yard man at the local lumber dealer to select your wood. Large posts and beams can sometimes be very unsightly due to weathering or watermarks if left outside or uncovered. I always recommend you hand pick your expensive timber and then watch it being loaded and unloaded so that it doesn't arrive in poor condition. Don't worry about special order shipments from the big mills. The grading and selection is carefully done to meet your order, and special wrapping is used in shipping to protect the appearance of the wood. Even so, make sure it doesn't sit outside at the lumber yard too long before you take delivery.

Post and beam construction has its limitations as well as its points of beauty and strength. Floors are often done utilizing T&G decking which are intended for uniform loads. Extra support members have to be included where excessively heavy equipment or furniture might be placed. Insulation is a problem as is electrical wiring and plumbing, since there are no hollow spaces in between construction components.

Recommended Innovations

There are several ways to overcome these liabilities. First, I like to use a combination of beam and decking with conventional exterior wall framing, so as to achieve the look of fine timber or beams and have good insulation as well. Instead of using solid lumber boards between the exterior posts and beams, fill the spaces with 2x4 or 2x6 framing and insulate as normal. No double top plate is necessary as the post and beam construction provides for top rigidity. As an alternative, you can frame the exterior with traditional

framing and use posts and beams only as the interior support structure. This makes for a high R-value exterior wall. The newest method, as mentioned previously, is to fill the wall spaces with factory made insulated panels. These come in thickness ranging from 4 to 12 inches thick and have structural OSB sheathing bonded to a foam interior. The panels never warp, and are strong enough to use as structural elements. One of their best features is the ability to span long distances on roof structures and provide built-in insulation as well. With sheathing on both sides of the foam, attaching interior and exterior finish materials is a snap.

As in all previous types of construction, I recommend you begin with a full basement, which also provides your foundation. Since the basement areas are largely storage or utility areas, there is no need to put in a decorative beam and decking ceiling. By using a normal, dimensional lumber or truss joist floor, there is ample hollow space for installation of plumbing, electrical, and some heat ducts. Floor trusses are preferable for all large houses. Dimensional lumber in long lengths tends to flex more than floor trusses. Even better, floor trusses have large spaces in between the triangular braces through which we can run plumbing and heating ducts. Thus, we are not restricted to running ducts only parallel with the joists, as in dimensional lumber.

Second, the upper ceiling, whether for the roof or a second floor, can be done with beams and decking in areas where the open beam is most effective. As bathrooms are usually located on all floors and sometimes arranged so that they are located vertically above another, it is best to maintain conventional floor joists in these areas to accommodate plumbing in the hollow floor/ceiling. When you must hang a light fixture under a T&G floor, you must either surface mount the wires in a decorative raceway or build up a false floor on top to allow for the wire runs. This is simply done by nailing down 1x2 furring strips on the floor, running the wire to the light fixture and then covering the floor with plywood and other finish flooring materials. This is the preferred method when installing carpet on the top side of a decked floor. This does not usually interfere with the rustic decor since T&G decking is most often appreciated on the *underside* (or ceiling of the lower floor). The upper surface of T&G decking is often not sanded and is not intended as a finished floor.

Third, use a high insulation roof over roof decking. When decking is used on the final roof/ceiling, there are a couple of ways to overcome the difficulties in achieving high R-ratings for insulation. Normally, a very low quality fiberboard insulation is used for decking insulation. This I regard as unacceptable due to its low R-rating and its loss of R-value if it ever gets wet through a leak in the roof. Rigid foam with an R-rating of 6 or 7 per inch is highly acceptable, and I prefer a depth of at least 4” of insulation as the minimum. This, combined with the cedar or fir decking, plus shake roof, will give a total R-value of about 28. With greater thickness, it becomes difficult to find suitable fastening systems with long enough connections to penetrate the final sheathing and insulation into the solid decking beneath. With 4 inches of solid foam, both foam and the sheathing should be laid with perimeter gluing first. The corners of the 4x8 sheathing can then be drilled and nailed or screwed with a 3-1/2” fastener, which will secure it in place while the waterproof mastic or glue sets. Then the asphalt/felt and shingling material is attached normally to the sheathing by regular roofing nails.

There are also several commercial insulation products available on the market with particle board (OSB) sheathing already attached, as a nail base for the shingles. These insulation panels can be applied in successive layers since there exists an intermediate nailing surface. Be sure to glue between layers. This also has the advantage of almost completely eliminating any insulation bypass through mechanical fasteners. Without the use of this sandwich insulation material, it is necessary to build a separate roof above the decking, in order to achieve roof R-values in excess of 30. This is done with 2x8 joists set on 24" centers and then covered with 5/8" or 3/4" plywood sheathing. The hollow cavity is then partially filled with fiberglass batts (prior to sheathing insulation), being sure to leave room for air venting of the upper portion. After the sheathing, one inch of rigid foam is laid down to overcome the heat loss associated with the rafters. The overall effect is an R-30 ceiling. However, the sandwich system of built up rigid foam on OSB is the most cost effective since much less labor is involved.

MASONRY CONSTRUCTION

Overview

For our discussion here, we will include all earth, stone, and concrete substances under the term "masonry" since they all require a type of mason's skill in construction. This will include earth, adobe, earth/cement, clay brick, concrete brick, cement tile, block-formed concrete (standard and lightweight), and stone. While space does not permit a complete "how to" guide to actual construction with these mediums, we will discuss the design details you must be aware of, as well as their various strengths and limitations.

Benefits and Liabilities

In general, all masonry materials are very massive and dense. This lends itself to the erroneous conclusion that they are the perfect building materials – far from it. While there are many strengths, there are probably more liabilities. In terms of utility, these materials are heavy and strong. But it is not a resilient type of strength, such as found in wood, which will give a lot before breaking. Masonry materials are far less "plastic" and tend to only resist slow inertial movements. Rapid thrusts cause shattering and cracking. The danger involved in living in dense structures undergoing collapse is readily apparent from the history of earthquakes. Concrete block buildings in Central American countries tend to collapse upon the inhabitants in a heap of rubble, especially when the ceilings are made of cement block materials with little reinforcement.

As to insulation value, all masonry products rate very poorly. I object to the claims made about adobe or the new lightweight aggregate concrete as "good insulators." They may be good in comparison to other dense stone or standard concrete, but at best they don't even approach wood without some form of external or internal insulation. So beware of false claims which compare a product to a poor standard. This is one reason why it is important to get used to R-value terminology, which puts every product on the same scale. Even that doesn't tell the whole story since many insulators become less effective as the temperature of the material decreases.

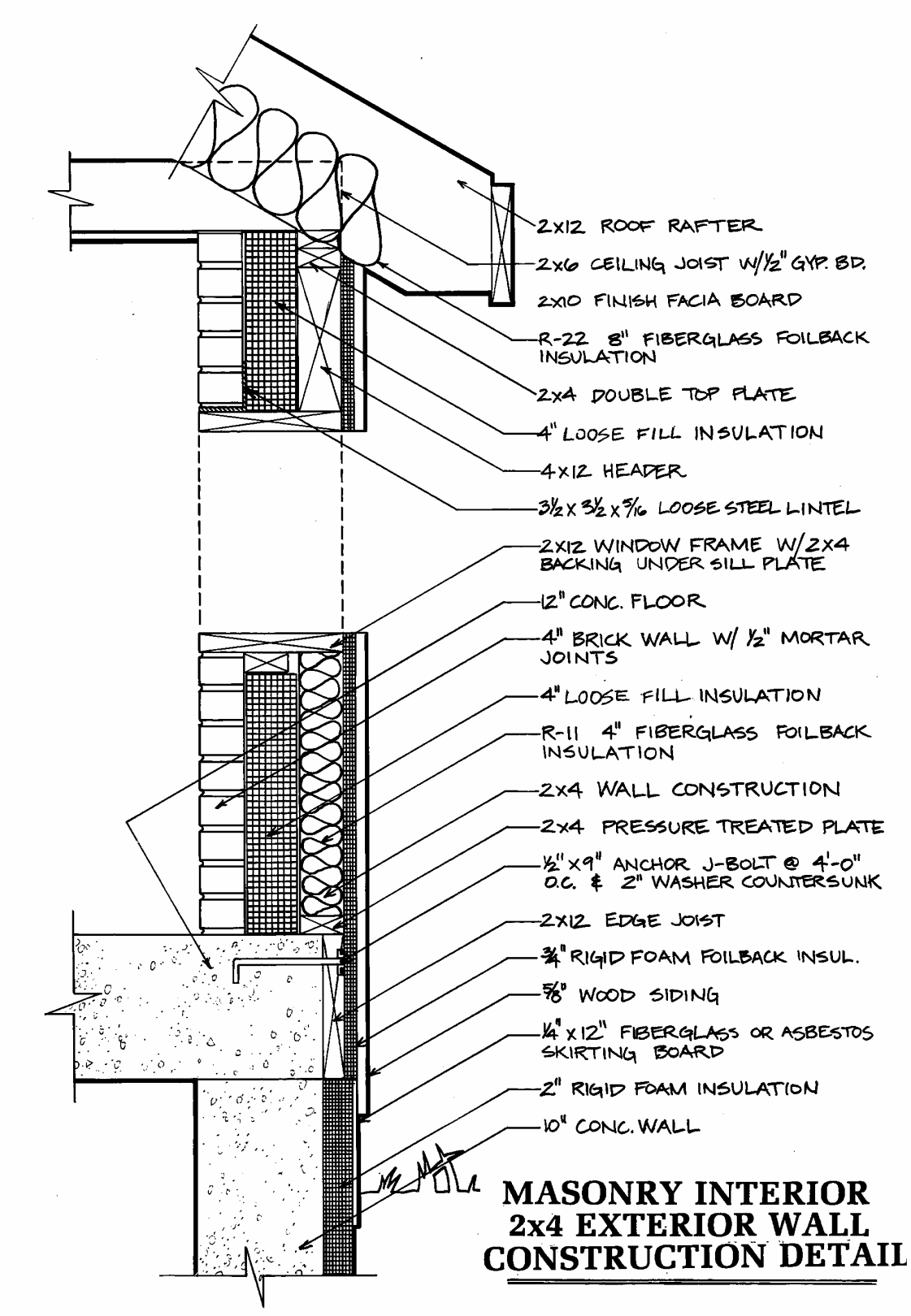
Masonry products have the additional problem of being very porous to moisture. This can actually dissolve some adobe and earthen types of construction, and can cause dripping condensation and mildew in stone and concrete. No masonry construction should be utilized without adequate moisture barriers, unless under dry, desert conditions.

The great plus of dense masonry materials, however, is their heat-retention qualities. Do not mistake this for insulative value. The two are quite opposite. In order to be useful, the masonry thermal mass must be integrated with insulation techniques to control heat retention and transfer. Remember that we are dealing with two primary factors in masonry thermal storage design: *density*, which relates to heat storage capacity, and *conductivity*, which determines the rate of thermal transfer in and out of storage. The most efficient thermal storage masses have high density and high conductivity, like water or Glaubers Salt (salt that changes phase from solid to liquid). But high conductivity is the opposite of high insulation value (which has low conductivity). We obviously cannot have everything in one material. We must also consider the relative cost of the material, since the ultimate criterion is cost-effectiveness. Twelve-inch thick, solid steel walls would have high density and high conductivity, but would certainly not be cost-effective. Water is very efficient and cost effective, but has low structural strength except in special containers. Masonry materials have only moderately efficient thermal storage properties, but are superior to other materials in overall cost-effectiveness, because of high strength and low cost. The general efficiency of masonry must be enhanced by the use of insulation to control heat transfer.

Recommended Innovations

HEAT MASS CONSTRUCTION with framed insulation (see illustration): The basic principle behind this type of construction is *controlled heat retention.* This is accomplished by reversing the conventional method of insulating masonry. Since masonry is usually placed on the outside to form a durable exterior finish, the insulation is placed on the inside before interior paneling is attached. While this does provide a durable exterior, the heat retention capabilities of the masonry work against the insulation properties. When exposed to the sun, masonry slowly absorbs and retains a high quantity of heat. This heat mass will continue to penetrate the insulation far into the night, causing discomfort or the need for air conditioning. In the winter, the reverse occurs, also to the detriment of insulation. The heat absorption qualities of masonry tend to act like a sponge for heat, encouraging more heat loss from the interior at a faster rate.

Now consider the advantages of reversing the insulation and placing it on the exterior. The primary objection to this has been a technical one associated with the difficulties of attaching exterior insulation and paneling to the concrete in a cost-effective manner. But these concerns have been more or less overcome with construction adhesives, both mechanical and chemical. There are also a whole host of *rigid foam block forming systems* which have integral plastic attachment systems embedded to facilitate interior



MASONRY INTERIOR 2x4 EXTERIOR WALL CONSTRUCTION DETAIL

exterior finishing. These have a disadvantage of being insulated also on the inside, but even so, insulation does not stop heat gain to the interior masonry, it simply slows it down. Thus, in a home with a lot of passive solar gain, we would simply increase the insulation on the exterior so that the interior foam will be the weak link and allow the masonry to warm in the winter. The preferred method of building heat mass walls is either through pre-cast concrete wall systems with integral exterior insulation, or reinforced concrete block walls, with voids filled. I like to reinforce even stack block construction so that in an earthquake the walls will hold together. The fiberglass/cement layer of stucco on stack wall block is very strong, but an earthquake could cause it to crack and come apart.

Construction adhesives are commonly available in tubes similar to caulking compound which will adhere insulation and paneling to concrete or block just as securely as many rigid fasteners. With the insulation on the outside, covered by wood or stucco, there is little heat absorbed by the exterior facade and the inner masonry remains relatively cool in the summer. Any heat that enters the home via doors and windows is quickly absorbed by the cooler concrete, which acts as a temperature stabilizer all day long. In the winter, the inner masonry absorbs heat from the interior air until it comes up to a stable temperature.

If you have too much heat mass designed into a home, this can be a problem in cold climates. The home may never heat up – especially when the foundation is placed deep into a wet, cool subsoil which acts as an inexhaustible heat sink. The solution to this problem is to insulate the inside surface as well as the outside surface. The exterior insulation over concrete inhibits the release of built-up heat to the outdoors. Such a double-insulated house initially takes much longer to warm up on the first cold night when you activate the furnace, but throughout the winter, the temperature is stabilized for long periods.

Materials

All of the following materials are suitable for above ground heat mass construction. Formed concrete is the best for subterranean construction, though concrete block is also suitable if a good footing foundation is provided.

Formed Concrete

I generally recommend formed and poured concrete for all sub-terrain construction because of its strength, uniformity, and ease of reinforcement. I prefer to design into the forming process all necessary electrical and plumbing chases or sleeves (pass-through openings). Conventional construction uses 2x2 furring strips which are nailed into the concrete, so as to be able to fasten paneling or sheet rock, or to install wiring or plumbing. New methods allow glue-on and shot-driven mechanical fasteners punched directly onto the concrete. There are a variety of forming methods available. The fastest method is the use of metal forms like “Simons” brand forms, which link together and allow for very rapid installation. In an area where many basements are built, it is not atypical for a professional crew to come in and set up the forms (footings already in

place), tie the R-bar, and pour the basement all in one day. This allows for tremendous cost savings, and such basement costs are usually 1/2 to 1/4 of custom forming costs. In large cities, these forms can be rented. They are easy to use and any handyman can learn to set them up.

Many concrete contractors still build forms out of plywood on each new job, using "Snap Ties" to hold the forms together during the pour. This type of forming system is suitable for the do-it-yourself builder with normal carpentry experience. The labor component of this type of forming is considerably higher than with Simons forms, so very rarely do you find this method competitive in price. There are a variety of books available to help you learn the principles and practice of forming concrete. Make sure you read up on this subject before attempting it for the first time. The weight of wet concrete at the lower portions of the forms is tremendous – any weak spot is a potential blowout for the whole wall and can ruin your day.

Foam-Formed Concrete

This is the newest and most promising innovation in cement forming to come along. Basically, various different manufacturers produce long foam blocks (looking somewhat like white Lego blocks, but much larger) that have built in plastic ties that hold the two sides together during the pour. The forming walls are built by stacking the blocks on top of each other. Special grooves help keep the walls aligned. R-bar is installed inside the forms as the wall is laid up. There are corner pieces available for making turns. The resulting wall retains the foam on both sides as insulation. The ties also serve as attachment points for wall finishes. These latter two features are what really add to the energy efficiency and labor saving aspects of this technique. Sadly, the cost of these forms is outrageously high – so high that there are no major cost savings, only a better finished product. Hopefully, increased competition will bring the prices down in the future.

There are two basic types – flat sided forms, which produce a wall similar to a regular formed concrete wall, and shaped forms which produce a lattice work of concrete inside the wall – like posts and beams. The shaped forms are only suitable for walls that will not have to retain much earth, or where you really need to economize on the amount of concrete in the wall. In almost all other circumstances, I recommend the flat-sided forms which provide a full-width concrete wall. Of these types, currently only a few manufacturers have form widths for pouring a concrete wall 8" or wider. Most try to get you to use the 6" forms. However, 6" is not enough width to act as a basement retaining wall, for long wall sections. Neither does it provide enough radiation resistance for shelter walls.

Before you contract with any of these suppliers, make sure you find out how easy the system is to install and brace. Some systems make you assemble your own forms which is time-consuming. Others lack a quick and easy system for aligning and bracing the walls. The best systems may even cost a little more, but will usually save a lot of labor. Each company will have training videos and other materials to help you learn the process. Highly recommended.

Precast Concrete

Above-ground poured construction is slightly more costly since a concrete pump must be used. This isn't as much of a deterrent as it used to be. Concrete pumps are numerous and more economical now so that almost everyone uses them. For the more innovative builder, a commercial type of construction technique can be used above ground. This is the use of tilt-up concrete construction. Precast methods are varied, but all generally involve horizontally formed and poured, reinforced concrete panels completed at a local factory and shipped to your site. There are several regional home building companies that specialize in this type of construction. Check the "Recommended Equipment and Sources" section for details.

As in all exterior-insulated designs, you must utilize some type of fastening system so as to hold the insulation and outer facade on to the exterior concrete walls. Some cast special anchors into the concrete to which the insulation and wire stucco mesh is later attached. Other facades can be used as well.

Do-it-Yourself Tilt-up Construction

You can even do your own tilt-up concrete wall design if you are an experienced concrete person. Basically, you start with a very flat and true concrete floor surface – usually the garage slab. You then form up your wall sections flat on that floor, covered with plastic to prevent adhesion of the two surfaces. How much of a house you can pour at one time depends upon the amount of flat concrete space you have to work with. In one house I designed and supervised, we poured a concrete ceiling over the entire basement, thus providing enough forming floor space to do the whole upper floor walls at one time.

Let's assume you are going to pour a 6" thick concrete wall. When you frame up the wall on the floor, you use 2x6 lumber to box out the windows and doors. You also install the grid work of reinforcement bars (usually #4 bars, 16" on center, both ways). Then you install any plumbing or electric conduit that needs to go into that particular wall. Be sure to allow the reinforcing bars to penetrate out past the forms where these walls will join with other walls. This ensures you will have something to weld the wall joints together with. As for insulation, you can either integrate it into the wall pour or attach it later.

In this particular home, I decided to integrate the exterior panel/siding and the insulation. First I laid down the perimeter forms nailed at the ends to form a large box. Then I attached the 4x9 foot cedar exterior panels to this frame. Next, we measured and cut out all door and window openings, and then added the forming lumber to these window and door openings. At this point we had what looked like a big exterior wall lying flat on the cement. Several of the men turned the whole box-form structure over so that the finished side of the siding was down on the cement (so that after the cement was poured in the box form and the wall was tilted up, the exterior finish would be on the outside of the wall. Having the interior surface up also allowed us to work on finishing this cement side to make it smooth.

In this case I used 2x8 lumber to do all the forms so as to make room for the extra thickness of the insulation I would place in the bottom of the form (on top of the face-down exterior siding). The 2 inches of rigid foam insulation was glued to the paneling with construction adhesive and weighted down till dry. Then the R-bar mat was installed on little "chairs" to hold it in the middle of the pouring area. To bind the entire sandwich of concrete, insulation, and siding together, we put 6" lag bolts through the insulation into the paneling (without penetrating the other side). This left a few inches of the bolt remaining above the foam insulation. Thus, when the concrete was poured, the heads were encased in the concrete prohibiting any future separation of the triple layers. The walls were then poured and the upper surface finished to a smooth trowel finish. This smooth finish became the actual inner wall surface, requiring no sheetrock. It could be painted or wallpapered at will.

Here are some modifications I would make to this design based upon experience. The interior walls became great heat sinks, keeping the home cool in summer and fairly warm in the winter. It was almost too much heat mass to warm up, however, in the cold climate where this home was built. It took almost a week of heating to bring the walls up to a stabilized temperature, due to the that the walls were sitting on a massive 12" concrete basement ceiling. It also became a major problem trying to hang anything on these cement walls – we had to use a concrete drill to put hangers in. Now, with numerous glue-on products, that isn't so much of a problem.

The biggest problem was the exterior paneling. The panels were not thick enough for the lag bolts to get more than a half-inch of grip. Thus on the west side, where the sun beat down on the siding, some of the boards popped loose due to curling of the plywood and could not be reattached (since there was no access to the bolt heads, embedded in the concrete wall). I would, in the future, put the lag bolts into 1x4 or 2x2 furring strips, embedded every 24" into the insulation. Then I would attach the exterior siding from the outside after the walls were raised into position. This way, the siding could be changed or removed if damaged. Be sure to allow for steel lifting anchors into the walls at the top side so that when the crane arrives to tilt the walls up, you have something to attach the cables to.

Concrete Block

Concrete block comes in a very nice variety of shapes and sizes to fit almost every building need. It is readily available and relatively inexpensive. It is very well suited for above-ground masonry construction as long as it is provided with a strong, poured concrete footing foundation. The major drawback of concrete block, which requires such an exacting foundation, is its propensity to crack along the mortar joints. The block is very rigid and will crack easily if the foundation warps with earth expansion or contraction (clay soils undergo different levels of expansion and contraction with changes in water content). The solution is either to build on a compacted, uniform gravel base over the clay, or use a non-flexible foundation at least 16" deep with embedded R-bar grids on both top and bottom. This far exceeds the requirements of any code, and most contractors will think you are being wasteful. However, if that is what it takes to keep the wall from cracking, I would do it. The only exception to this is in a particular area which has such stable, non-flexing characteristics that shifting is not a problem. For

the most part, however, we trust you will be constructing block walls on top of a nine or ten inch formed concrete basement wall. This setup will not flex to any degree unless you have too many doorways.

Additional strength is achieved by filling all void holes in the concrete block with mortar or cement (except holes which carry plumbing and electrical lines). Don't worry about reducing the presumed insulative value of these hollow spaces. We will insulate the wall on the outside, so we don't mind having the extra heat mass. To attach exterior insulation and wood to concrete block, you can either install metal fasteners in the mortar joints as the wall is built, or you can drill and set concrete anchors in the wall after it is done. These must be set at 12, 16, 20, or 24-inch intervals to accommodate exterior plywood. The 16 and 24-inch centers are the most common. Use a jig to ensure that each fastener is in the right place and extends the proper distance. These fasteners can be long bolts with the heads embedded in the concrete, or long U shaped wires which can later penetrate the rigid foam application and be twisted closed around wood furring strips.

Bricks

(Including clay, concrete, and adobe-earth.) Brick is normally an exterior facade, but in the "heat mass" context, we will consider it as an interior wall construction medium. Unlike block or concrete, brick can actually serve very aesthetically as the interior wall surface if appropriate to your decor.

Commercial clay brick is more expensive than block, but is better looking and stronger, depending upon the type. Dark bricks usually have magnesium added in with the clay in order to achieve the desired color. Magnesium-based brick has higher conductivity than light colored or red brick, and hence, more efficient thermal storage. In comparison to block, brick takes more expertise and time to lay up since it is smaller in size, although other sizes are emerging which are larger than the common brick. Because of the expense and beauty of commercial brick, I only recommend its use for "heat mass" construction when you plan to leave it exposed on the interior. You may wish to use it in combination with other less expensive bricks where you may design certain walls to be exposed and others not.

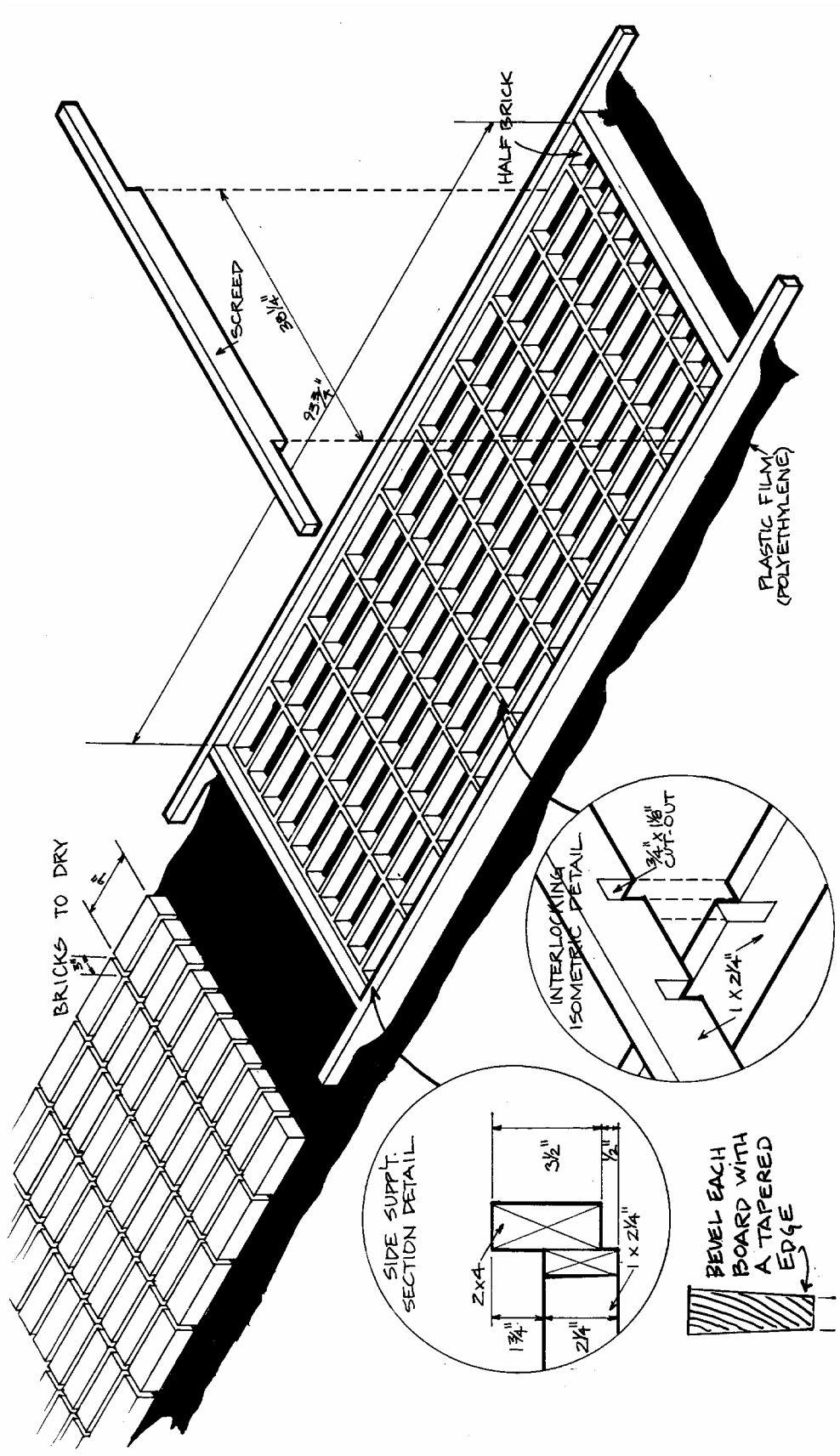
When brick is used as a self-supporting structural wall, it is always laid up in a double-wide course to provide vertical stability. A unique insulation technique can be used to improve its heat control properties. Begin laying the double course with a three-inch gap between courses. This will allow room to place electrical and plumbing pipes in between as well as 3 inches of rigid foam insulation. Use rigid steel brick ties to penetrate the foam board and extend into the mortar joints on either side. This will keep the two walls tied physically together without degrading the insulating qualities. Another method is to simply inject liquid foam insulation between the walls every time the wall rises another 12 or 24 inches.

Making Your Own Concrete or Adobe Bricks

A simple brick form (see illustration) can be constructed for making your own brick out of concrete or adobe. In building the form, you do not have to follow the sample dimensions. Make the forms to fit the size of bricks you want to make. Clay or adobe mud are better in smaller sizes so that cracking is minimized. Concrete bricks can be any size you want. Make sure before you cut the cross notches in the boards that you put a slight tapered edge along both sides, lengthwise. This will ensure that the bricks will release from the form easily. If you fail to do this, you will have to shake the form very hard to get the wet bricks to release, and they will be misshapen.

The operation of the form is simple. Grade out a nice long, level stretch of ground, somewhat like a road, and lay down a strip of plastic wide enough to accommodate the entire form. Order a stiff grade of concrete (which has very little “slump”) via truck. Lay down your brick form at one end of the plastic, pour concrete into it, tamp it so that the cement conforms to the form shape, level it off with a 2x4 screed, and carefully remove the form by lifting upward. The concrete must be stiff when you pour it (low water content) the bricks will not deform appreciably when you extract the form. Order the mix with a maximum 4” slump and do not let the truck driver add water to the mix when he arrives. Be sure to tamp the cement into the forms to remove air pockets. Gently lift the form up and move it down to the next spot on the plastic and repeat until the truck is empty. During the next few days, the bricks must be kept wet (after they have set) so that they will cure without cracking. You can make your brick forms any size and shape you desire, but if you plan on tying in with commercial brick, you’ll need to match the size closely.

This same process can be used for a good grade of adobe clay for sun drying. Some shrinkage and cracking will occur, especially with larger bricks due to the difficulty of drying the inner core evenly. These bricks will need to be turned during the drying process. Low quality earthen clay or mud brick must be mixed with a strengthening agent of 25% sand and 10% cement. Only in the most primitive circumstances would we recommend using mud bricks due to the superiority of commercial concrete. Adobe clay has a wider range of qualities and is superior to cement for non-structural situations, especially in the arid southwest. Of course exceptions are allowable where extreme financial limitations preclude even the purchase of concrete.



HOMEMADE CONCRETE OR ADOBE BRICK FORM

Ferro Cement

Ferro cement is a cement construction technique involving spray-on or trowel-applied cement to a steel reinforcing framework. It differs from poured concrete in that it requires no double sided forms and the cement is not poured as a liquid, but rather as a stiff stucco-like mixture. Swimming pools are commonly constructed out of ferro cement as are certain types of dome shaped underground homes. Essentially, all we need is a wall surface as a form. To this surface is attached the reinforcing grid of welded wire mesh or steel R-bar, and then a stiff concrete mixture is sprayed on over the reinforcing until sufficiently thick enough to cover the steel or wire. The surface is then troweled smooth.

Concrete dome homes use an inflatable or rigid form to make a half spherical dome. The steel reinforcing grid is tied over the outside surface of the dome form, looking much like a basket weaver's initial grid, only upside down. Windows and doors are framed into the concrete before the cement application. The concrete is then sprayed on about 6-8 inches thick. When the concrete is cured, the form is removed (if inflatable) and then interior or exterior insulation is sprayed onto the cement dome. Another do-it-yourself technique is to make a huge mound of dirt for the form, cover it with plastic, set the R-bar and then spray on as before. Then, when the cement is cured, the dirt is excavated out through an oversized door. The hardest part of this technique is forming a uniform curve in the dirt mound. Some builders eyeball a nice shape, while the more perfectionist types build a large curved quarter-circle shaped truss attached to a pivot point at the top of the mound. The truss is then moved around the dirt mound a couple of feet at a time, so that the excess dirt can be scraped away or added as needed to make sure the dirt mound is uniform. To perform the concrete spraying one must hire a swimming pool company that has this type of equipment.

The most promising of the ferro cement techniques is the "stucco method." This is the same method used by ferro-cement boat builders. Believe it or not, the reinforcing is nothing more than conventional galvanized chicken wire, in multiple layers. If this kind of construction can be used for ocean-going yachts, it will certainly serve well on land. In my opinion, there is no cheaper and better way of putting on a rigid, reinforced cement exterior for the do-it-yourself builder than this method. So why not use stucco itself? Stucco is relatively soft and is used for decorative exterior facade. Ferro cement is very hard and can give you a high security wall for the same relative price. In thicker applications, it can even serve as the structure element.

Let me describe briefly how to do this simple building technique. This can be applied over a conventional framed wall, or as a rigid, bullet proof barrier to straw bale construction, wood cord stack walls, or even mud brick walls. I have not covered straw bale construction or stack wood walls since these are a little far afield from the focus of this book. There are, however, excellent books on the subject listed in the bibliography. Ferro cement can even be used as the roof surface. First staple or nail waterproof tar paper over the entire exterior wall or roofing surface. Next, staple the first layer of chicken wire over the surface, and then follow this with a second layer of wire that is shifted left or right about a half-inch so that the normal 1 inch holes in the chicken wire are reduced in size by the overlapping wire holes. I recommend 2 layers for the standard

1 inch thick ferro cement wall. Now mix your cement and sand (3 parts sand to 1 part cement) and add enough water to make a very stiff trowelable mix. Place a 2 foot wide piece of plastic at the bottom of the wall to catch any cement that falls down. Now, you can either begin flinging the cement onto the wall with a large paddle to make it stick or trowel it on from the bottom like the stucco workers do. The first coat should cover the wire mesh completely and be approximately 1/2 inch thick. After a day, the cement will be set and begin to cure. Spray a little water on it and start all over with the next coat. If you are making a structure wall, add another layer of wire. If doing a finish coat, simply trowel on another 1/2 inch finish coat. Use a long stucco mason's trowel or a long straight board to scrape down the wall slightly from time to time to give you an indication of where the high and low spots are.

Ferro cement is labor intensive, but cheap. When cured in about 2 weeks it will be extremely strong. I have seen tar paper shacks covered with ferro cement that turned out very, very strong. Some have used ferro cement as the final roof surface on underground homes that have wood beams and decking for the structural elements. The roof is then covered with a couple of layers of asphaltic emulsion and finally with bentonite clay pellets. Follow the clay layer with black plastic and then cover with a 2 inch layer of sand for drainage and then dirt.

Ferro cement can also be used to make cisterns in the ground that have been dug by hand. I have seen others use it to line the inside of hillside caves or excavations used for cool summer storage. It can also be used to line tunnels to protect against cave-ins. In short, wherever you have a single wall surface that needs a weather tight or projectile resistant surface, use ferro cement.

No-Maintenance Exterior Coverings

I realize that notwithstanding our discussion of the supreme benefits of internalizing the masonry for utilization of its heat mass, there are still some who simply want a masonry exterior – which is nearly maintenance free (and goes well with certain styles of homes). This is an advantage, though both cedar and redwood solid boards or plywood can be made reasonably resistant to weathering with the new breed of penetrating finishes. For the masonry enthusiast, however, there are some interesting thin masonry exterior materials which work well over an insulated surface such as rigid foam. We have already discussed ferro cement. There is also a commercial epoxy-based formulation that is very durable, is maintenance-free, and can be made to look exactly like stucco.

Fiberglass/Cement Stucco

While more expensive than standard stucco facades, this is the best no-maintenance system at a commercial price. These materials are a mixture of epoxy, sand, and cement and were originally designed to be applied to stacking type concrete blocks laid up without mortar. The glass-fibrous cement compound is applied directly to the blocks which have been stacked without mortar to form a wall. The end result is supposed to be as strong as one with mortar joints. I would have my doubts about this in an earthquake situation, however. I like having reinforcement wire inside the mortar and R-bars in the central voids.

However, this system used as a better form of stucco is a sound, although more costly, solution. It can be applied over 2" or 4" rigid insulation, and can be used to cover both concrete or wood structures. The mechanical fasteners, which hold the foam to the structure, also attach the wire mesh which holds the epoxy stucco cement. The finished product will resist expansion, cracking, and weathering for many years longer than conventional stucco.

Stucco

One of the most common exteriors is stucco. Advances in the last decade now allow stucco to be used even in colder climates where cracking used to be a major problem. Stucco used to be restricted to warm stable climates. But now, with the use of expansion joints and modern stucco formulations, these restrictions are no longer necessary. A heavily expanded metal wire mesh is attached to the exterior, and the stucco cement mixture, which can be colored to suit, is laid up in several coats, much like plastering. Varied textures are available from smooth to very rustic "Spanish" style finishes. The higher the cement content, the more impervious stucco becomes to moisture and cracking, so don't allow the mason to soften it with too much lime. Some lime is necessary for workability, but it does weaken the total mixture if used excessively.

Brick Tile

Another alternative is brick tile. These are small slices of brick which are mortared into place over a heavy wire mesh, and look just like brick when complete. Obviously this facade does not have the strength of a full thick wall, but it does give you a maintenance-free exterior and the brick look, without the high cost.

Brick

If only the real thing will do for you, then I recommend the following wood frame/brick combination which will isolate the brick from the insulated wall. This is important to keep the brick heat mass from radiating through your insulation on sunny days.

First, start with a minimum 10" thick basement foundation wall. Place your sill plate (to support the interior wood floor structures) on the inner 4" of the wall top surface and leave 5" of basement wall top exposed for a base on which to set the brickwork. Overlay the 2x4 inner exterior wall with 1-inch rigid foam insulation and then have the masons lay-up the brickwork a full inch away from this insulated wall. This will leave space for a ventilation air gap, if the mason strikes off the mortar which protrudes inside as the bricks are set. The lowest brick layer is air-slotted so that the wall becomes a heat-venting design.

If you choose this exterior brick surface, by all means use it to the full height of the exterior walls. Half walls of brick are acceptable if you want a bullet-resistant exterior from the waist level down for security, or if you live in a rainy area where you want to protect the lower half of your walls from the constant splatter of rain water.

THE PROPER USE OF GLASS IN DESIGN

Except in rare cases, glass is not technically a true construction type, but with its high usage in homes for purposes of either solar insulation and/or view windows, it deserves our consideration. Glass, more than any other wall type, has been used to enhance a design for aesthetic reasons. There is no other design medium to compare with its ability to open a room to the outdoors, short of open air itself, nor any other wall medium with its ability to adversely transfer heat. Herein lies its two great liabilities in the security context: First, glass has an extremely high U-factor (coefficient of transmittance of heat, the reciprocal of the R-factor) which means it transfers tremendous amounts of heat when a temperature differential exists on either side of the glass. This happens through both radiation and convection. As you may remember during our previous discussion on convection, windows act as veritable heat-loss factories. Air contacting the surface of the glass cools rapidly which causes air density to increase. It thereby begins a rapid descent down the face of the glass, pulling more warm air into contact with the upper portion of the window. This also cools and begins its descent, causing a steady flow of cold air across the floor. The speed of the descent is proportional to the *vertical height* of the window and the coolness of the glass. Thus it should be obvious that a wide, horizontal window is preferable to the same area of glass oriented vertically. I am fully aware of how attractive long floor-to-ceiling windows are, not to mention the proliferation of enormous sliding glass doors. However, in my opinion, they must be used rarely or at a minimum in the preparedness home, which you have carefully designed for maximum security and energy efficiency with careful attention to financial expense. I have found through experience that judicious use of smaller, horizontal windows can bring you the same pleasant aesthetic views that most think can only be achieved with floor to ceiling windows.

Window Size

There are several design factors to consider in the sizing and shaping of windows. I have already mentioned the avoidance of long, vertical sections. In practicality, there is rarely any reason for extending a window below 24” off the floor. Even while sitting in a low chair, one can see below the horizon with a 24” based window. It is well to remember also that most building codes require that windows below 18” from the floor have to be made of tempered glass. Besides adding substantially to the initial cost, the tempering process can produce visible warpage and distortion in glass – though this rarely happens anymore with modern techniques. This same disadvantage pertains to all sliding glass doors.

The minimum top height of a window is normally 6’ (72”) so as to avoid stooping down to see out level (for the average person). However, most usually specify a height of 6’6” to 6’8” just to make sure the very tall will not be inconvenienced. While some may feel that every view ought to have a view window, I am more conservative in this regard due to other important window factors such as cost, insulation, and protection. I normally recommend that all rooms other than living or dining areas use a bottom window height of 36” and a top edge of 72”-78.” This gives you a modest 3’ high window which is very ample for natural light and view. Obviously, there are exceptions where the critical

features of a view are either very low or very high, such as in mountainous areas or overlooking a lake below.

Insulation (factor) is by far the greatest drawback of glass under normal circumstances. But in times of social unrest, the greatest concern is protection against vandalism and breakage, especially when replacement glass may no longer be available. For this reason, I try to design homes with some sort of protective covering for glass. Particular types will be discussed in the Security chapter.

Shutters and Drapes

In terms of design considerations, space between successive window treatments is sometimes important. A rolling or vertically sliding shutter requires the least space between windows (4 inches for the rolling type and two inches for the sliding type). This is to ensure that an object striking the flexible shutter does not deflect the shutter material far enough inward to break the window.

Hinged shutters, which open all the way back against the outside wall, require the combined measurement of half of each adjoining window as the distance between windows, plus whatever else you may decide is necessary for reasons of style. The last type, bi-fold shutters, are the least secure and have the added disadvantage of not folding flat against the wall. This is an advantage in some cases, however, where minimum space is desired.

In terms of design preference, and where bulletproof protection is not needed, I prefer the commercial rolling shutters over the homemade types. The rolling shutter, made with rugged PVC plastic slats (available with steel inserts) are fully operable from inside the house. With manual, conventional, or sliding shutters, you either have to open the windows or go outside to secure them. In the winter, this is a decided drawback – especially if you have sealed storm windows. In terms of cost, you will probably find that building your own metal insulated shutters in metal frames will exceed the cost of the commercial rolling shutter, if you count your labor (see illustration in the Rolling Shutters section, page 285). On the other hand, the commercial rolling shutters are never bulletproof.

Additional insulation can be gained by building a sealed, insulated shutter. This is only effective, however, if you use them every cold night. Since most people will install **drapes** around a window, it is important to design and install drapes correctly so as to inhibit the convective currents as previously described. They must have a valence (or cap) over the top to prevent the entrance of air, and they must be attached permanently to the walls at the sides. They should drag the floor or the window sill, if the window is not floor length. Additional measures can be taken such as installing rolling blinds which have a thin, dacron lining bonded to the back surface.

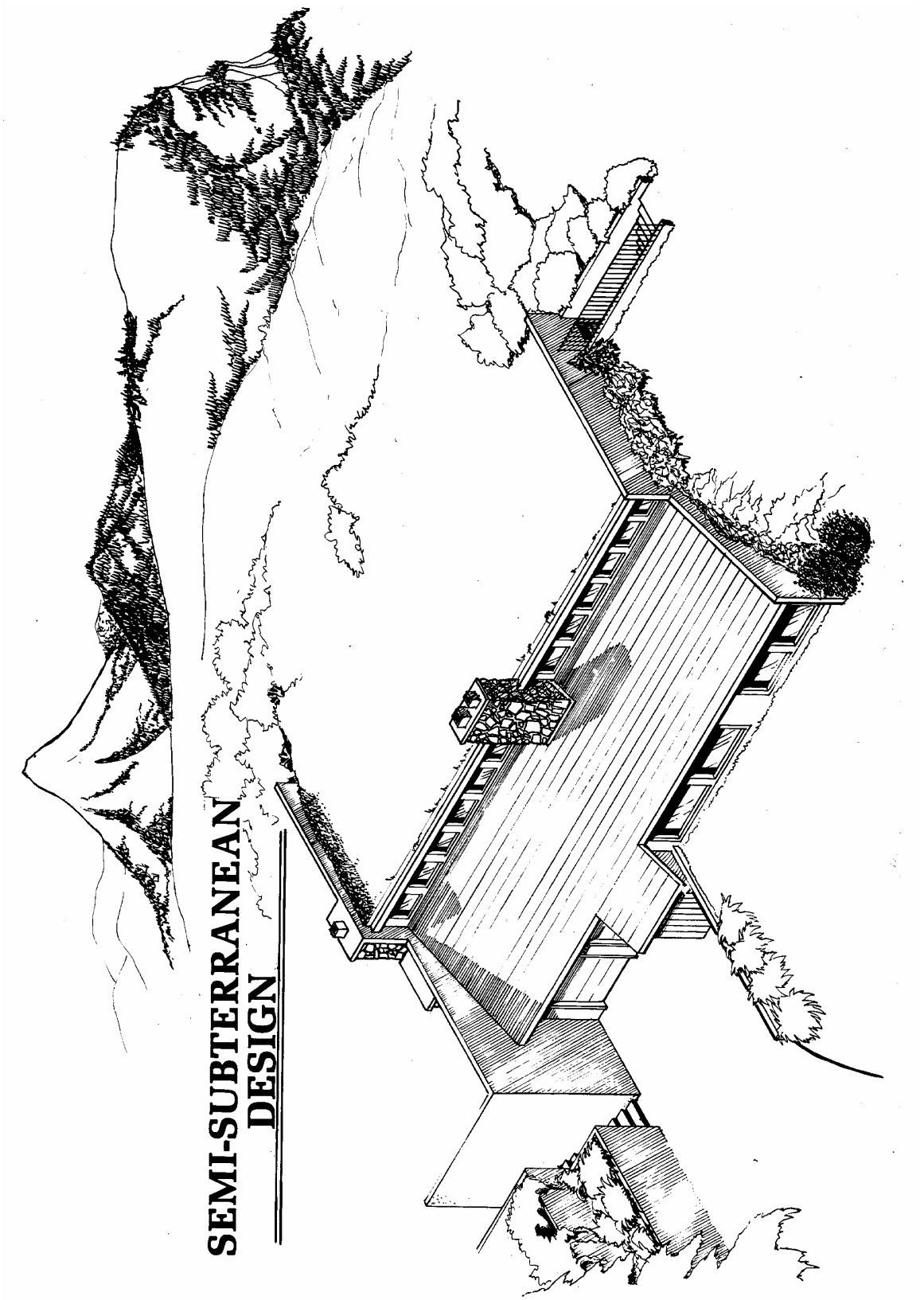
UNDERGROUND HOMES

As my readers are already aware, I am reluctant to recommend completely underground homes for survival residences or retreats – primarily because of the undue notoriety that underground homes receive. There is also the problem of an intruder having direct walking access to the home's vents and chimneys. To thwart this easy access, one must design tamper-proof, heavy-duty metal barriers and screens for any roof penetrations. There is also a tremendous expense involved in waterproofing the roof portions of the home, and in providing sufficient strength to handle the tremendous earth load on the roof. For these reasons, I generally prefer a conventional looking, above-ground home that utilizes a superinsulated design so that the energy conservation features of underground homes are preserved. Naturally, we can still design significant underground portions of the home into the basement areas. This, of course, is not a true underground home, even if the energy conservation is equal. But it does provide for, and match the security aspects, of underground housing. One of the other recent developments in building construction has eroded a major advantage heretofore only enjoyed by an underground home – hardened, bulletproof exterior walls. With the advent of foam formed, insulated concrete, used above-ground as well as for the basement, even conventional looking homes can have hardened exterior walls that are impenetrable by small arms. But given all these reasons, some of you may still desire to build an underground home. Let's look at some ways to make the best of this design innovation.

In true underground homes, I recommend using a semi-subterranean design placed into a south sloping hill as illustrated. The only real technical difference here as opposed to a full subterranean design is that the front-sloping portion of the roof is of conventional roofing materials rather than of sod. There are some good architectural reasons for doing it this way, but the primary reason is to maintain as much of a conventional front facade as possible, and to avoid the high cost of heavy roof reinforcing and waterproofing. You should also be aware that earth does not provide much insulation in layers less than 12 inches deep. Frankly, it is very difficult to place that kind of depth on a front-sloping roof without large, unsightly retaining structures. Thinner depths of soil tend to dry out so rapidly that constant watering and trimming of the upper lawn roof is required – a definite disadvantage compared to a no-maintenance design.

On the other hand, there are two situations where I would accept a full underground design. The first is in a hot, dry climate like parts of Texas where total relief from air conditioning is desired. A 100% self-sufficient home in these very hot areas must go underground since no amount of superinsulation will stop heat penetration indefinitely. Above-ground, mammoth thermal mass designs like the Alma in San Antonio are possible but not as cost effective as going underground. Great structural strength must be employed in the roof supports since the roof must be covered with a minimum of 4 ft. of earth with built-in intermediate levels of insulation.

Secondly, for clients with very high security needs, we must sometimes design a completely underground retreat, complete with subterranean power generation and other



SEMI-SUBTERRANEAN DESIGN

hidden features. These situations are rare, since few people need them or can afford the complexity of the legal, architectural, and strategic efforts required to do a completely secret subterranean retreat.

As in the section on solar, rather than rewrite the same design material that has already been published, I will refer you to one of the finest references in the field (see bibliography) and then give you some guidelines for design and construction, which will be most helpful in making your design decisions.

GUIDELINES AND SUGGESTIONS FOR PLANNING AN UNDERGROUND HOME

Find the Right Piece of Land

There is nothing more frustrating than trying to design a solar-heated, underground home on an unsuitable site. Some will fall in love with a heavily wooded site with a spectacular view to the north of a beautiful lake. Trying to give the client a bay of south-facing windows (for solar gain) as well as lots of glass to the north destroys almost all of the earth sheltering advantages of the home unless we employ some very restrictive and sometimes expensive options. Often, the alternatives aren't much better. In the high altitude Rockies, most of the sunny slopes are nearly barren of trees since the trees grow only on north facing slopes (where the snow stays longer on the ground). Optimum solar sites are not always the most aesthetic. Sometimes a person will get their heart set on a certain design which will not match the terrain they want to build on. So, if you are set on going underground with solar, find a good south-facing slope. You will usually have a view of something when you find a sloping piece of land, but try to find one which does not overlook any significant roadway (where others can easily see your home).

As a general rule, find the right piece of land first, then design the house to fit. For example, if you must build on a north-facing slope which is heavily wooded, we may use a vaulted roof facing back upward toward the south – reaching for the sun, so to speak. As long as the property breaks downward or is level at the top, we can bring the sun in through the high rear portion of the house, perhaps even through second level bedrooms (which would be ground level from the high rear side). This would allow the light to pass through a set of interior windows or balconies into the open ceiling to living areas below. Care must be taken to make these high, south-facing windows large enough to compensate for the changing sun angle during the year.

We can earth-shelter the sides and north side below the view windows and still maintain all the trees, except those that would shield the south windows. If the property to the south doesn't level off enough to allow full solar gain, we can sometimes excavate a flat terraced spot to the south of the house for parking or recreation, so as to create a treeless buffer zone. The high trees are then selectively replaced with low shrubs which won't block the sun. Such properties around the south sides of lakes with high rims often have access from above, and additional excavated parking is required.

West Sloping Land

Avoid the selection of land on west sloping faces which usually occur on the benches of mountain ranges that are aligned north-south. This is a classic problem in the Wasatch mountains of Utah and the west side of the Sierras in California. The views are beautiful since most of the valley lights are on the plains below and to the west, but the sun settles low in the western sky and all those view windows become massive, unwanted, passive solar collectors which operate during summer as well as winter. Sun shades are required in these situations and add substantially to the cost of having a lot of west-facing glass. Unfortunately when the shades are down, the coveted view is lost, and without them (with the sun in your eyes) not much is visible anyway due to the glare. Anti-glare coatings are a good solution, but the exterior mirror-like surface makes the home visible for miles away.

South Sloping

If I had to choose between a house site on a nicely wooded north slope on a hill overlooking a southern valley view or on the sunny, but barren south slope on the other side, I would select the southern slope. You can always create a micro environment of beautiful landscaping around the home itself, and get the advantages of better solar orientation as well. The added aesthetic advantage is that your view from the barren side is better since it takes in the wooded mountain side across the lake or valley, whereas those on the wooded side have only the barren south hills in their view.

Have a Complete Soil Analysis of the Proposed Site

Consider the plight of the young couple counting every penny toward the completion of their special underground design, who find massive bedrock two feet below the surface when they begin the excavation. This can occur as an isolated rock outcropping even when septic tank test holes and other nearby properties indicated no such problems. Soil engineer rates for analysis can run from reasonable to outrageous (like most licensed professions), so I would recommend that you simply hire a backhoe operator who is competent in the installation of septic systems. These men usually have good experience in soil types and will be able to dig several nine foot deep holes to explore the subsoil for potential problem areas. Be especially careful to locate any large rock outcroppings, underground springs, or large masses of expansive clay soil. Rock outcroppings, if too firm to be broken by a large excavator, will have to be removed by explosives. Underground springs will have to be diverted completely away from the foundation or a permanent water problem will result. This is sometimes beneficial in a severe hot climate where the damp foundation provides a permanent heat sink, but usually it is not. Clay soil is very difficult to work in during wet weather, and has such tremendous water absorption qualities that it can cause a house to rise and settle with the expansion of the clay. If found in layers between other soil types, it can trap quantities of water which can lead to huge mud slides (sometimes large enough to move a house off of its foundation, or break long concrete basement or retaining walls).

Prepare a Dry and Stable Foundation

Regardless of the effectiveness of the waterproofing used on the underground walls, it is important to temper the temperature and moisture content of the soil surrounding the home if we desire maximum performance. This is especially important with high moisture holding soils such as clay. Clay soils can be built on and are very hard and stable when dry. Keeping clay stable is the name of the game. Plan on using lots of run-off barriers like plastic sheets embedded under the topsoil. Moisture control is accomplished by using impermeable sloping membranes buried under the top layer of soil which carry rain water at least 10 to 12 feet away from the foundation walls. This water is then channeled away to drain fields that are at least 18 inches below the foundation of the home. Do not sit any home directly on clay. Use at least 12 inches of compacted gravel as a base over undisturbed clay. This way, even if the clay absorbs some moisture it will not serve as a direct heat sink to the foundation. The gravel will not hold moisture if connected to an appropriate drainage system. It is important that drainage systems be substantially lower than the footings so that moisture does not saturate the footing area as it attempts to find its path to the drain tile. These anti-percolation or moisture barrier control features would not be implemented if we desire to maximize soil moisture for a heat sink in a hot climate. However, we must still design the drainage system so that the moisture doesn't get into the clay under the house footings.

Additional, horizontal insulation extending out from the house, under the plastic, will slow summer heat penetration into the cool subsoil, thereby enhancing the heat sink effect. *Use only waterproof rigid foam insulation on underground walls*. Three types of foam are considered waterproof: Urethane, which has the highest R-rating (R-8), Expanded Polystyrene (the most economical per R-rating), and Extruded Polystyrene (the most stable and reliable insulation). The only one I trust for absolute waterproof integrity is Extruded Polystyrene. If you have severe water problems, use only the latter type. With drier soils you can go with Urethane which is the best insulator (as long as it stays dry).

Using water to enhance the heat sink effect of earth necessitates absolute integrity of the waterproofing on the actual foundation walls. Improper attention to potential punctures from backfilling operations and the sealing of joints along walls and footings are two of the major errors of underground home waterproofing. Waterproofing methods are covered at the end of this chapter.

Make Sure Footings are Substantial Enough to Hold the Load

The pressure on footings in an underground home is substantial due to the weight of concrete walls and the rock storage thermal mass, as well as the weight of earth and moisture on top of the roof, if any. It is not uncommon to have live loads of 200 lbs. per sq. ft. or more on the roof of an earth sheltered home, especially with the addition of moisture from winter snow melt or spring rains. The purpose of footings is to spread the load from the foundation walls across a wider surface area so as to reduce the load per sq. inch on the subsoil. The lower the load on the supporting soil, the less chance of settling and cracking of the foundation. It is not a simple matter of spreading out a wider footing.

We must also increase the thickness of the wider footing so that the edges do not break off as the wall pushes down in the middle.

As a general rule of thumb for conventional basement footings, the footing is twice as wide as the basement wall, and the extension of the footing to the outside of either side of the wall shall not exceed the depth of the footing. These guidelines are sufficient except for homes with earthen roof coverings. Normal footings on any other base except hardpan or rock will experience significant settling under a load of 2 or 3 feet of wet earth on the roof. For underground homes, plan on footing widths 2.5 times the basement wall thickness for earth coverings up to 3 feet, and 3 times the wall thickness for coverings in excess of 3 ft. Footing depth should be increased to 60% of footing width.

I always recommend the use of steel reinforcing in the footings of all homes, especially underground and heavy thermal mass homes, to help ensure against non-uniform settling. This is very important if you are using concrete block for a foundation or basement wall, which is susceptible to cracking when the foundation settles. I prefer two #4 bars within 1-1/2 inches of the bottom for normal footings and a double set of top and bottom bars in areas subject to high stress or earth movements. This will resist both up and down flexing more effectively than two bars in the bottom of the footing only.

Insulate Underground Masonry According to Temperature Control

Principles:

1. If you have very cold winters and mild summers, use 2 inches of polystyrene insulation (will not take on water) on all outside basement walls and under foundation slabs or heat storage slabs. Also, you must insulate all interior walls from the concrete as well – furr out or glue on at least one inch of insulation. The goal is to eliminate all possible heat sink effects.

2. If you have cold winters and hot summer days, but nights that cool off, insulate the same as in #1 but omit the under-slab insulation. This will contribute enough to the heat sink for summer cooling of the heat mass, but will not adversely affect winter heating. Interior insulation is optional but highly preferred on a majority of basement wall surfaces in any cold climate.

3. If you have warm winters and hot summers with hot or warm nights only, insulate the exterior subterranean walls 24 inches below grade, and/or use horizontal 1” insulation extending out from the house 12” below grade for 8 ft. Do not insulate the basement walls directly.

Orient the Home for Solar Input

If potential views are toward the south, use regular view windows on the main level designed to capture only fall, winter, and spring sunshine by designing main level roof eaves to overhang accordingly. If the views are to the north, use minimal window area necessary to capture the view and insulate windows. One pane of a double or triple pane window should be acrylic, rather than glass (preferably an inner pane for maximum

warmth, or the outer storm window if you lack vandal-resistant shutters or louvers). Active solar collectors can be mounted on south facing roofs for solar input to compensate for north-facing glass. Keep west walls shielded or heat vented. East wall upper glass is nice for early morning light, which generates less heat than westerly afternoon sun.

Floor plans with rooms to the rear of an underground home, without exterior windows, can be provided with some overhead light either with skylights or a high bank of windows, as in the home illustrated in this section. Solar tubes are a new innovation that bring sunlight down a mirrored tube that penetrates the roof. I prefer the upper banks of windows, but they should be protected from intrusion by those who may have access to the roof. Skylights are more expensive, and less secure, unless ordered with reinforced glass/acrylic glazing. Both window options can be opened for ventilation.

Earth-Covered Homes

Have your walls and roof support system professionally designed if they will be covered by earth. You can do many things on your own in designing your home, but you should not attempt to design for critical or dangerous roof loadings without at least having a structural engineer check your figures. The design books listed in the bibliography can give you some of the design data you will need, unless you are using a pre-engineered and manufactured cement plank or truss. In those cases, you will have to acquire the structural data from the manufacturer or the installer/distributor. You can always overbuild, but when you are talking about thousands of pounds of load and huge structural members, overbuilding for safety can be far more expensive than a few hours of an engineer's time.

Walls

Walls must sustain the vertical pressures from the heavily loaded roof and at the same time act as retaining walls for the earth on the exterior. Because of concrete's high compressive strength, even an 8" wall will be sufficient for all vertical loads. But lateral loads could make a wall bend inward, crack, or even break if there is insufficient reinforcing steel or wall thickness. The thickness of the wall and the placement of the steel work together. The pressure always comes from the exterior side of the wall, which may be severe depending upon the content of the soil. In order for the wall to withstand the pressure, reinforcing steel bars (R-bar) are placed vertically and horizontally within the concrete. The R-bar placement is critical since concrete has only compressive strength and very little tensile (connective) strength. By placing the R-bar in the concrete wall close to the interior side, it acts like a steel web backing to keep the concrete from bending inward. The steel has high tensile strength, meaning that you cannot easily pull the molecules apart. As the concrete begins to stress inward under the lateral exterior thrust, the steel gridwork keeps the interior side of the wall from cracking open. As the R-bar stretches tight under the pressure, the concrete between the R-bar grid and the lateral force tries to compress. That is where the concrete is at its best – it will not compress, so the wall stops bending and successfully holds back the lateral force. The strongest parts of the wall are the ends connected to other walls standing at right angles to the lateral force. Notice the concrete slab or precast roof provides an additional

immovable edge to retain the forces behind the wall. Since the lateral thrust against the wall always tends to cause the most stress against the section of wall farthest from any fixed edge, you can see how a long wall, unsupported at the top, will tend to buckle under less pressure than a wall supported around all its edges.

The long wall must retain the weight along its entire horizontal length (unless there are intermediate concrete walls at a right angle to it). When supported at all edges by concrete walls, floor and ceiling, the stress is applied across the vertical height of the wall, which is about 8 feet. Retaining the pressure on that short span is far easier. Typical walls will contain #4 R-bar (1/2" dia.) at an interval of 12-16" on center vertically and 16-18" on center horizontally. The gridwork is placed within 1 inch of the interior of the cement forms for maximum leverage under pressure from the outside. Note that if it were placed toward the exterior side, it would not have any concrete between itself and the origin of the lateral thrust to provide compression. The inner wall surface would crack open and the R-bar would simply bend as the wall breaks inward. Placing the R-bar carelessly in the center of the forms is like having a wall only 4" thick. For structural purposes, the only thing that counts is how much concrete is between the R-bar and the origin of the thrust (outside).

Roofing

Roofs can be constructed in three primary ways:

1. Pre-cast, pretensioned concrete planks
2. Poured-in-place concrete
3. Heavy timbers and decking

Pre-cast, pretensioned planks are the strongest units of the three. They are also the most expensive. Pretensioning means that the R-bar is prestretched during the forming process so that the plank is already under full tension to retain the load overhead. Poured-in-place concrete will sag slightly until the R-bar takes tension and begins to hold the pressure. Heavy timbers act like poured concrete; they take tension as they flex. The major difference is that they will flex more than reinforced concrete.

Poured concrete is the easiest of the masonry alternatives for the do-it-yourself home owner. Precast, pretensioned planks are definitely a factory item only, and require a crane for placement. There is a new system on the market that does offer an intermediate solution. It is called post-tensioning. High strength cables in lubricated sleeves are placed in the bottom of the concrete form. The concrete is poured and when partially cured, a special hydraulic tensioner applies stretch to the cables and a special locking nut secures the cable from retracting into the sleeve. Now the roof has been tensioned and will not sag under load. This allows you to use a thinner concrete slab and still achieve the same strength. This is competitive in cost with pretensioned planks.

Heavy timber roofs are the easiest for the owner-built home since the individual beams can be lifted into place by 2 or more people. Typical beams are 6x12 placed every 18," which can span about 14 feet and hold two feet of moist earth. These are covered with 1x6 decking and then with 3/4 inch tongue and groove plywood to provide a uniform and

smooth surface for upper waterproofing. All wood members should be pressure-treated for moisture rot and termite protection just in case they penetrate your membrane. If wider-spaced beams or heavier earthen loads are desired, I usually recommend changing to a larger glue-laminated beam on 4 or 6 foot centers. This requires 2x6 or even 3x6 decking plus plywood to support the load between beams. The thermal storage mass could be a liability in a cold climate if you have too much. In these cases, I normally always specify heavy timber roofs. I believe they look more appealing as well. However, in Texas, I always use the maximum amount of thermal concrete mass for cooling purposes.

Provide a Thermal Break with Non-Insulated Retaining Walls

Cast a layer of foam into the joint where the non-insulated wall meets the home. Thus the only contact for heat conduction between outside retaining wall and house wall is the steel reinforcing. The steel will conduct heat out of the insulated home to the retaining walls, but not in significant amounts.

Secure all Accessible Vents and Windows Against Intrusion

Special care must be taken to protect underground homes against vandalism. While underground homes often appear as fortresses, with all their concrete retaining walls, they are quite vulnerable to intrusion and vandalism because anyone has easy access to the roof top and windows at ground level. Vents extending through the roof should be of heavy galvanized metal and should have special security caps so that they cannot be blocked or have unwanted items dropped down them. The lightweight commercial variety on the market are not suitable. Custom variations in heavier metals are preferable. Chimneys should have damper caps and be totally screened in with heavy expanded wire mesh. Sod-covered roof portions should have physical barriers such as rock landscaping around the perimeter to keep cars or trucks from inadvertently driving on top of the house. Don’t laugh, it has happened more times than you might imagine. All windows should have external security in the form of rolling shutters, thick acrylic storm windows, or louvers.

Use Parapet Masonry Walls to Retain and Separate Earth-Covered Portions from Exposed Parts of the Home

In an underground home, the waterproofing system and structural system must be well-integrated. You must consider how the roof-wall juncture will appear as it emerges from the earth-sheltered portion into the open. The earth-covered waterproofing materials are not necessarily appropriate as a covering for that portion of the building that emerges to open view. The transition should look nice and not provide breeding places for vermin in nooks and crannies. In our illustrated design, you can see that we have made extensive use of vertical concrete insulated walls to use for transition between earth-covered portions and the regular styled front roof. Take care that such transition walls are totally wrapped in insulation and then weatherized by epoxy stucco-type materials such as Pleko or Dryvit. Otherwise, you will have a built-in “cooling fin” sticking up in the air acting as a heat sink.

WATERPROOFING METHODS AND MATERIALS

Asphalt Emulsions

Regular asphaltic emulsions will only give satisfactory results if more than one coating is applied and if there are no air bubbles – which is sometimes hard to accomplish if the cement wall has numerous defects. The better material is rubberized asphalt emulsion. This are laid up in thick, multiple layers. This product is very flexible and can be used over rough surfaces. It comes in 4 ft.-wide rolls backed in plastic to keep it from self-adhering. Some types have self-adhering edges. With a small 4-inch overlap, you can effectively seal the seams. Others require special cement. In either case, you must apply the materials on dry surfaces above freezing. With narrow rolls and wide surfaces to cover, there will be many seams. Thus, great care must be taken in the seaming process. W. R. Grace and Co. manufactures a wide variety of these products (locally available).

Polyurethane Liquid Applications

These are professional products that must be applied with great care due to toxicity. The surface must be clean, dry and smooth, but the results are excellent. I prefer this type because it is easier to handle in five gallon buckets than the 50' rolls, and there is no seaming to mess with either. United Coatings of Spokane, Washington makes an excellent liquid polyurethane elastomer.

Elastomer Sheeting

Large sheets of butyl rubber or ethylene propylene are like laying down a vinyl swimming pool layer. They work fine if the seams are sealed properly and there are no holes. Poor installation can be disastrous, however, since water trapped inside the membrane will not leave – your basement will become the swimming pool. At much higher expense, the solution is to glue the membrane completely to the walls so that one small leak will not compromise the entire job.

Sodium Bentonite

This special, natural clay is mother nature's own waterproofing. When fully wet, it has the capacity to swell to at least 10 times its natural volume. It is inorganic, like all clays, and will not deteriorate with time. It can seal over rough or smooth surfaces, wet or dry. Two types of applications are available, unless you have raw bentonite available locally. One is a trowel grade application that comes in 5 gallon buckets under the trade name of "Bentonite", and the other is a cardboard impregnated panel of raw bentonite granules. The trowel grade material is easy to use, but must be applied in thick layers (3/16" min). It is self-sealing, but will wash away if subjected to flows of water underground or above. The bentonite panels are also easy to use. Place the panels with a slight overlap and then carefully backfill. The water in the soil dissolves the cardboard over time and the bentonite presses together and against the wall surface forming a perfect seal. You must be careful of soil alkalinity, however. Salt laden soils inhibit the expansion qualities of sodium bentonite.

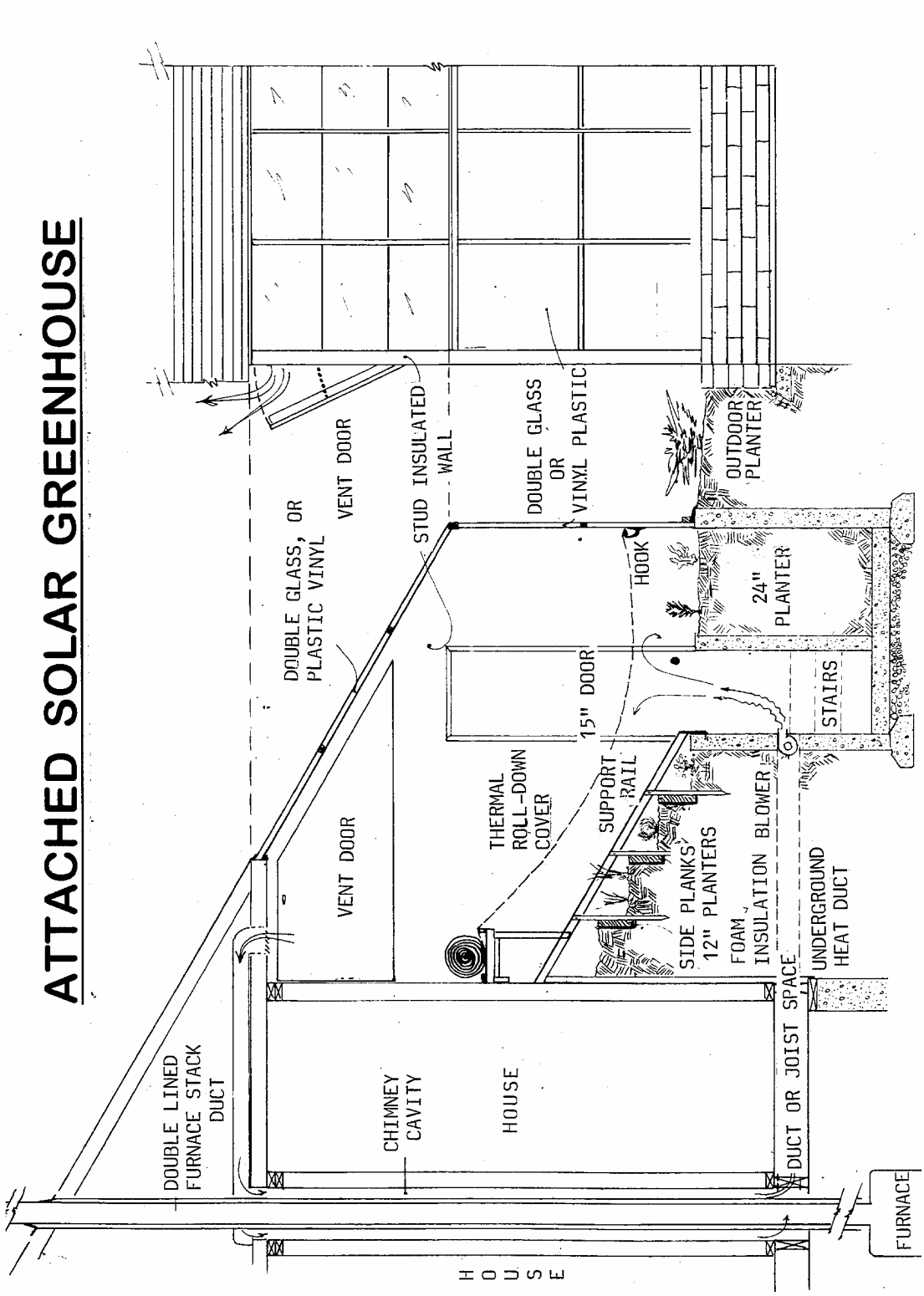
GREENHOUSES

The greenhouse is a special construction type that deserves some careful attention. I use greenhouses in all climate types where the growing season is short. Starting plants in a greenhouse can effectively extend any growing season by a month or two. However, running a full time greenhouse through the winter is another matter. All cold climates will require some added heat to keep a greenhouse warm during winter nights and cloudy days. Unless you have a cheap source of heat, the fuel will cost more than the money you save growing your own food. Naturally, in a famine, you will gladly trade fuel for food, but it is costly during good times. If you decide to grow some things during the winter, the most cost-effective way is to grow plants that are *cold weather tolerant* so that you don't have to spend a lot on heating. Such things as salad greens, Swiss chard, radishes, peas, turnips, and cabbages will do fine in the winter inside a greenhouse. These are essentials sources of vitamins and minerals anyway. Many people like homegrown tomatoes year round, but they are very heat-sensitive and require 70° plus weather constantly for good growth. These warm-blooded vegetables are not good choices for greenhouses without supplemental heat.

Attached Greenhouse

The most economical way to allow your greenhouse to stay warm at night is to build it against the south side of your home. An attached solar greenhouse as shown in the illustration captures any heat lost from that side of the house, and also allows the house to share in any excess heat produced by the greenhouse itself. If we design an attached greenhouse addition, we can duct normal furnace heat directly into the room or use waste heat from chimney flues. One technique is illustrated whereby waste heat is ducted out of the chimney space to add heat to the greenhouse. If you have a wood stove in the basement on this side of the house, you can bring the chimney pipe out through the attached greenhouse to provide extra heat. Some people even use special flue heat exchangers that have forced air fans to facilitate removing heat from the chimney. If you choose to supplement with a greenhouse heater, the wall-mounting gas catalytic ventless heaters are by far the most economical. They produce negligible amounts of carbon monoxide but do add water vapor in the exhaust which is beneficial to the greenhouse.

The attached greenhouse shown has planting beds to the front and to the rear of the central walkway so that plants can be tended from either side. The beds in the back are raised like stair steps so that each receives ample sun. In unheated greenhouses, it is often a good idea to use a roll of bubble plastic lined with foil to cover the plants at night. These foil reflective rolls will trap the heat in the soil all night and help plant growth.


ATTACHED SOLAR GREENHOUSE
DOUBLE GLASS, OR PLASTIC VINYL
VENT DOOR
STUD INSULATED WALL
DOUBLE GLASS OR VINYL PLASTIC
OUTDOOR PLANTER
HOOK
24" PLANTER
15" DOOR
STAIRS
THERMAL ROLL-DOWN COVER
SUPPORT RAIL
SIDE PLANKS 12" PLANTERS
FOAM INSULATION
BLOWER
UNDERGROUND HEAT DUCT
DUCT OR JOIST SPACE
FURNACE
DOUBLE LINED FURNACE STACK DUCT
CHIMNEY CAVITY
HOUSE
VENT DOOR
HOUSE

During the summer, excess heat is vented out the side vents. These are easier to construct than top vents, and can be manually or solar actuated. Several companies make automatic solar vent openers that require no power. These will be described in the next section on stand-alone greenhouses.

Another way to store heat inside a greenhouse during the night is to place dark painted barrels of water on the house side of the walkway, under the lower set of planter boxes. The sun will warm these barrels during the day and the stored heat will radiate back to the greenhouse during the night. Water is a very effective heat storage medium. These types of barrels would not fit within the narrow walkway shown in the present drawing without a wider excavation. However, in a greenhouse with raised up planting beds made from redwood planks, the barrels could easily serve as the first row of supports next to the walkway.

Stand-Alone Greenhouse

To grow a substantial amount of food in a cold climate it is often necessary to construct a separate greenhouse. Large greenhouses rarely look good attached to a residence, so it is best that they stand alone. There are two options here: buy a *ready-made* greenhouse kit or build a *custom* greenhouse. Almost all kits are variations of the traditional peaked roof all-glazing greenhouse, although most use some form of plastic glazing rather than glass. Some smaller ones are fairly economical and easy to construct. The larger ones are made for small commercial growers and are quite costly. They almost always have many motorized venting and heating components which make them costly to operate unless one is growing commercial plantings that bring in a profit. The preferred glazing for cold climates is Lexan Twinwall polycarbonate. This special extrusion is two layers of plastic with clear plastic ribs between the layers. This sandwiched construction adds strength as well as insulation value. The plastic is UV protected for long life in the sun as well. These panels will span up to 3 feet without support. Naturally the cost can be very high; many alternate energy suppliers sell this for $4 or $5 a square foot. However, I have found a way to beat the high prices.

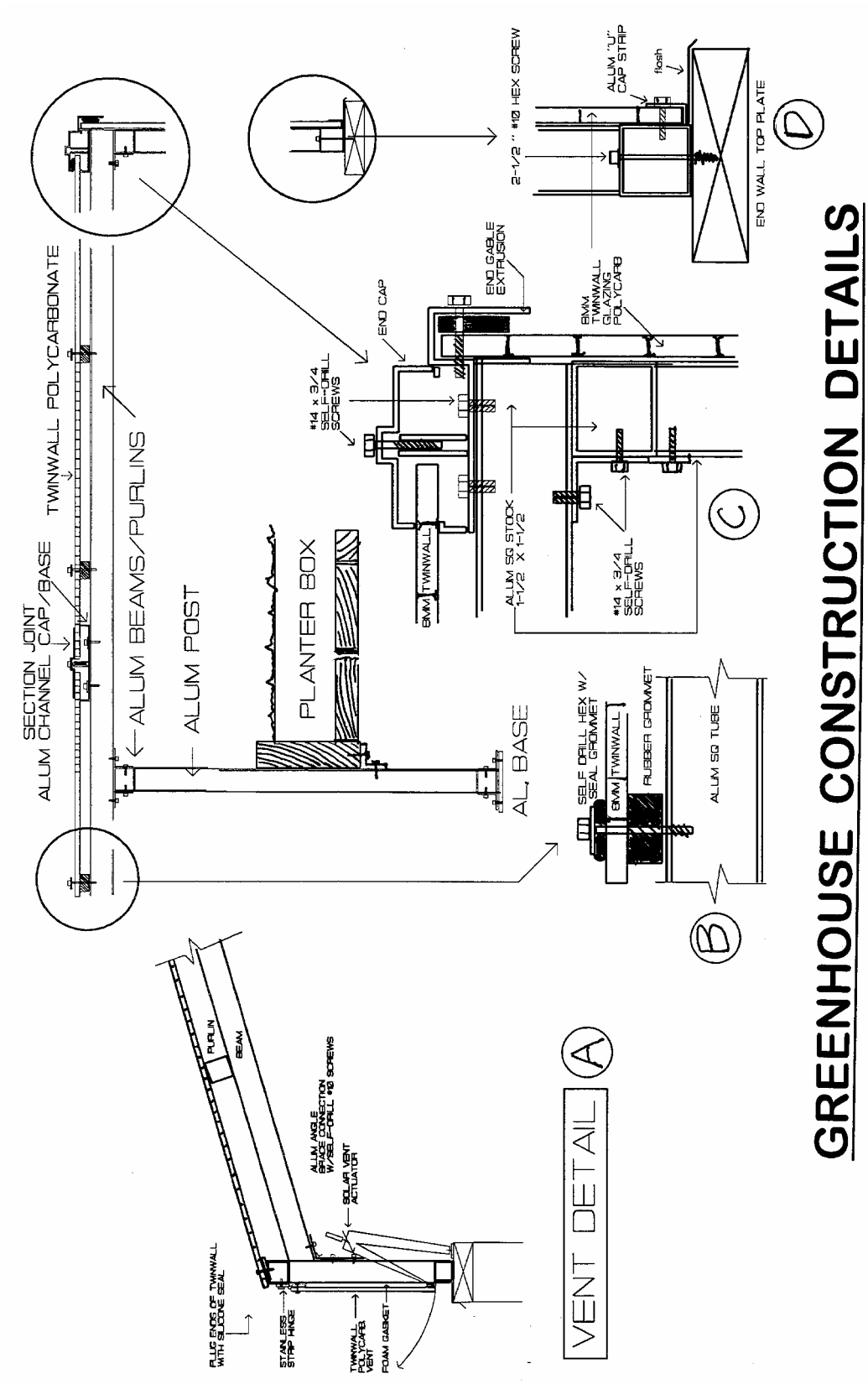
I discovered that the big custom greenhouse manufacturers in the West typically sell this material for under $2 a sq. ft. as long as you buy it in standard sizes (typically 12 and 16 feet long and 4 or 5 feet wide). But this is fine with us since any medium or large-sized greenhouse will use several of these large sizes. I also discovered that they will sell commercial greenhouse aluminum extrusions to almost anyone, as long as you don't hassle them about details like a small retailer. These special extrusions are made to accommodate the attachment of Lexan to regular aluminum square tubing – the preferred structure of choice for commercial greenhouses. In the construction details that follow, I will show you how to connect ordinary aluminum tubing to make the framework for the greenhouse covering. Aluminum square tubing is available in numerous sizes from most metal suppliers in large cities. Look in the Yellow Pages under Metal, Steel or Aluminum. The preferred sizes are 1-1/2" x 1-1/2" for spans not exceeding 4 feet and 2" x 2" for spans up to 6 feet.

The shape I prefer for a custom greenhouse is a lean-to style, much like the attached greenhouse previously shown, only instead of attaching the high side of the greenhouse to the house, we build an 8 foot high concrete block wall that is insulated on the outside and earth bermed. On top of this wall will be a 16 inch high wood frame that will contain the upper vents. With this design, we paint this tall rear wall a dark green paint and it will act as a reserve heat source for cold nights. From this high point of about 10 feet, our greenhouse will slope downward some 12 or 16 feet horizontally (depending upon the length of Twinwall glazing you buy) at a 4/12 pitch. Then at the bottom, short wall we build another vent opening so that we will have a natural flow of ventilation going from low vents to high. No mechanical ventilators will be needed.

Construction Details

Refer to the Construction Details drawing that follows. Start with Vent Detail A at the left. This illustrates what the bottom wall of the structure looks like. This is a short wall about 16” high made out of aluminum square tubing. The aluminum stock is screwed together with small pieces of L-shaped aluminum that we cut from a long L-shaped aluminum angle stock (also readily available). We use self-tapping screws in a screw gun (a battery powered drill with a hex bit in the chuck). These self-tapping screws with a bolt head have a drill bit type of tip instead of a point on the end. They will drill their own hole and then screw into both the L-shaped bracket and the aluminum stock. Thus, the whole thing goes together like tinker toys. To connect the sloping aluminum beams to the vertical pieces, we must put the aluminum L pieces in a vise and bend them to the proper angle. But most connection are done with right angle pieces requiring no bending. Purlins (cross members on top of beams) are placed every 3 feet going up the slope of the beams to support the Lexan. The funny little scissors gadget on the vent is the automatic vent opener. These are heat operated. When the greenhouse reaches a certain temperature the special fluid in one arm expands on a piston and opens the scissors action. When it reaches an adjustable temperature setting, it will reverse and close. Make the vents no bigger than 6 feet long and use one opener per vent. Follow the same process with the top vents. Make sure that you provide a large underground plastic conduit out to the greenhouse if separate from the house. If you want to add additional electrical, plumbing, or even communications to this structure, you will have a built-in channel to pull the wires through without digging up the yard.

Detail B shows how the Lexan Twinwall is attached to the aluminum tubing. The greenhouse manufacturers who can supply the Lexan can also supply these special self-tapping screws with rubber grommets. There is a bit of rubber under the head of the screw to seal the hole in the Lexan, and a larger grommet underneath to keep the Lexan from rubbing on the metal supports. Above Detail B, a cross-section of the structure is shown. Notice the aluminum cap and base channels that go over and under any seam or joint in the Lexan sheets. These can also be supplied from the greenhouse manufacturers.


GREENHOUSE CONSTRUCTION DETAILS
TWINWALL POLYCARBONATE
SECTION JOINT
ALUM CHANNEL CAP/BASE
ALUM BEAMS/PURLINS
ALUM POST
PLANTER BOX
AL. BASE
END CAP
#14 x 3/4 SELF-DRILL SCREWS
BMM TWINWALL
END GABLE EXTRUSION
BMM TWINWALL GLAZING POLYCARB
ALUM SQ STOCK 1-1/2 x 1-1/2
#14 x 3/4 SELF-DRILL SCREWS
2-1/2 " #10 HEX SCREW
ALUM "U" CAP STRIP
flash
END WALL TOP PLATE
SELF DRILL HEX W/ SEAL GROMMET
BMM TWINWALL
RUBBER GROMMET
ALUM SQ TUBE
PURLIN
BEAM
ALUM ANGLE ADJUSTMENT CONNECTION W/SELF-DRILL #10 SCREWS
SOLAR VENT ACTUATOR
PLUG ENDS OF TWINWALL WITH SILICONE SEAL
STAINLESS STRIP HINGE
TWINWALL POLYCARB VENT
FOAM GASKET
VENT DETAIL
A
B
C
D

Each company has different shaped extrusions, but they all accomplish the same general purpose of sealing Lexan joints at the edges and at the intermediate seals across the roof.

Detail C shows the extrusion and attachment details on a corner assembly. It looks complicated, but it really isn't once you realize that all these convoluted shapes of aluminum are ready-made. Detail D shows how the aluminum structure attaches to a wood sill plate. The wood sill plates are attached to the concrete block walls that form the base and foundation around the greenhouse.

Don't be too discouraged if you can't understand these details. These are provided mostly for people who already have a lot of building experience who may wish to take on the project of building their own greenhouse structure. Most of my readers will be content to hire a professional greenhouse installer to do the work. Greenhouses can be done in wood as well, or even in dark colored anodized aluminum such as you see in classy greenhouses for offices or restaurants. Wood is beautiful, but the high heat and humidity of a greenhouse will make it difficult to maintain a nice wood look. If you do go with wood, don't try to put a waterproof finish on it. Use redwood with a penetrating oil finish that will breathe. Prime all woods with a mildew and fungus repellent before the oil to ensure the wood members don't become permanently stained with these agents.

Summary

Greenhouses and solariums can be some of the most dramatic additions to a home if designed into the overall plan. The "Recommended Equipment and Sources" section and bibliography will give you additional resources and books to help you decide on the best option

Section

III

Security and Self-Sufficiency Systems

Chapter

9

Security

In this chapter, I will discuss the physical aspects of security. However, this is only half of the equation. Each person must have developed proper security procedures in order to successfully use his security equipment. Since these tactical procedures have more to do with personal family training, I have previously detailed them in Chapter Two: *Strategy and Training for Quick Reaction to a Crisis*. If you bypassed the Philosophy of Security and Self-Sufficiency section which contains Chapter 2, I suggest you go back and read that chapter before proceeding.

DESIGN CRITERIA FOR A HIGH SECURITY HOME

The following are five critical factors or components that ought to be included in your security plan. Each will be discussed in detail throughout this chapter:

1. A strategic, secure location
2. A secure structural shell resistant to fire, intrusion, and projectile damage
3. Accurate and timely threat detection systems
4. Tactical preparations and equipment to carry out multiple defensive responses
5. A way out – should your situation become untenable

Within these criteria, we will discuss various levels of security. This is important since few people need or can afford every possible security function. Here is my Security Levels Rating System:

- LEVEL 0: Tract home construction – no security precautions, cheap door knob locks.
- LEVEL 1: Standard construction, basic security system, mid-grade locks plus dead bolts, a few automatic outdoor lights, and basic fire alarms installed.
- LEVEL 2: High grade construction (at least the lower 3 ft.), solid exterior doors, high grade locks, extensive security and fire alarm system with central station monitoring, intercom, full security lighting, and a tamper-proof automatic garage door opener.

- LEVEL 3: Same security features as Level 2, plus some form of fire-resistant and vandal resistant exterior for walls and windows. Also, some alternate energy equipment and a high security vault room with minimal outfitting and equipment.
- LEVEL 4: Same as Level 3 plus at least half-wall bulletproofing on the main floor, full perimeter alarm/security fence, and surveillance cameras for a broader ring of security away from the home. A fully outfitted and concealed secure room with EMP protection, secure communications and escape exits.
- LEVEL 5: Same as Level 4 plus full fireproof, bulletproof construction.

I will cover all the necessary equipment to produce the level of security you desire. All my readers should try to achieve at least a Level 2 security. If you are building a new residence you should try for a Level 3 as a minimum, even if you do not have funds to fully outfit the shelter or alternative energy equipment. To build new and not provide for all the basic security structural elements will cause a nearly irreversible situation and be very difficult to attain later without costly excavation and remodeling. Level 4 is really only possible if you have an ample yard where fencing and perimeter security systems give you a viable distance between your home and the threat. Fencing a yard with a 5 foot setback on the side between tightly packed houses is marginal at best in efficacy. Level 5 bulletproof construction is necessary only for a few high-risk families. Fortunately, with my innovative *gravel-in-the-wall* system, it is fairly economical.

SOME BASIC SECURITY TIPS TO START OFF

- Select a low-risk neighborhood toward the periphery of a safe city
- Acquire only low or normal profile material possessions (house, cars, clothes, etc.)
- When you fence a house, use materials you can see through and that aren't too high
- Keep your affairs private, but not so much so as to raise red flags

Keeping a low profile does not mean you have to look poor or squalid. Just make sure that, within your chosen surroundings, yours is not the biggest and best-looking house on the block. Don't drive a Mercedes or a Lexus when you can get by with a Camry or Suburban. Your house should be well-kept and nicely landscaped. It will not necessarily give the appearance of great wealth as long as its size and style is fairly modest. Now let's look at some of the security features in more detail.

STRATEGIC LOCATION

This is very important since how much you will spend on protection depends upon how safe or unsafe your location is. This was a small part of the original *Survival Home Manual* and now requires much more space. I took this section and made a whole book out of it called, *Strategic Relocation – North American Guide to Safe Places*. For those

of you who don't have that book, let me review the key points about picking a specific site once you have a general idea of the secure area in which you are going to live or set up your retreat. If you need more detail, don't hesitate to get the book.

Some people must, out of financial or other necessity, live in a high-risk area. In fact, there are no absolutely secure locations anywhere on earth. Every place has some risks. It is just that some places are much much worse than others. If you live in one of these "worst" areas and cannot leave, you must provide in advance some place to retreat to – even if it is living temporarily with relatives or friends who are in a safer area. In such contingency situations, you must take great care to plan how and when you are going to leave (before or during turmoil), what kind of vehicle will get you to where you need to go, how to stash fuel at secure way stations along the way, etc. Don't count on just hitting the freeways and cruising out to rural America, filling up at gas stations along the way.

Ten Essentials of a Good Specific Home Site

When you pick a specific site, you want to try your best to find the following:

1. A homesite that is not visible from a major city or county road – and especially not visible from a freeway.
2. You want a little bit of elevation and distance between house and road in order to see who is approaching on your access road. If there are physical barriers that must be crossed before getting to your property, so much the better. Fence lines with gates, irrigation canals or streams to cross, and small ravines all allow you the ability to place easy barriers in front of would-be intruders.
3. You do not want to be on top of a hill, visible to all the world. If you have a view of them, they will have a view of you. The only exception to this is where you overlook large tracts of forests that have no major roads breaking out into the open which can see your home.
4. Do not pick a homesite up a narrow canyon serviced by a narrow road that may cause you to get trapped in a road block while heading home, or coming down the canyon. I prefer sites that have at least two other ways of getting in or out of the general area.
5. Make sure the ground you pick is geologically stable. If in an earthquake area (as most good mountainous areas are), site your home on the bench areas (foothills closer to the actual mountains) and not on the valley floor. This will keep your home out of the wave action set up during a quake, when the wet earthen lowlands start to act like water rather than land. If close to steep mountains, avoid areas with steep rocky cliffs above. In a quake, many of those rocks may dislodge and come crashing down on your homestead.
6. Try to find an independent water source. Make sure the area doesn't have smelly or foul water as is common in some states. Find a place with good well water and a nice nearby stream, if you can. If you have a spring as well,

so much the better. If city or county water is available, use it (except for drinking), and develop secondary sources as well – even if only storage tanks on higher ground that can gravity feed to your home.

7. Make sure you have a sunny area to grow a garden. Avoid north-facing slopes to build on. In dense forest, you will have to clear some trees.

8. Try to always find property that has basement potential. Not only are basements essential for many things, but a good security plan involves alternate entrances and exits that may be underground. Having to resort to blasting during your excavation is costly and sometimes a violation of the low profile rule. Of course, sometimes you have to do *whatever it takes* to get the job done. Avoid flood plains, unless you build high enough to be out of harm's way.

9. Do not, if possible, buy a lot in a rural subdivision that has an owner's association. These are very difficult to deal with and always engender tension. Always try to find unassociated property with its own access. If there is an association that only has powers over roads and utilities – and not over what you build or can't build, then that may be acceptable. Always become acquainted with your neighbors before you buy. While you can't always guarantee that good neighbors will stay, one bad neighbor with a house full of delinquent kids can cause you infinite amounts of grief.

10. I like properties with some rolling hills and forestation. If you ever have to leave under duress you don't want to have to cross miles of open ground.

HIGH SECURITY CONSTRUCTION

It is important to realize that there are limitations to any level of destruction resistance you may wish to design for. Any protection level above resistance to vandalism and easy intrusion becomes expensive. Bulletproofing is not difficult for walls, but is very expensive (or used to be) and hard to conceal if used in doors and windows. Higher levels of resistance for tornado, earthquake, or war-time destruction can be so cost prohibitive that it is better to use relocation strategies for defense rather than further hardening of the structure. As you are aware, I do not recommend making a home into a fortress (with gun ports, etc.), nor do I recommend defending it as a bunker – at least while you have other choices. Fixed targets are always vulnerable to other tactics such as isolation from resupply, chemical weapons, or even fire. In the final analysis, the opposition can usually come up with more powerful weapons than what you are using for defense, since they are not constrained in time, location, or resupply. That is where strategic design comes in–having more than one escape route, for instance, and other contingencies. These are only useful, however, if you use them in a timely manner before such options are cut off or unavailable. I will stress the following three types of residential hardening from a construction strategy point of view. These correspond to security levels 3-5 listed previously:

- LEVEL 3: A conventional, above-ground structure with normal utilities, vandal-resistant doors and windows, high quality locks, high security basement shelter, and a passive security system.
- LEVEL 4: A bulletproof wall construction above ground on the main floor with non-bulletproof (but entry-proof) windows, heavy metal doors, basement security shelter, and underground secured utilities. An active security monitoring system that gives real time information on intruder sound and location.
- LEVEL 5: Full bulletproof exterior including walls, windows, and doors; fireproof exterior construction; full perimeter security fencing; protected underground utilities (or full self-sufficiency); and full security private basement under concrete slab, with privacy entrances. Active, remotely-activated defensive measures.

Most of my readers with ample funding will select Level 3 or 4 for their security needs. Only in very special situations would someone need Level 5. To accomplish Level 5, one would not only need a great deal of money, but would also need to hire their own construction crew of highly loyal and reliable people so that it could be done in absolute privacy.

SECURITY OF MAJOR STRUCTURAL ELEMENTS

Walls

Conventional non-masonry wall construction has very little resistance to destruction. Wood stud walls, the most common type, are designed with minimum structural strength and high insulation value, mostly for cheapness of construction. If the exterior facade is of wood, vinyl, or aluminum siding, there is little destruction resistance, and no bulletproof value. In the event of a weapons attack, the only value your walls would serve would be to shield your position from view. Even the wood studs will not stop most bullets. A brick exterior is the most preferable of the conventional construction types since it does offer initial resistance to bullet penetrations as well as to most types of vandalism. The mortar joints, however, are soft enough that brick walls will not stand up to multiple shots in the same general area – the wall starts crumbling down. Stucco, though it appears solid, offers no effective projectile resistance. The old style stucco that was an inch thick and more like concrete was more effective than today's high-tech, flexible stuccos. The anti-cracking formulas of today are softer and more elastic and are fairly easy to penetrate. Even concrete block houses are not fully bulletproof unless the voids are filled with concrete and the joints are reinforced with steel ladder wire and R-bar. Hollow concrete block is very brittle and will disintegrate rapidly under multiple shots.

Vandal Resistant Exteriors

The types of exterior wall surfaces that are best for moderate resistance to vandalism attack, short of bullet resistance are, in order of preference (best to worst, without regard to aesthetics):

- Stucco (both cement-based and epoxy-based): Normal Stucco has a moderate fire resistance rating, is moderately flexible, strong, and easy to repair. It is not stain resistant, but can be repainted easily. "Geobond" Stucco is absolutely fireproof and has some bullet resistance.
- Vinyl siding: Vinyl is flexible, stain proof, sun resistant and very tough. It is easy to repair but not fire- proof.
- Steel siding: It is not flexible and will dent easily. It is not as easy to repair as vinyl but it is more fire resistant. The paint coating can wear through if bushes rub against the walls.
- Log walls: Flexible, easy to repair (unless deeply damaged). Will stain, but is fire resistant – in that it takes a long time to burn through, unlike hollow wall construction. Note: Log walls are mildly bullet-resistant. It takes about 24" of dry oak to stop a high velocity rifle bullet.
- Wood siding, log siding: These veneer surfaces are fairly strong and resilient and look good. However, they are not fire or stain resistant. They are easy to repair physically, but difficult to match to the existing siding due to sun discoloring.

Bullet/Projectile Resistant Materials

Bulletproof ratings by "levels" from most economical to least:

LEVEL 1: Up to .38 special (1,280 ft/sec [fps] and 475 ft-lbs. of muzzle energy)

LEVEL 2: Up to .357 magnum, 9mm (1,450 fps and 750 ft-lbs. of muzzle energy)

LEVEL 3: Up to .44 magnum rounds (1470 fps and 1,250 ft-lbs. of energy)

LEVEL 4: Up to 7.62, 30-06 rifle rounds (2,523 fps and 3,102 ft-lbs. of energy)

LEVELS 5-8: Deal with major military applications beyond the civilian arena

Brick and Hollow Concrete Block

Brick and hollow block are only marginal shields for high powered projectiles. But they are readily available and relatively affordable. Both can be made much stronger with R-bar and ladder wire in the voids. Concrete block is often reinforced with voids filled. But few people know that brick can also be reinforced. Each brick has 3 holes in it, through which you can place #3 R-bars. Small 4-inch ladder wire can be placed in the mortar bed every 2 or 3 courses. Solid masonry walls must have interior insulated walls to achieve proper environmental control.

The Gravel Wall System

The best and most efficient form of bulletproofing (when you desire a completely hidden or do-it-yourself system) is something I developed within the last 2 years. It involves the use of 3/4 or 1/2-inch gravel packed within the outer walls of a framed home. For maximum effectiveness, you must use *steel studs* instead of wood studs for framing. Wood studs are not bulletproof and you don't want to take a chance on a stray bullet coming through a wood stud. The best thing about gravel is that it can take *multiple hits with no degradation*. It simply chews up bullets, unlike brick or cement which can be chiseled away by multiple shots. A measly 3-1/2" stud wall will absorb the full impact of multiple high velocity 7.62 military rounds without degradation. The disadvantage with this system is the need to build a second interior wall on the inside if you need insulated walls. But the total double wall system gives you extraordinary soundproofing as well as shielding from the latest infra-red snooping equipment. If you live in a mild climate, you can simply apply 1" foam sheathing over the plywood sheathing on the outside, inside, or both sides and then use whatever interior or exterior finish you desire. I will explain how to build these walls shortly.

Reinforced Poured Concrete

With the advent of the new foam blocks for forming concrete, it is practical to build an entire home out of cement. The forms have built-in plastic ties to which interior and exterior siding can be attached. Use only the types of forms that are capable of producing a full 6 or 8-inch thick wall – not the types that pour a lattice-work of concrete. The parts of the wall that are all foam won't stop much of anything.

Kevlar/Fiberglass Bulletproof Panels

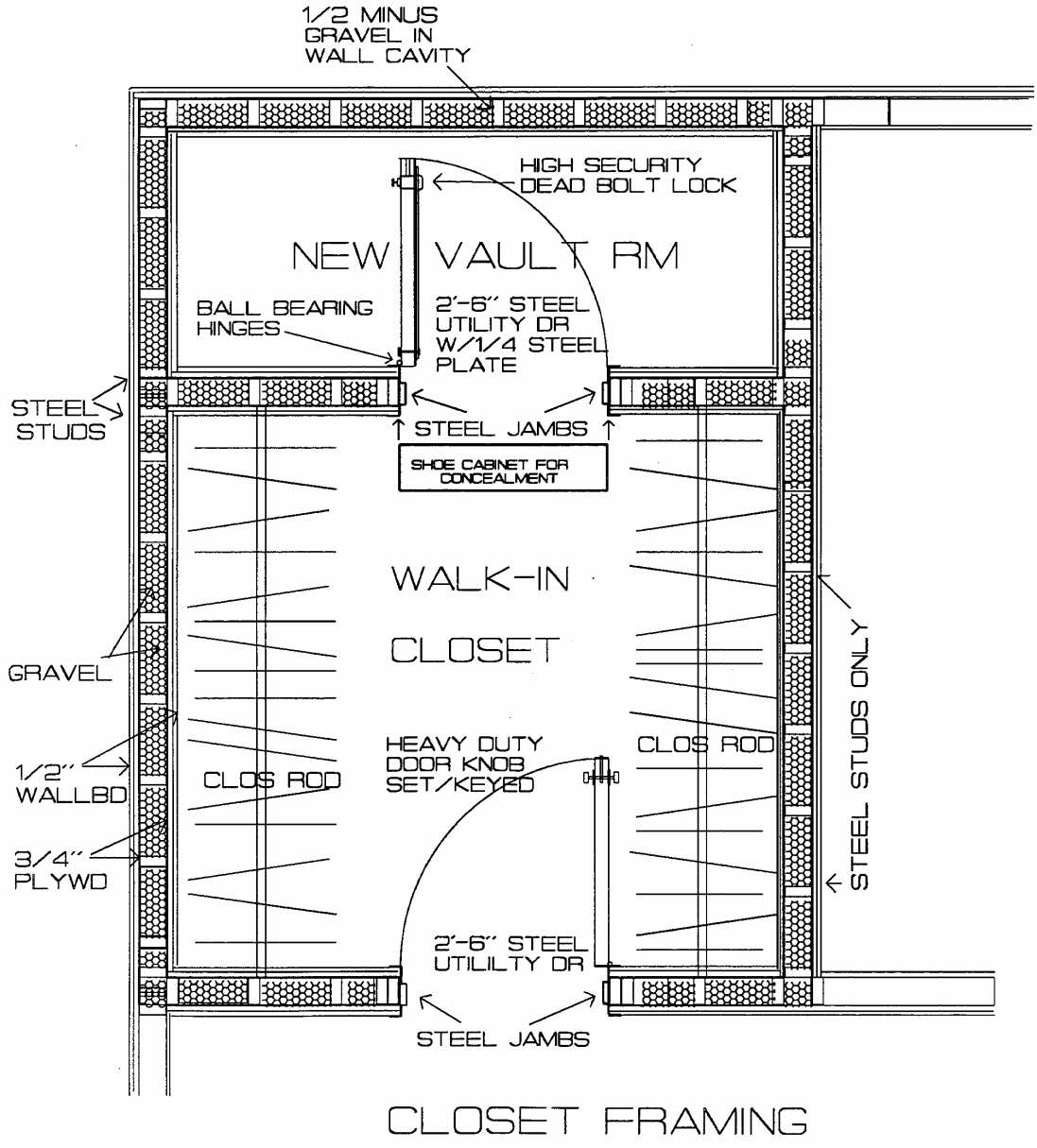
These can be purchased in large sheets of various protection levels and cut like plywood. They can be used as exterior sheathing on frame construction to give fairly good bulletproofing. They will not sustain multiple hits in the same general area, and they are fairly expensive. (See the "Recommended Equipment and Sources" section.)

Armored Steel Panels

These can be installed at even greater expense. Every 4x8 sheet will cost you about $400. While costly, it is reasonable for many high security installations.

Building the Gravel Wall Protection System

(See illustrations) I will deal with the two basic alternatives: single and double wall construction. The first illustration shows a hardened closet floor plan. This demonstrates one of the prime uses of this gravel bulletproofing: building a secure walk-in closet within the master bedroom complex. You may also decide to harden all the walls of a master bedroom to ensure against intrusion at night when you are sleeping and



CLOSET FRAMING

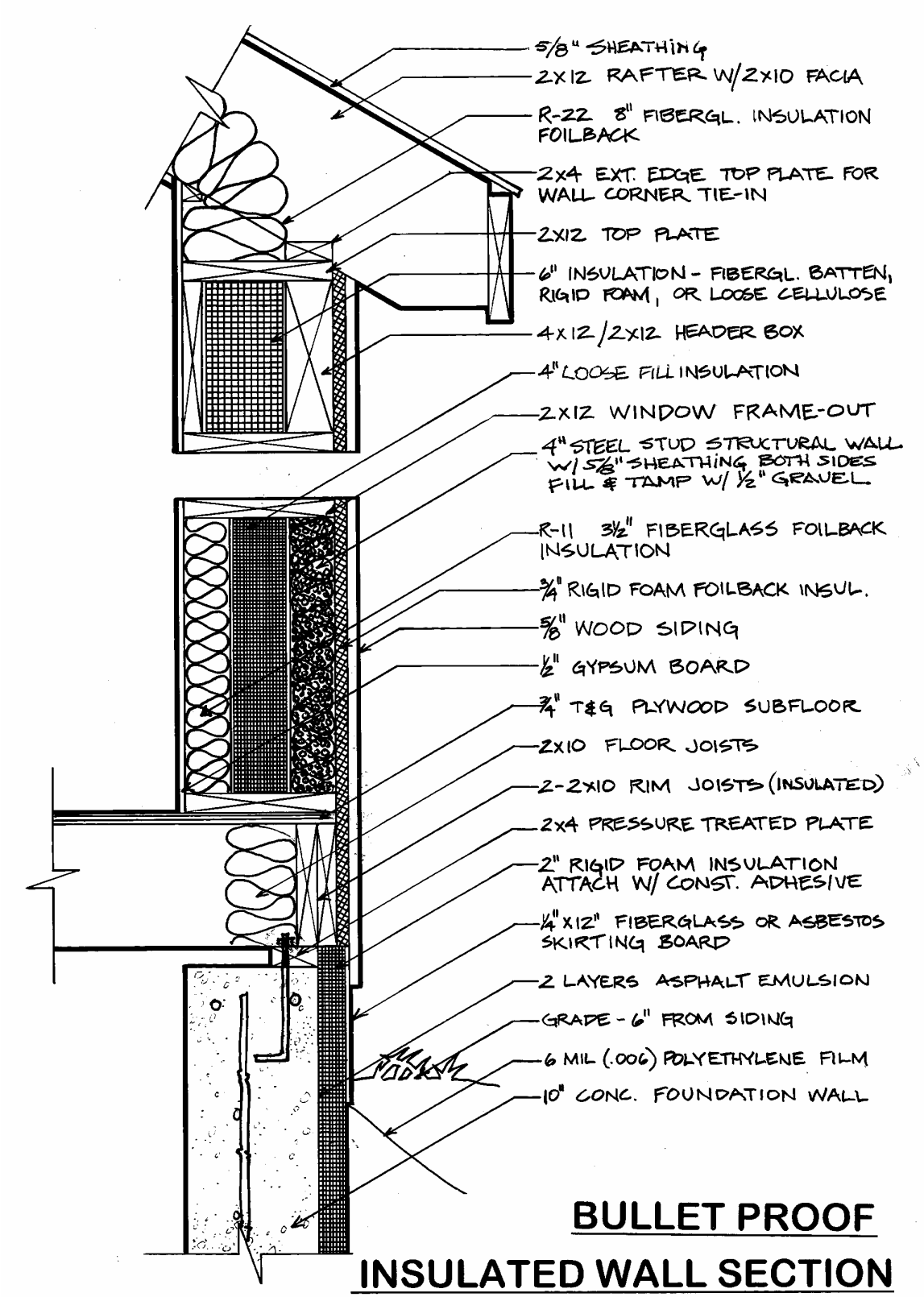
GRAVEL BULLET-PROOF WALL SYSTEM

vulnerable. As with all these gravel wall designs, use steel studs instead of wood for maximum effectiveness. The illustration shows a hollow box for each stud for clarity. In reality, the steel studs are shaped like a squared-off "C." So when the gravel flows in around it, there is virtually no space for a bullet to squeeze through without encountering the gravel barrier – unlike wood studs which provide a 1-1/2 inch space of soft wood for the projectile to bypass the gravel. You must mount 5/8-inch or 3/4-inch plywood to the studs as primary sheathing, so that the compressed weight of the gravel does not bow the wall surface outward under the pressure. Sheetrock will not hold the weight and will lose its connection strength quickly under the vibration of multiple bullets hitting the gravel. Interior walls can then have 1/2-inch or 5/8-inch sheetrock placed over the plywood for a finished surface. For electrical wiring within these walls, use metal boxes and place electrical wiring in metal conduit for protection against the abrasion of the gravel. The metal boxes surrounding the duplex outlets will also help them stay in place better than plastic boxes.

This wall has tremendous sound deadening features as an added benefit. This can be increased even more by adding a layer of 1/2" foam board between the sheetrock and the wall sheathing. Greater soundproofing is achieved by using two dissimilar layers of sheetrock on top of one another such as 1/2-inch sheetrock followed by a layer of 5/8 sheetrock. Different thickness absorb different sound vibrations. Remember that a bulletproof wall is not much help unless you install a bulletproof door and jamb. Follow the recommendations in the door section below.

The next illustration shows a section detail of an exterior steel-studded wall filled with gravel with a second interior wall for insulation. The drawing shows a 12" thick wall for superinsulation. This could be reduced to two 4" walls side by side, with no insulation space in between, for those areas not requiring superinsulation. Simply use the appropriate width bottom and top plates to match the desired wall width.

Double wall construction is done as follows. The main exterior structural wall, which supports the roof is constructed from steel studs with 5/8-inch or 3/4-inch plywood (or OSB board) mounted on each side. No plumbing or electrical will go inside the gravel wall. Next, on the interior side, erect a normal 2x4 wall (can use either wood or metal studs) about 1/2-inch away from the exterior wall. This wall will be insulated and will contain all normal electrical and plumbing materials. Leaving a space between the two walls helps with soundproofing and also allows for easy threading of electrical wire, so the studs do not have to be drilled. Fill the spaces completely with insulation to avoid creating vertical paths for fire inside the walls. The newer foam-type insulation seals all gaps between stud spaces.



BULLET PROOF

INSULATED WALL SECTION

Filling the walls with gravel is fairly easy. Install the plywood sheathing on the bottom half of the wall (using grabber screws every 6 inches on center – not nails) and fill with gravel. Order what is called “half-inch-minus” gravel. This means gravel that is run through a 1/2-inch separator. You will only get gravel 1/2” and less in size. You can use 3/4”-minus, but it is a little harder to come by and more difficult to compact. Do not go any lower in size than 1/2-inch. Sand-sized particles stop bullets by friction and will require a much thicker wall to accomplish the job. Larger gravel actually causes the bullet to ricochet and change directions, forcing the bullet to deform and loose its conical shape. After the first impact the bullet is so misshapen, it doesn’t have good penetration capacity and quickly gets chewed up.

Pound on the lower parts of the plywood to vibrate the gravel downward. Now, before installing the top half of plywood, cut off the top 5 inches on the plywood (on one side of the wall) so that you will have a gap at the top for installing the upper gravel layer. By the way, you must use tongue and groove edged plywood so that the seam at the 4 ft. level doesn’t split outward. Fill the upper half through this gap using a large metal dust pan for a wide scoop. If you have a second story above, you can also build a custom trough and pour gravel in from buckets above. This is much faster than hand scooping it in. Have someone tap and vibrate the wall to make sure the gravel packs in tightly. This is essential for making sure the bullets cannot work their way through the gravel spaces. When full, install the 5-inch strip you cut off to close the wall in. There will be a small gap at the top without gravel, but this will be well above the threat zone for normal-sized people.

Security Doors

The most vulnerable part of a door is the latching mechanism and jamb material. Most door frames are of clear fir or pine which is set into a stud wall frame. Depending upon the gap between jamb and structural frame, you may find that the jamb has been shimmed out as much as 3/4 inch. The only shear strength of the door frame is found in the nails that connect the wood jamb to the nearby framing. With soft finish nails, that’s not much protection. If you want wood jambs, specify oak or a similar hard wood and shim the full width of the frame with various thickness of plywood set with nails and construction adhesive. Set your door knob strike plates into the jamb with long 3” hardened screws so that the metal strike plate can’t be dislodged. If you have a fairly conventional door, you can strengthen the area around the dead bolt and the door knob by installing steel or brass shield plates, sold at most lock shops. These deter a thief from using a chisel or screw driver to remove chunks of your door between the locks and the jamb. If they succeed in breaching the door in these places, the door can be levered open with a bar.

My preference is for metal door jambs, even if you use a solid wood door. They are much stronger than the best woods. Vault locking mechanisms for doors are now available that slide four bars into each face of the door jamb. And there is one company that makes a threshold vault-type lock that keeps the bottom of the door from being kicked in. These types are recommended for main exterior doors, the master bedroom door and the high security shelter or storage rooms. Note that the expense of bulletproof

doors on the exterior of the home is not justified if windows are not likewise protected or if you lack masonry walls. Always watch for the weakest link in your external security. The typical residential metal front door is not really a security door. These are built with a foam sandwich technique inside, and are not much more difficult to break down than a hollow wood door. Even if you have a reinforced metal utility door, keep in mind that it is highly resistant to intrusion, but not bulletproof. It takes over an inch of regular mild steel to stop most rifle bullets. In contrast, it only takes 5/16" of tempered steel to stop high-powered rifle bullets. Not only is the thinner tempered steel plate lighter, but it is cheaper and tougher than 1" inch mild steel. With 1" steel, it would take a crane to put the door up. Even with the 5/16" tempered plate, it takes two or three men to handle the weight.

Bullet-resistant doors are made by only a few door manufacturers. Only one have I found to offer a Level 3 door at a reasonable price. Another big name outfit charges more for their Level 4 door (over $5000) than what I would pay for a full vault door (around $3000). So do check the "Recommended Equipment and Sources" section for specific recommendations before you buy. I am also presently experimenting with my gravel bulletproofing to see if a regular 2" thick 16 gauge reinforced utility door can be made bulletproof by taking out the insulation and replacing it with gravel. Most utility doors would not be suitable for this, since they are merely two sheets of light metal glued to a foam or honeycomb core. However, reinforced doors have vertical 18 gauge metal I-beams every 4" in the middle of the door. Thus, they are structurally very stiff – though not bulletproof. I'm anxious to see what gravel inserts would do for these doors. I'll keep you posted through my Online update on my website at http://www.joelskousen.com. For any bulletproof door, always order the metal jamb in a thickness of 14 gauge steel. Twelve gauge is even thicker and stronger. However, not all companies have 12 gauge available.

True bulletproofing cannot be had without an armored plate of tempered steel on the face of the door. Heflin Steel in Phoenix Arizona makes these plates and is very helpful in providing their "Armor Plate" to the residential customer. These plates must be attached to a reinforced utility door with ball-bearing hinges, to handle the increased weight. There are also large, full-length piano hinges available for utility doors. Make sure you have Heflin Steel cut the holes in the plate before they ship it to you. Otherwise the metal will be too hard to drill, without heating it up with a torch first. You will need 1/2" holes near each corner for attachment and holes for the dead bolt and door knob set.

If you go to all the trouble of putting a bulletproof plate on a door, I recommend you have custom dead bolts placed in both the top 1/3 of the door and the bottom 1/3. This gives three points of closure (counting the door latch) instead of two, and they are spread out over the door so as to keep the door from giving way under force – especially at the bottom where it is more vulnerable. See the explanation below in the lock section about how to bevel your bulletproof door plate holes so that they fit tightly over the dead bolt and keep them supported when under attack.

Doors that may be subject to explosive blasts, storm forces, or heavy blows to force them open should be reinforced utility doors, as previously described. It is also necessary under some circumstances to put a 1/4-inch steel plate on the front to keep the structure

from being damaged by multiple blows. Under the threat of concerted attacks, it is always necessary to have the additional security of vault- type locking pins which insert into all jamb faces. Short of using a regular vault door, you can always resort to the old pioneer trick of barring the door with a sturdy wood brace set in heavy metal brackets on either side of the door, both top and bottom. These are only effective as the strength of the brace attachments. Make sure they aren't just screwed into the wall. They should be welded to a heavy metal jam or bolted with hardened stove bolts. Hardened bolts are bolts that are tempered. They can be purchased at any specialty bolt shop – look in the yellow pages.

Security Gates

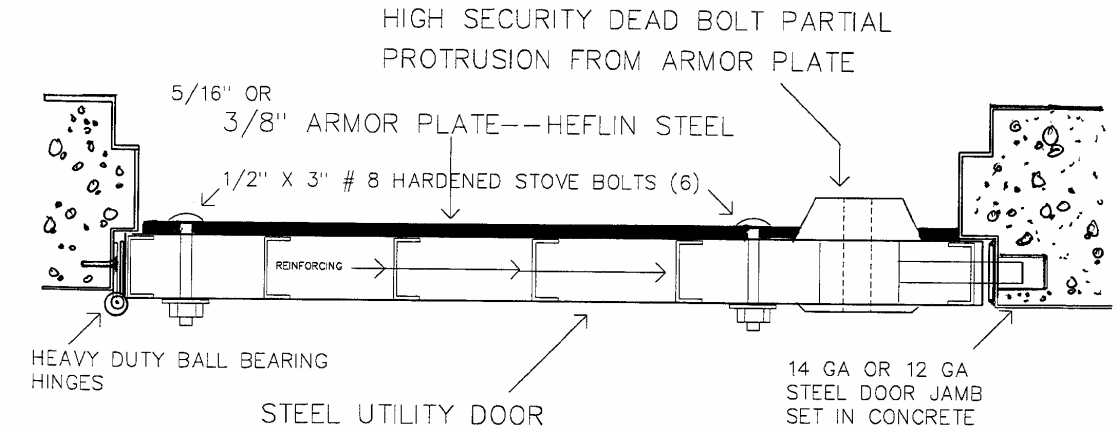
These are sometimes advisable for courtyard areas or open air vestibules. Every large city has a variety of ornamental iron shops that can make these gates. There are also a number of national firms that make ready-made gate and fence systems. In rural areas, or high crime residential areas, it is always important to have a fence and a locked gate. This lets you know that if someone is inside that gate, without having rung the bell, they are a security threat. Unfortunately, many local city codes prohibit security fences in residential neighborhoods – especially in the front. They feel it is very unneighborly. Perhaps so, but so is crime, and a citizen should have the right to put up suitable passive defense barriers.

Locks

Locks must match the security level of the rest of the home. It does no good to put a high security lockset on a hollow core door, any more than it does to put a conventional tumbler cylinder lockset on a bullet resistant door. There are a variety of specialty locks on the commercial market – everything from magnetic keys to ones that respond to your hand and/or voiceprint. For practical purposes, you can achieve as much security as you need with one of several "pick-proof" cylinder locks. One type, the Norman cylinder, uses a unique concept that forces the keys to unlock all of the pins simultaneously. Virtually all lock picking techniques take advantage of the fact that other cylinders unlock each pin individually. This cannot be done with the Norman cylinder. Also, all keys are reproduced only at the factory. Someone cannot run down to the local locksmith and get a copy of your key. The Medeco lock is pick-resistant and almost pick proof. The manner in which the key faces are cut requires the pins to rotate before they will unlock. This makes them almost unpickable without special Medeco tools. The ASSA pick-proof deadbolt is built to withstand heavy hammering, and has a double row of pins in the cylinder. It is considered pick-proof.

No dead bolt is any stronger, however, than its attachment to or through the door. A large sledge hammer can knock a dead bolt off the door if the door metal is thin. The illustration below shows a metal utility door that has a bulletproof 5/16" tempered steel face attached for the ultimate security. If you will look closely, you can see that the pre-cut holes made by Heflin Steel (as per your dimensions and instructions) have been beveled in order to tightly fit around the dead bolt. Since Heflin does not do this bevel, you must carefully measure around the dead bolt 5/16" away from the original door face to determine the smallest diameter of the bevel hole. This is the diameter hole size you

tell Heflin Steel to cut. When you get the door plate, grind the bevel with a small grinding wheel attached to an electric drill. It takes a little while. Use the dead bolt itself to keep checking your bevel until it fits into the steel plate tightly. Now attach the dead bolt to the utility door, place the bulletproof plate on top (with the utility door laying on horizontally supports) and drill through the attachment holes of the plate, into the utility door. Use hardened stove bolts from automotive supply shops (#8 hardness) to secure the plate to the door. Then mount the door to the frame with the heavy duty ball bearing or piano hinges.



BULLETPROOF PLATE ON UTILITY DOOR

Secure Windows

There are no easy, cheap answers to the question of window security. It is by far the toughest item to tackle on the perimeter of the home. The only redeeming value of regular glass is that it is clear, hard to scratch, and cheap. On the downside, it is brittle and dangerous when broken, converting itself into a thousand flying splinters. Securing windows takes several different types of materials and methods. We can shutter the windows, apply protective films, add unbreakable glazing, or using bulletproof glass. Most of these are not cheap. Let's go through your options.

Acrylic Plastic Storm Windows

The least expensive way to protect your windows from intrusion and breakage is to install acrylic plastic (trade names like Lexan or Plexiglas) storm windows on the outside of all glazing. If you use the most expensive acrylics, the cost will still be much lower

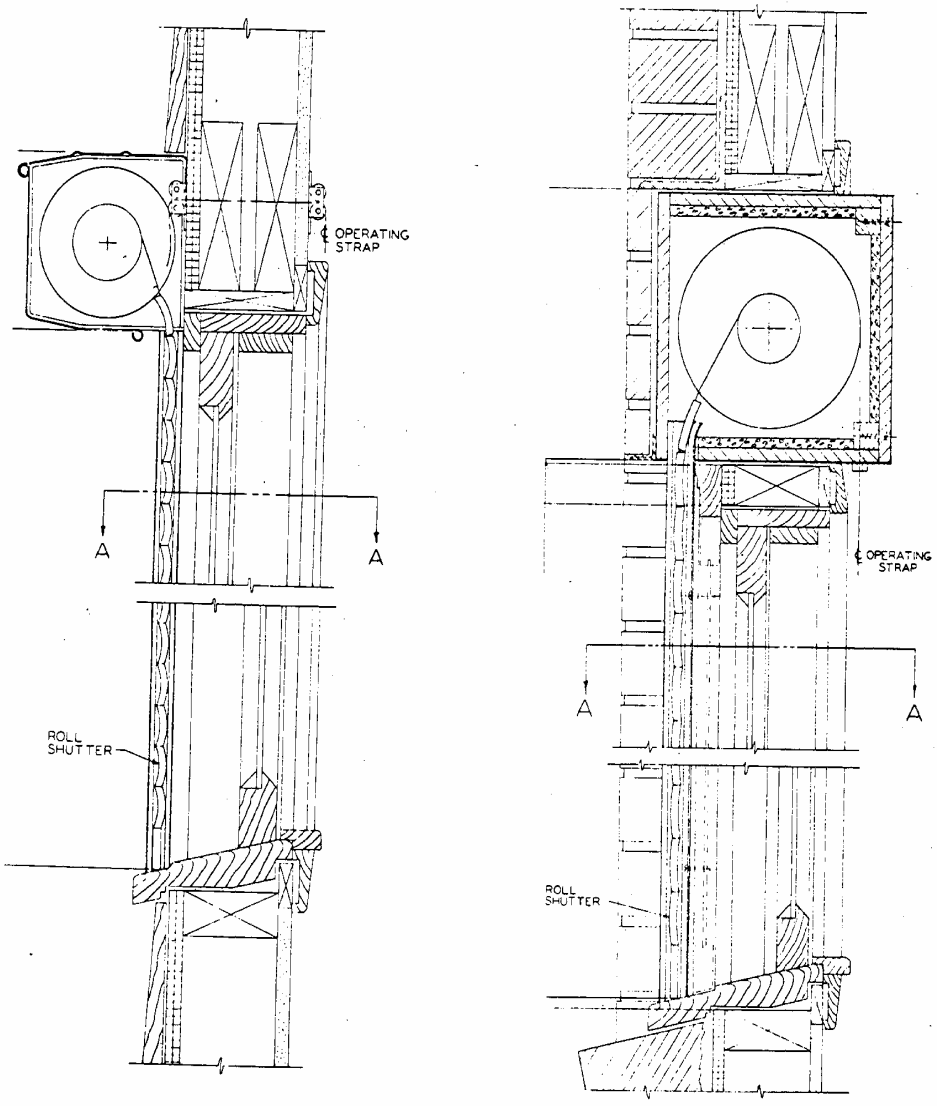
than external rolling security shutters. The least expensive shutters will cost at least a $1,000 per window including installation. On the other hand, acrylic storm window will cost around $300 per window. This remedy provides an unbreakable layer of protection if used in thickness of at least 1/4 to 3/8 inch depending on window size. Larger plate glass windows need 1/2 inch material. However, acrylic plastic does not provide privacy or sun protection like rolling shutters – one of the compensations for their high cost. Two other problems with acrylic storm windows are: first, lack of ventilation when windows are open, and second, susceptibility to being easily scratched. The ventilation problem can be solved partially by drilling a series of 1/4 inch holes along the bottom and top, or by mounting the storm window frame on small strips of scrap acrylic (which leaves small, almost invisible slots behind the frame work). Acrylic is not bulletproof except in the thicker glass/plastic laminates of 1/2" or thicker. Straight 3/8" acrylic will stop small glancing caliber rounds like the .22 or .25 auto.

Acrylic or Mylar Film

There are several brands of high tensile strength plastic films that are professionally installed with a special clear adhesive to the inside of your windows. These make your glass entry-proof and bulletproof to light, small pistol ammunition, and they have the advantage of still allowing you to open your windows for regular ventilation. Naturally if the windows are attacked, the glass will crack, but it will stay intact – even under repeated blows. This stuff is amazing and reasonably priced. Care must be taken on cleaning the inside so as not to scratch the surface. But the inside is not as susceptible to damage as the outside, which is often subjected to blowing grit and dust.

Bulletproof Glazing

Bulletproof glass is an alternative for special needs only. Cost-wise, it is the most expensive alternative – not because the 1" thick glass/acrylic laminate itself is so costly, but the custom window frames to accommodate this thickness of glazing are so expensive. For full protection, the frames must be metal. However, any damage to the laminated glass will require extensive replacement costs. Bulletproof glass does stop bullets, but not without shattering the glass surfaces which must be replaced for aesthetic reasons. Bulletproof glass will also not sustain multiple hits in the same area without failure.

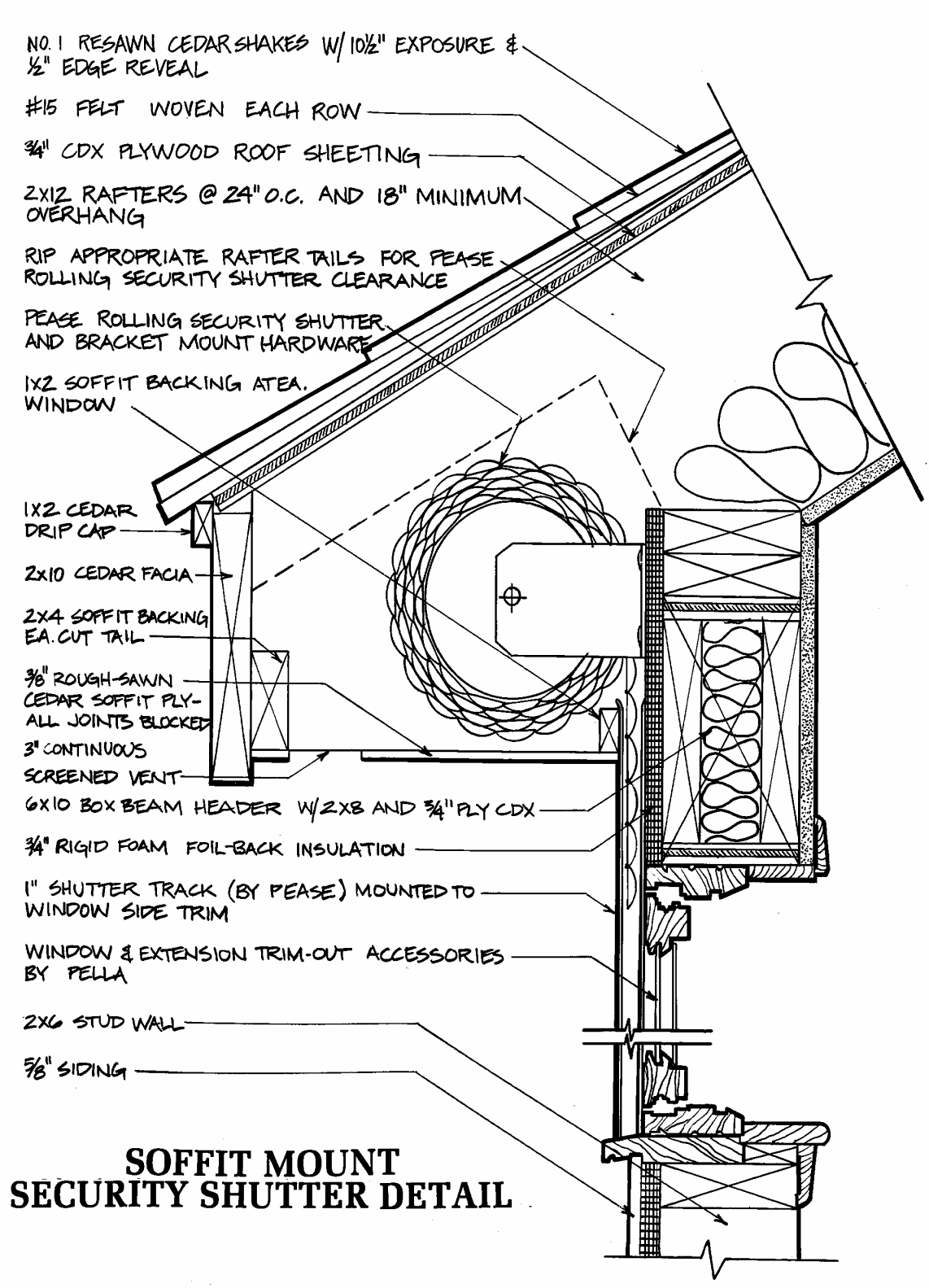


ROLLING SECURITY SHUTTERS

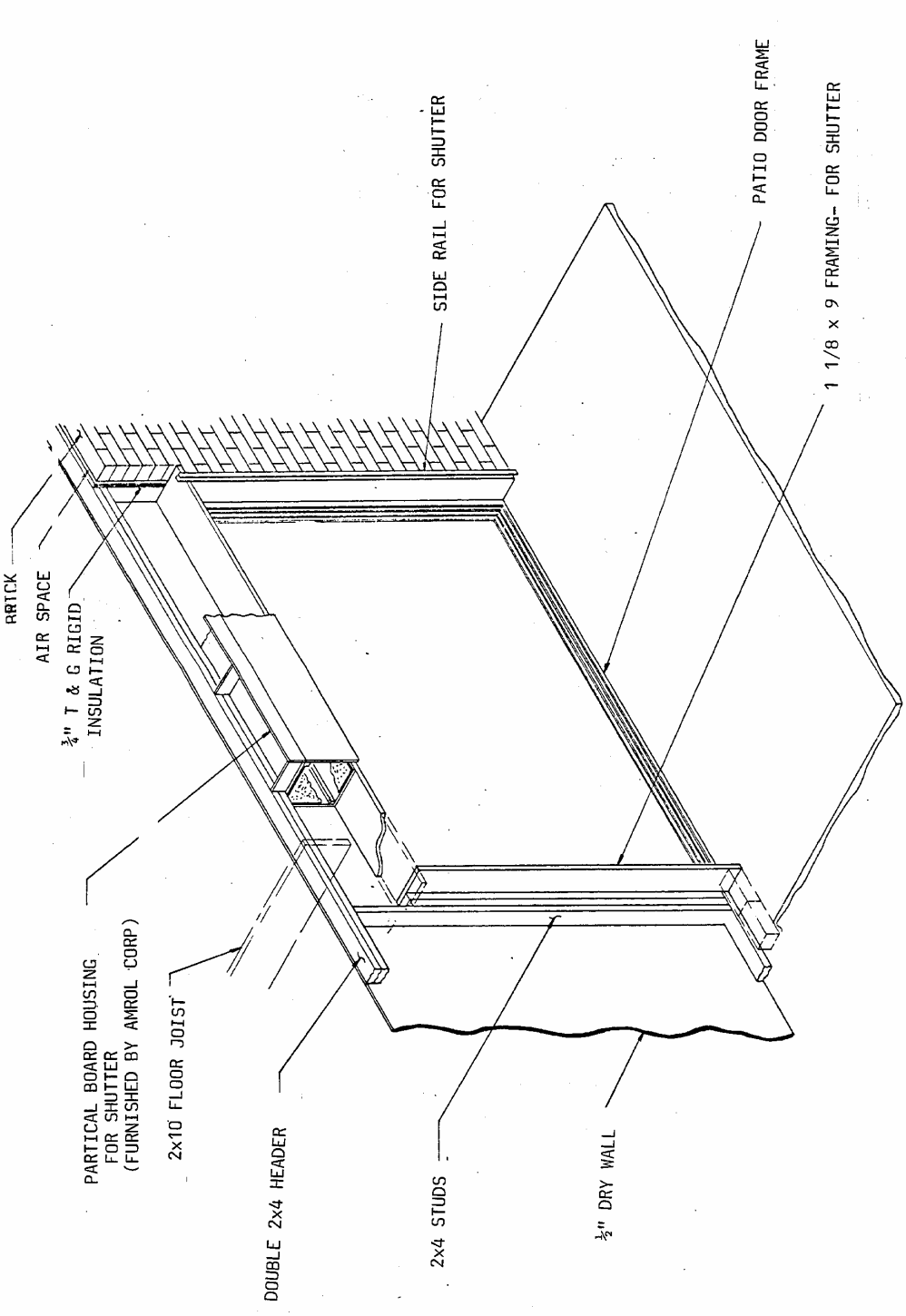
Rolling Shutters

Rolling shutters come in two varieties: PVC plastic and the European metal type rolling shutters, either aluminum or steel. The metal rolling shutters are stronger than the PVC and cost about 1/3 more. They are not as good looking or versatile as the plastic, and they are not any more bulletproof. The plastic shutters can span longer widths at less cost than the metal because of their lighter weight (the limitation is more a factor of electric motor limitations than strength). The PVC variety also comes with metal inserts to increase the strength of the plastic slats. See the accompanying illustrations of typical shutter details. There are two types of installation on the first drawing. The installation on the left shows a surface mount. The shutter is enclosed in an anodized aluminum or painted steel enclosure. This type is most appropriate for remodeling applications or where the exterior walls are not thick enough to accommodate the internal installation shown on the right. The interior shutter installation is safer from tampering and is also the preferred installation if you are going to use manual actuating straps. A third alternative follows in the next illustration. Here the shutter is placed within an enlarged soffit structure as an integral part of the house. The great advantage here is that the shutters are nearly invisible when stowed except for the track on either side of the window. Note that in order to have soffit enclosures for all shutters you must design your roof system as a hip roof, rather than gabled, so that all walls have soffits near the tops of the windows. The rolling shutters are also available with pull strap mechanisms, but I do not recommend them as long as you have an alternate 110 volt power system in the home. Manual operations are cumbersome for a couple of reasons. First, they require that each window be operated individually, whereas the electric shutters can all be closed at once with a master switch. This is very convenient when leaving the home, or when danger threatens. Second, the closing is slower and more laborious than the electric option. All of this comes down to the fact that with manual operation, shutters are not operated as often as they need to be to ensure that they will offer protection when needed. When lots of warning is available, there is no problem, but that is usually not the case – even in many natural disasters or storms.

The final shutter drawing in the series (facing page) shows how to remodel and add one overhead to provide security for these large openings. Because of the width of sliding doors (from 6-8 ft. wide), a middle vertical support bar is added between the shutter and door to give the shutter more rigidity.



SOFFIT MOUNT SECURITY SHUTTER DETAIL



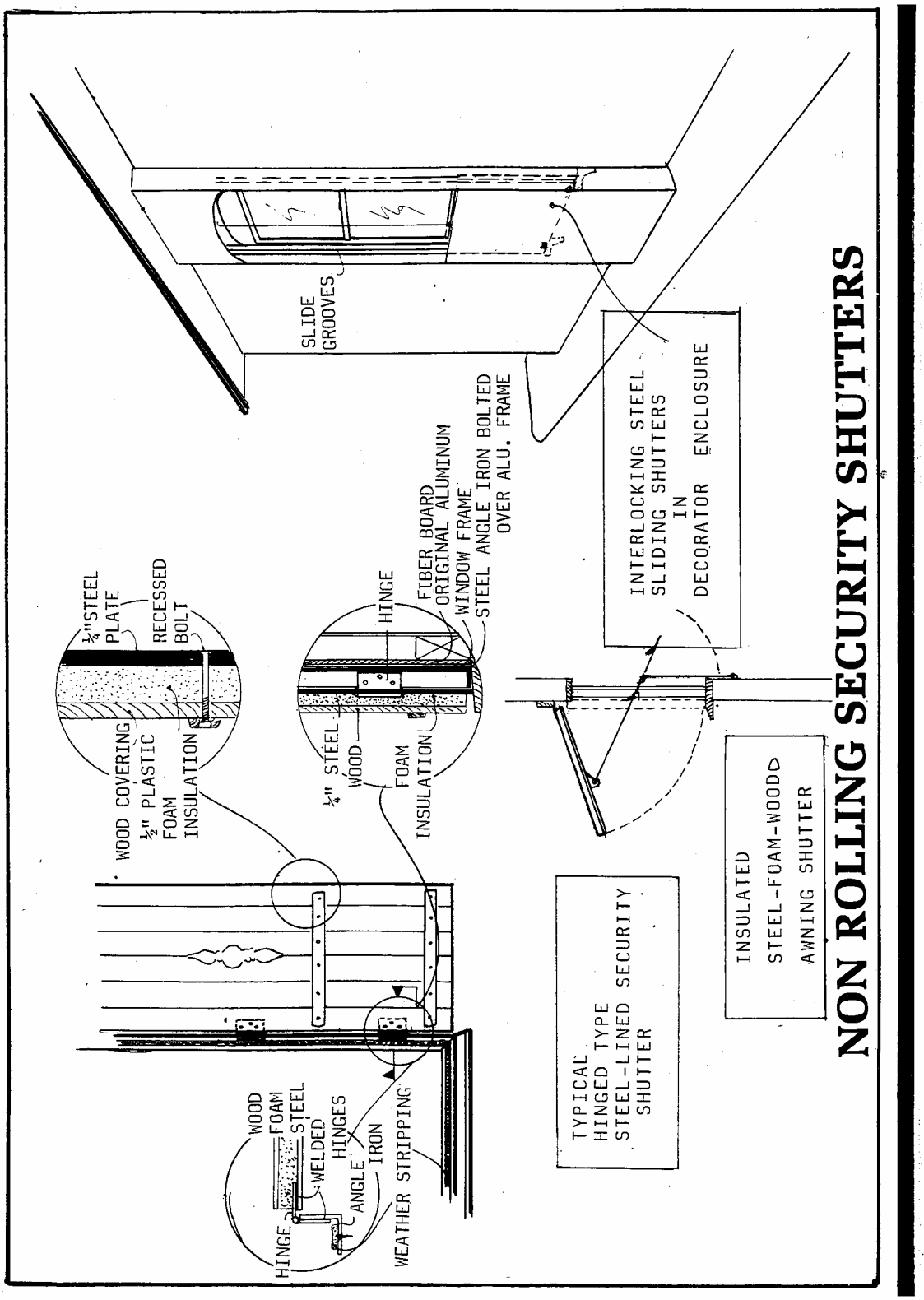
SLIDING DOOR MODIFICATION-ROLLING SHUTTER

Do-It-Yourself Shutters

There may be those who want to construct their own security shutters. I have detailed several types, as illustrated in the following pages, ranging from metal-backed hinged type of the traditional variety to vertical sliding types. Both these custom varieties have one tremendous advantage over the commercial variety – they can be made of bulletproof steel and offer total window protection. While the increased strength is an advantage, the disadvantage is that custom flat steel shutters, whether hinged or hung, are difficult to open or close electrically. Lastly, the labor of constructing custom armored shutters is substantial. Unless your labor is free, the commercial shutters are far more economical in the long run. Of course the bottom line is protection level. If you need full bulletproofing, custom shutters are the only way to get it short of bulletproof window glazing. At least with bulletproof shutters, you save the glass from destruction, which may be a very critical factor when no replacement glass is available – especially during the winter when you cannot tolerate large openings in your walls.

For this reason I always keep a few rolls of clear vinyl roll sheeting in storage so that I can cover broken windows when replacement glass may not be available. Big rolls of vinyl can be had from the Rubbermaid Corporation, and is much more suitable than standard white plastic from the hardware store. White plastic is not UV protected and will become brittle within a few months in the sun. The vinyl is expensive but it will outlast white plastic for years of service. It is perfectly clear and thus can serve as a permanent window replacement. It is also unbreakable – although it can be cut.

The old fashioned hinged shutters are the easiest to build. However, they must be closed manually by either leaning out the window or by going outside – both of which may be risky when danger is close at hand. Also, locking mechanisms are difficult to design in such a way as to enable quick and safe operation in a crisis, or when you must exit a window in a fire. Notice as well that the typical shuttered look on modern colonial homes does not provide a shutter wide enough to actually cover the window. Installing a shutter that is half the width of modern windows would be awkward looking, indeed. In order to preserve the long narrow shutter look, we end up having to design and construct a bi-folding shutter, which adds to the complexity of the locking and closing mechanism. Once closed, some type of bar mechanism must be inserted from inside in order to keep the shutters from being pried open.


NON ROLLING SECURITY SHUTTERS
SLIDE GROOVES
INTERLOCKING STEEL SLIDING SHUTTERS IN DECORATOR ENCLOSURE
STEEL ANGLE IRON BOLTED OVER ALU. FRAME
FIBER BOARD ORIGINAL ALUMINUM WINDOW FRAME
HINGE
¼" STEEL PLATE
RECESSED BOLT
WOOD COVERING
½" PLASTIC FOAM INSULATION
¼" STEEL
WOOD
FOAM INSULATION
INSULATED STEEL-FOAM-WOOD AWNING SHUTTER
TYPICAL HINGED TYPE STEEL-LINED SECURITY SHUTTER
WOOD
FOAM
STEEL
WELDED HINGES
ANGLE IRON
HINGE
WEATHER STRIPPING

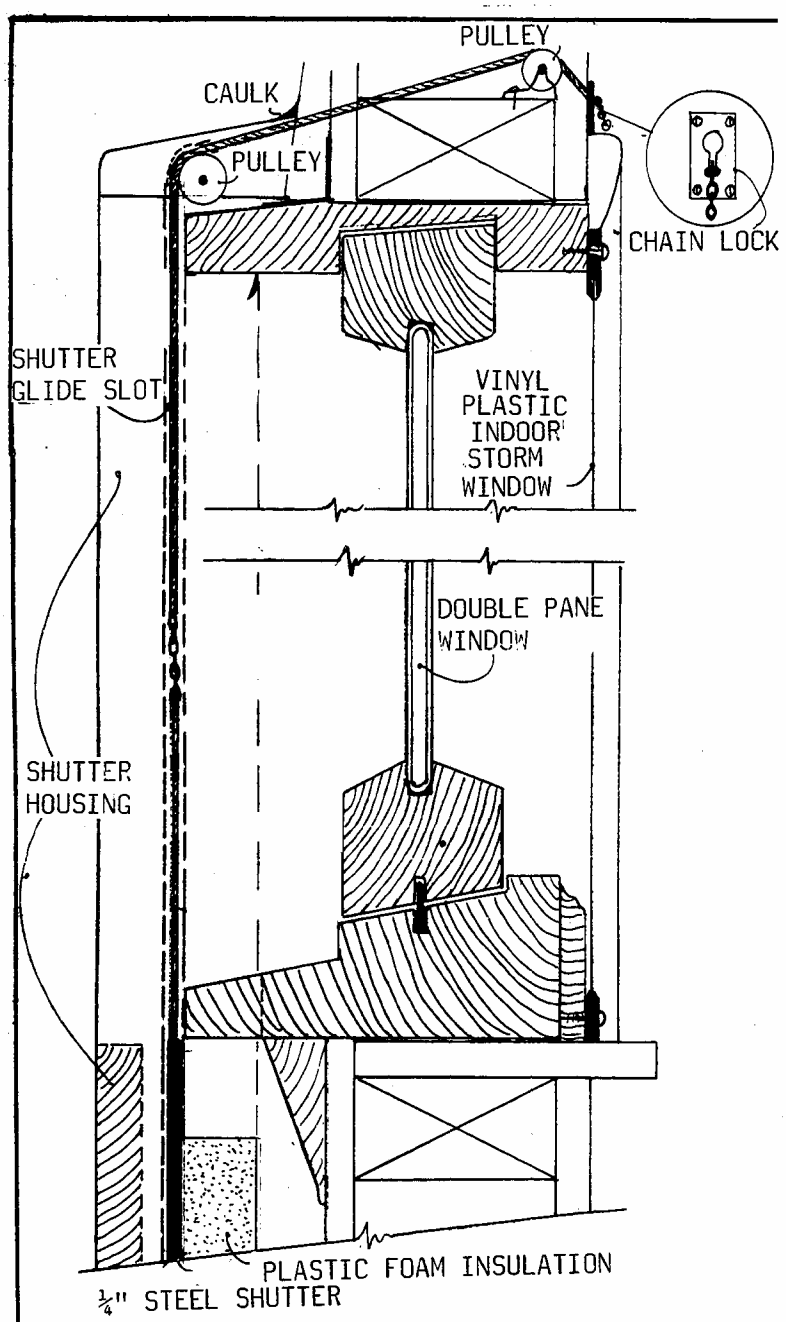
As noted in the first illustration, another variation is to hinge a full-sized shutter at the top of the window, like an awning. If you make a shutter out of bulletproof steel, this would be quite heavy and only appropriate for smaller windows. However, it has the advantage of being easily actuated by a push rod from inside the window (penetrating the side of your frame), and can be lowered and locked in a flash. It also serves as a sun shade and can be partially opened for ventilation while still maintaining privacy. The interlocking steel sliding shutters shown to the far right are illustrated in more detail on the drawings that follow.

Explanation of Vertical Shutter System

The previous two details on vertical shutters show two different ways to handle one problem. A vertically sliding shutter has to somehow be stored in some type of enclosure for aesthetic reasons and to inhibit tampering. In a single story house, there is not enough room above the window to store the steel plate, so we must build something below. As illustrated in the first drawing of this series, a full wall height enclosure would probably look more attractive than something only below the window. However, if one had window boxes under each window, it would conceal the sill opening and detract beneficially from the support structure below. We are still limited size-wise by the fact that the distance below the window must equal the height of the window – for total concealment of the steel shutter when down. The advantage of the one-piece vertical sliding shutter is that it can be insulated and closed at night in the winter time for added heat loss protection. Because of the weight, these shutters must be actuated by a pulley mechanism, and if too heavy, perhaps with a winch or hand crank. Using a cable for actuation does lend itself to electric winch operation. An attic-mounted winch can actuate all the pulley cables simultaneously if all cables are routed to the winch drum. Realistically, a separate winch drum should be used for the shutters on each side of the house. Notice that no matter how long each individual cable run is, the shutters all have to move upward the same distance (if the same size), thus allowing one winch to pull on all cables simultaneously – as long as the cables can be routed conveniently.

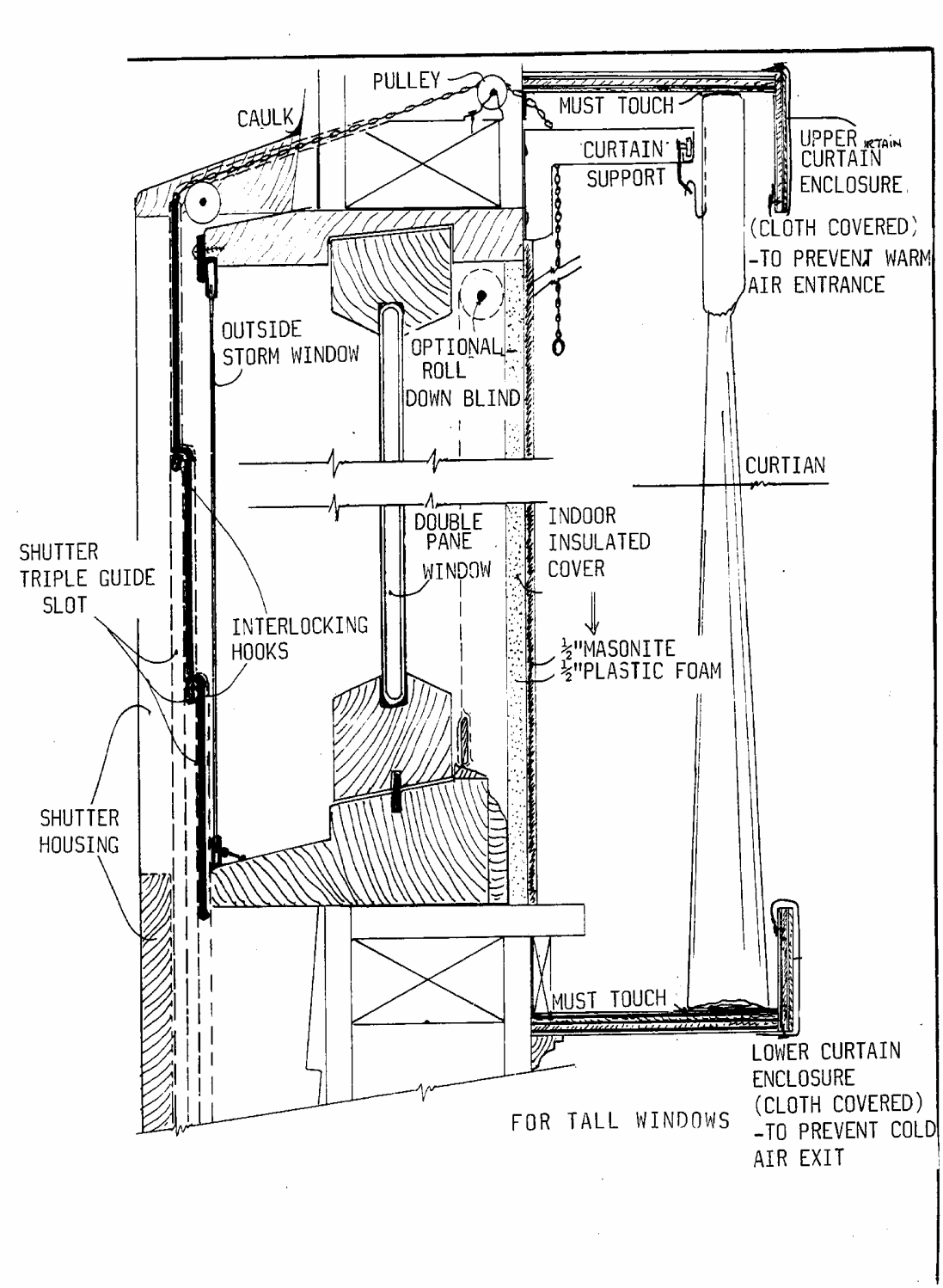
The last drawing shows how to design a series of vertical shutters to handle windows that are higher than you have space under them to store the shutters when down. Three interlocking steel vertical shutters might be connected so that as the first is raised, it latches on to the next and so forth, until all are raised. The last shutter should have a built-in stop at the bottom so that once raised, the hooks connecting all three could not be disengaged by pushing further upward on the lower hanging plates.

This last drawing also illustrates a typical curtain arrangement to insulate windows from the cold. To prevent or hinder drafts from circulating against the cold glass at night, include a top valance over the top of the curtain with physical contact, and have weights in the bottom hem so that the curtains drag on the lower curtain sill. This will trap the cold air between the curtain and the window for better draft control. On very tall windows, this type of contact barrier will not be sufficient to stop the powerful weight of the cold air behind the curtain. More positive forms of window insulation will be necessary in such cases, as detailed in chapter 10.



STEEL INSULATED SHUTTER

W/ INDOOR VINYL PLASTIC STORM WINDOW



INTERLOCKING STEEL SHUTTERS

W/ INDOOR INSULATED COVERING AND CURTAIN ENCLOSURES

Window Well Protection

Window wells are retaining wall type enclosures around windows that allow light to enter even when the window is below ground level. Window wells also provide safe egress from a basement in an emergency. Because basement windows are so accessible from the ground level and because window wells provide a means of concealment for intruders while trying to open the window, it is essential that some form of security be provided.

The most common method has been to build a steel grate over the top. An inexpensive way to do this is to weld up a grate from #4 or #5 sized R-bar. These are hinged to the basement wall where the window well meets the house. The problem with securing these grates is that the holes in the metal must be small or someone can reach down through the grate and undo the closure mechanism. If you use a tamper-proof padlock, there is the potential of locking someone down in the basement when they may need to get out via the window well. Finding a key or working a combination in a panic is difficult.

The newest safety measure comes in the form of reinforced Lexan plastic window well covers. They keep water and debris from entering the window well and have a simple safety pin latch under the cover. Since there are no openings, an intruder cannot gain access to the latch. Bilco Door Company also makes a pre-fabricated window well (called Scapewell) that has terraced stairs integral to the design for ease of exit. The downside is that the opening is so much larger that it is much more costly to cover with a custom Lexan security cover.

Roof Surfaces

The prime security purposes of roofing, besides moisture and heat protection, are fire resistance and penetration resistance. Fire resistance is always necessary in forested areas, or where one might expect arson. There are many products which afford some degree of fire resistance, even for wood shingles (see products listing for fire retardant spray-on coatings). New types of asphalt shingles have much higher fire ratings than the original types. But the most fireproof roof types are metal, tile, cement and slate roofs.

In any conventional home, the roof is one of the weakest security links, especially for an intruder toting a chain saw – however infrequently this is used, it is fast and effective. Most roofs can be penetrated in a matter of seconds with only the shingles and 5/8 inch sheathing to slow the intrusion. A metal roof is the most resistant to forced entry – not because the metal is very thick, but because it is tedious and dangerous just to make a hole big enough to allow an intruder clear access – especially in a standing seam style roof, where cut metal leaves razor sharp edges. Slate is equally as difficult to attack, especially if installed on a steep surface. Anything more than a 6/12 pitch does not provide an easy surface to stand on, and slate can be very slippery. Slate is much better than tile overall, but also the most expensive roof you can buy – and the most beautiful, in my opinion. The asphalt shingle roof is by far the easiest to penetrate, being relatively soft. The clay tile roof is also relatively easy to penetrate, although it does make more noise because it is brittle. One or two taps with a hammer and tiles break right off. Cement tile is much tougher than clay tiles. They are reinforced with fibers and will not

crack and break as easily. Overall, the best security roofs from the standpoint of fire-resistance, cost, and difficulty to penetrate are metal.

Of course, a formed and poured concrete roof would be the most impenetrable, but the entire house would have to be concrete to support the weight. The cost of forming such a heavy roof is very high. Underground homes almost always have concrete roofs, either formed or domed. While these roofs are clearly the most impenetrable and strongest, underground homes have the disadvantage of giving an intruder easy access to the roof vents and chimneys, as previously mentioned. Great care must be taken to harden and screen these vents with heavy metal in order to secure them.

For optimum security with conventional roofs, choose metal, slate, tile, or concrete imitation shingles. These are all fireproof, storm-resistant, and highly resistant to forced entry. If all of these are beyond your budget, choose architectural grade fiberglass/asphalt shingles. These are very heavy with multiple layers of roofing to give a strong, multi-layered look.

Utilities Protection

It is very important to extend utilities security preparations beyond the normal precaution of placing them underground in electrical conduits. Even when you have alternative power, allowing someone easy access to tamper with your electric or water service can present additional opportunities to lure you out of the safety of your home, or to disable other security measures. The weak link in underground utilities (especially telephone, electricity, and gas) is the placement of interconnection boxes or meters on the exterior surface of the house. The utility company isn't really interested in your security as much as it wants easy access to troubleshoot or read your meter. This also gives easy access to the would-be intruder or terrorist as well. The multitude of regulations attending your acceptance of public utilities prohibits the burial of these junction boxes. What we can do is to place them in a tamper-proof enclosure where access becomes a major effort. These connection boxes can be padlocked in a manner where both the owner and the utility company have a key. Some jurisdictions mandate that the fire department have outside access to cut off your electric power in case of fire. This presents an easy opportunity for tampering as well. Fire departments don't want to hassle with keeping track of keys for even 10 houses in the community, so if you ask them they will say you can't lock out their right of access. But it's your house. Just padlock the outside circuit breaker enclosure anyway. They never come around and check. If the house is burning down, they can pry open the enclosure by force anyway.

Your telephone connection box is especially vulnerable – in two places. The main branch box somewhere in the neighborhood is owned by the company and is always locked. This is where the telephone man makes basic neighborhood connections. But there is also a small vertical metal box about 16" high somewhere in the easement of most subdivisions where the phone lines of 4 or 5 house are connected. This box is easily tampered with, as is the plastic box on the side of your house. While they can't be easily locked, you can have a security person put a tamper switch inside that will trigger your alarm system when the box is opened. If you have aerial telephone lines instead of

buried ones, the position your cable travels down the pole is another weak link. It should be in a metal conduit so it can't be cut or tapped.

These precautions also apply to underground power. Additionally, you must be concerned about the vulnerability of the meter. Fortunately, remote meters are available so that you may have your meter inside the house with a remote readout on the outside. Some utilities demand to come inside the house to read gas or electric meters. Demand *remote* metering rather than accept this intrusion of your privacy. With remote metering, the meter is inside the house, but it is connected to a small set of dials that goes to the outside of your house for meter-reading.

ELECTRONIC DETECTION AND RESPONSE EQUIPMENT

Equipment Overview

(See illustration) In your overall security plan, your electronic detection devices are there to give you advanced warning. It is rarely helpful (though better than nothing) to have only a siren go off and scare you to death. The most important trait we are looking for is "real time" information. This refers to the ability of the sensor system to tell us not only of an intrusion, but the type, direction, and location as well. This is not easy with even modern advances in security equipment. The technology is available, but no one in the security industry has put it all together in a reasonable residential package. I will briefly outline what is generally available in intrusion detection devices, and processing and response equipment.

Central Control Panel

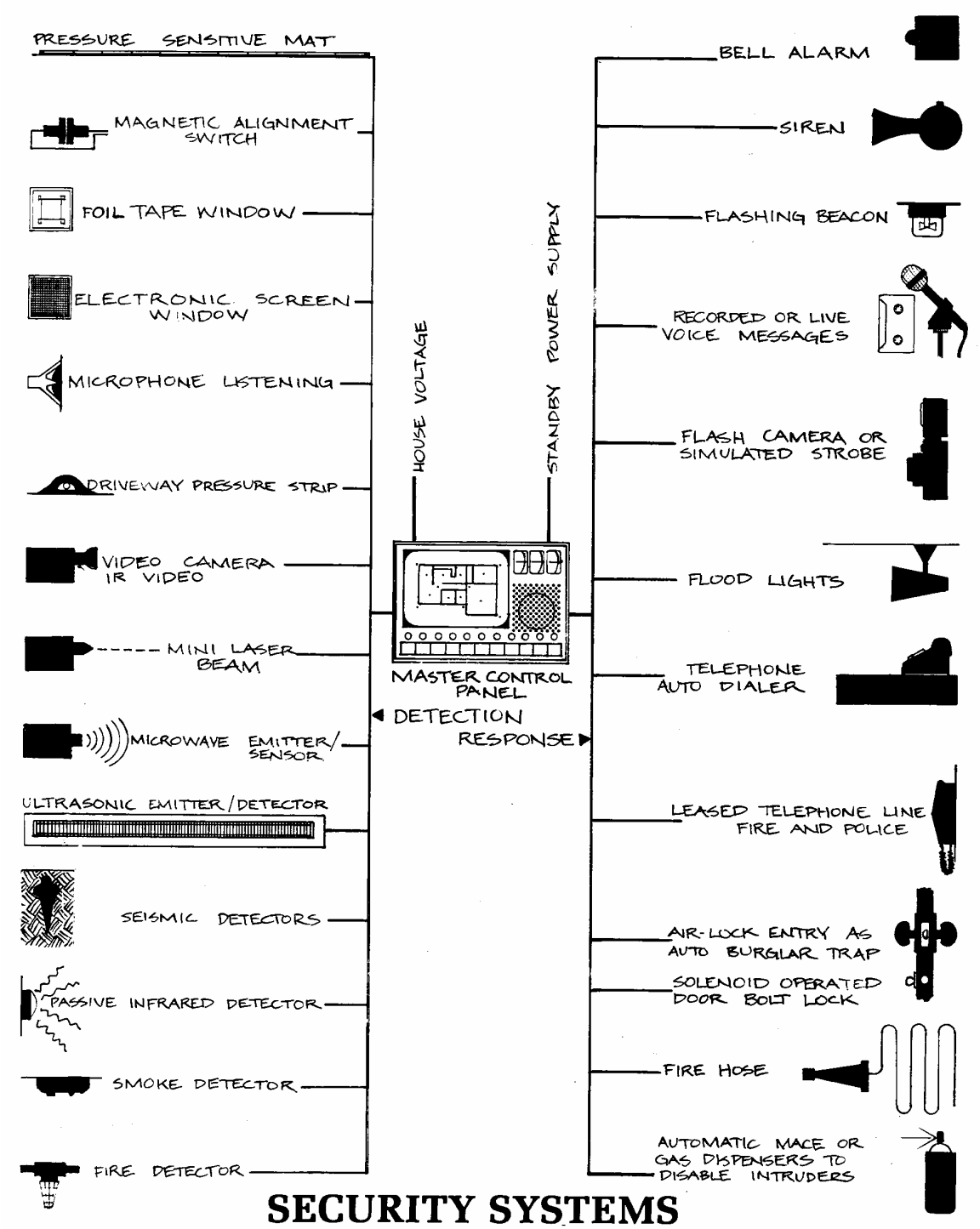
As the illustration points out, the central control unit processes signals from intrusion detectors, and relays a programmed response to a variety of output devices – an alarm siren or bell, a telephone dialer talking to a central station monitoring service, or even a silent indicator light or LED (light emitting diode). Some will even give you a verbal warning. The type of panel I recommend should be able to handle a variety of functions. It should:

1. Function and be controlled remotely at normal entrances, in the security shelter, and at other strategic locations. Make sure the type you specify has discreet ways of entering a panic code in case you are forced by an intruder to disarm your system. Most systems alert the central monitoring station without sounding an audible alarm. Codes should be easily programmable and easily changed. The better remote arming panels also allow for arming only portions of the system, if desired. This is particularly useful when you have exterior and interior trap zones, and you only want to cover the perimeter of the home and perhaps hallways once everyone has gone to bed.
2. Accept normally open (NO) and normally closed (NC) switch inputs.
3. Have its own internal rechargeable battery and charging circuit.

4. Allow for various time delays for entrance before an alarm is sounded.
5. Monitor several intrusion zones and at least one fire zone for each floor.
6. Give separate warning sounds for intrusion and fire.
7. Have automatic telephone dialing or central station response capability.
8. Operate two other separate alarm outputs, such as a bell or siren.
9. Have an integral panic circuit (one which activates intrusion warning by push-button).
10. Give you real time information as to where the intruder is moving about the house.

Almost all modern security systems have all of the above except number 10 – one of the most important. True, most will light up an LED when a particular zone in your security system is violated. But usually the light stays on and you don't know where the intruder is going next. More on this later.

There are several operating methods to choose from in security control. Most systems use hard wiring – double wire pairs that go out to each sensor and back to the control unit. A few systems use multiplex wiring. This allows the system to send and receive multiple signals over a single pair of wires. For large, complex systems this provides a considerable savings in wiring costs. However for most moderate sized homes, direct wiring is still cheaper. Multiplexing control equipment is more expensive than the simpler control modules. Most large central stations which monitor many apartments in a complex will use multiplex systems. For remodeling situations, where the prospect of drilling holes into existing walls and ceilings is a costly job, you can use a wireless system using coded radio signals to transmit between units. This can also be used for separate buildings that are within the specified range of the transmitting and receiving units. Keep in mind that radio systems are more susceptible to false alarms. Lastly, you can use your existing electrical system to run a limited security system and even a computer controlled set of appliances and lights. Line Carrier technology allows the unit to send FM signals over the same wiring the unit is plugged into. Intercoms are also available using this system.



SECURITY SYSTEMS

Detection Devices

Pressure Sensitive Mats

These are used for monitoring entrances and hallways or for tracking the present location of an intruder (using multiple mats). These must be placed under some type of floor covering for protection and concealment.

Magnetic Switches

These switches are installed in opening devices such as window frames or doors and give an indication to the control panel when opened. They can be totally concealed during construction and are very reliable. Like pressure mats, however, you must install one at every possible entrance to be complete. In a remodeling this can involve a lot of expense in wiring. Windows must all be closed before you can leave the home and arm your security system.

Foil Window Tape

This is the most traditional way to detect glass intrusion. Its drawback is its visibility and time consuming installation. Additionally, all individual panes must be covered. In commercial installations, its visibility is a deterrent rather than a liability.

Electric Window Screens

These screens have hidden wires built in which detect any intrusion. This is a preferred alternative to the magnetic switches and the foil tape where complete protection of individual windows is desired.

Glass Break Detectors

These units have special circuitry that distinguishes only the sound of breaking glass. They are fairly reliable, but are somewhat limited in range. They will usually cover all the glass in a room and thus save on numbers of detectors and subsequent wiring.

Vibration Detectors

Shock and vibration detectors are touchy and subject to false alarms if the sensitivity is set too high. Some are non-discriminating as to vibration and will pick up earthquakes, etc.

Capacitance Detectors

One unit on the market hooks to the door knob and detects anyone touching it, with or without a glove. Basically foolproof for that specific coverage.

Microphone Listening

An excellent technique for a second verification of intrusion from a remote location. Most intercom systems, such as the Nutone, have remote listening capabilities. There are even devices on the market that can listen into the home and be actuated by calling your own telephone silently. This is especially useful for central stations which monitor many different homes or for a private individual wishing to monitor his vacation cabin

immediately after his security alarm has notified him of an intrusion (via auto dial recording).

Driveway Pressure or Magnetic Strip

Above ground or buried, these units notify you in advance on driveway entrances when someone has crossed a certain point. The type that sense magnetic disturbances are now the most common. A large body of metal (such as a vehicle) will trigger its circuitry. The liability here is that people or bicycles will often not be detected.

Video Cameras

There are several different types of video cameras, each designed for a specific light level or other function. The most common are ordinary natural light scanning units that televise the activities of an area to a remote video monitor. Cameras are shrinking in size and price, so they are no longer limited to only the wealthy. The more sophisticated ones have low light level viewing capabilities. You can even get cameras with night vision qualities using military technology (at a commensurably high price). In between, and more effective for the widest range of activities, are the infrared (IR) cameras. These units have an infrared light which floods the area to be monitored, and a special infrared camera, seeing only IR light, monitors the area. The advantage is that the illumination source is constant, and video detectors connected thereto can more consistently monitor any changes to the video image. These cameras are the only types that can be used for the widest range of marine applications.

Mini Laser or Photo-Electric Beams

Both types use the same principle of an invisible beam of light which, when broken, gives an alarm. These are only effective if the sender and receiving units are well hidden. Both can be enhanced by using tiny mirrors to send the beam many times around a house at various heights to obtain more complete coverage.

Microwave – Doppler Radar

Microwave radar sensors detect motion by analyzing the radar returns around the room, and are almost immune to false alarms in a building which will successfully contain the microwave energy. Microwaves will penetrate glass easily, wood moderately, and sheetrock only a small amount. Metals contain it completely. Large metal objects can sometimes even reflect the energy into other areas. There are a few liabilities, however. Fluorescent light can sometimes appear as a moving target at certain frequencies. Metal fan blades should have a metal shroud around them to avoid false alarms. Pets are a big problem with any alarm system unless the detection pattern is higher. If it is too high, intrusions can occur at the lower level. Finally, the unit must be mounted on a firm base away from any vibrations to ensure total reliability. Despite all of the potential false alarms, you should not assume they are very common. Microwave is one of the most reliable. Sizing patterns correctly and using the sensitivity adjustments properly can eliminate all false alarms in almost every situation. The units are so consistent that once you thoroughly test for false alarms outside the building, they will not suddenly appear thereafter. It has a variety of coverage patterns available and can be used for long-range

perimeter protection as well as area protection. Some exterior use can be achieved as long as a processor can successfully discriminate between large and small targets.

Passive Infrared (IR)

These units are very popular since they see the heat of an intruder only, and not any other moving cool object. Additionally, they must sense heat in motion. Most units will not detect the sun or a car's headlights unless the car moves into the field. But there are some limitations. The target area should be temperature stable. Opening doors between cool and hot areas could set up waves of warm air with the appearance of movement. Never mount a unit above a light bulb or other heating unit. Even though the source is not moving, the heat waves may move as they drift upward. Pets will also be detected unless the detection pattern is above them. These units are somewhat affected by high background temperatures. The higher the background temperature, the less the target body will be visible to the heat sensor.

Combination Units

Most area sensors (sensors that monitor the open spaces within a room or hallway) are combination sensors. They combine at least two technologies, such as Doppler radar and passive IR. The goal is to pick two technologies that complement each other's weaknesses. IR sensors can be fooled by waves of heat from a heat vent, but Doppler radar will not sense this. Radar might be fooled by a slow moving target, but IR will detect the intruder's heat signature as he moves into the sight of a different beam in its multiple sensing elements.

Ultrasonic

Ultrasonic units emit high frequency sound waves in order to establish a frequency pattern that, if broken, can be detected. These do have more frequent false alarms, though an experienced installer can successfully avoid them. Units can emit false alarms if the waves are reflected back from large stationary objects too close in position. The range control should always be set at the minimum level for detection, never on the high side. Air turbulence is the most common cause of false alarms, from heat registers to large air gaps in doors. Waving curtains can cause alarms. Vibration-free mounting is also required as well as shielded cable for remote "slave" units feeding information back to a "master" unit. Otherwise, radio frequency interference can sometimes induce a signal in the wire. Multiple units must be crystal-controlled so they don't "talk" to other units. Even rain on a metal roof can set up harmonic sound patterns that may give false alarms. Do not mount units near televisions, stereos, or telephones. Ultrasonic sensors have almost all been replaced by the combination type sensors, where ultrasonic might be only one of the sensors used.

Electromagnetic Field

This type of unit sets up an electromagnetic field around a cable that encircles the protected area. A computer sensing unit monitors the field strength which will be distorted when an intrusion occurs. These are very sensitive and will detect any object's intrusion. These are limited to special security areas due to sensitivity and cost.

Seismic

These Vietnam War-developed detectors sense people walking and are extremely effective. When used with the special processor, they can cover large areas outdoors where normal sensors would have too many false alarms. The processors can successfully distinguish between most other types of seismic movements, and will tag a walking man every time. These are the most effective type of sensor for outdoor areas, where birds and other small animals may abound. Sources have told me these sensors are now hard to find

Smoke/Fire Detectors

There are several types of sensor heads. Some are temperature sensitive, others smoke detecting, and some are sophisticated combinations that even measure the rate of heat rise. Even if you have central panel warning, it is nice to have the individual units sound their own high decibel warning as well so as to be able to better locate the position of the fire by sound. Most building codes require numerous sensors be placed at key locations around the house. The codes also require that the detectors be interconnected so that when one goes off, all do. This, of course, doesn't help you locate the fire – it just scares the wits out of you in the night. But that's the way the bureaucrats think. No longer are battery-only units allowed. Everything thing on the market today is hardwired, and most have battery backups should the electricity go off. One nice thing about these new features is that the small chirping sound they give off when the electricity fails lets you know the power is off.

Video Movement Detection

This high tech innovation provides a new way of monitoring and recording problems inside and out. Video cameras have always had the disadvantage of needing someone present to watch the camera, or perhaps a continuous loop recorder. Even then it would take hours to review the tape for an incident. Now, a few companies have developed computer software to scan the video image for changes that match the profile of a person or animal moving across the screen. These criteria are adjustable for different situations. When a threshold of movement is reached, an alarm can be triggered, or a light, or even a tape recorder. When the movement stops, the recorder will turn off. A series of these cameras would ensure that any intrusion would be caught on camera, and that you or the police would have a concise record of the action.

This system is particularly useful for monitoring outdoor fenced areas. Set the threshold sensitivity so that birds or small animals would not trigger an alarm, but anything large like a person would initiate a signal. The alarms can even be set so that you can be awakened at night to check the camera for details. Camera systems like this are particularly useful when you are in a shelter situation.

Response Equipment

Bells and Sirens

The traditional alarm bell or siren is well known. However, the latest innovation is to use, in enclosed areas, extremely high volume sound to incapacitate the intruder. Super

decibel sounds cause stomach cramps and incapacity rapidly. These should be used with caution, making sure you yourself are protected from false alarms.

Flashing Beacons

Mounted on top of your building, this unit provides faster directional recognition of where the alarm is coming from when police attempt to find your home.

Recorded Voice Warnings

Warnings can precede areas where greater danger can be expected, or used to caution those trespassing on private property. Use these with caution in areas where kids might discover them and play games trying to set them off. just to hear the warning message.

Automatic Video Recording

These units capture the incriminating evidence on video tape using regular or low light cameras. Make sure the cameras are hidden and protected from theft themselves. Long play video recorders are useful for such work. Others use a continuous loop tape that tapes over itself every day or two. So, if you have an intrusion, you need to be sure and recover the tape before it is re-recorded.

Simulated Flash

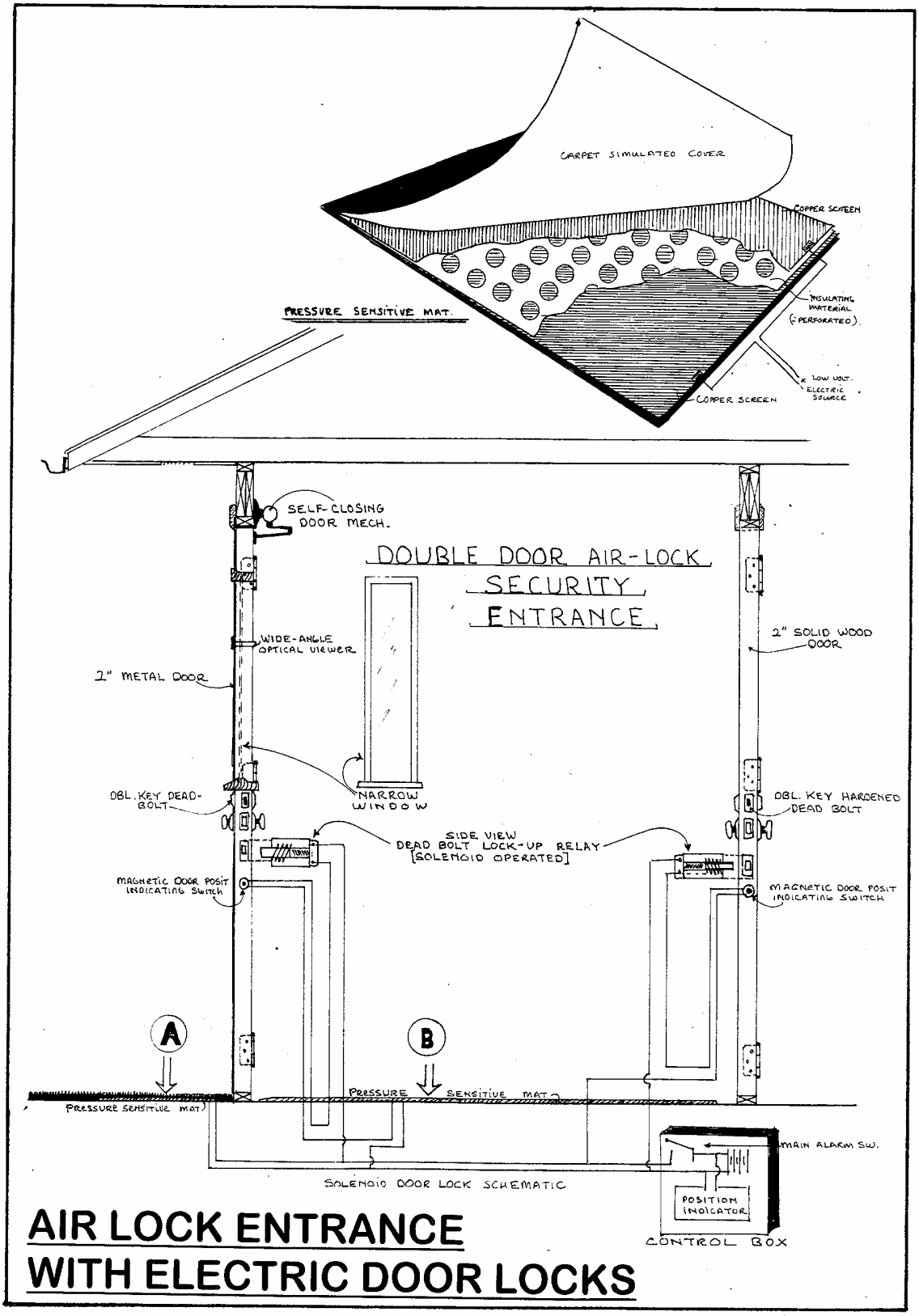
Besides causing temporary blindness, this is a very effective way of making the intruder feel he has been photographed.

Automatic Flood Lights

When coupled with outdoor passive infrared detectors, an effective deterrent to intrusion is formed. These infrared-detecting flood lights can be found at any home improvement store and the price is extremely affordable. These units are useful for automatic outdoor lighting when you leave or enter the home, as well. They shut off after a 2-4 minute delay as long as no further movement is present. Automatic flood lights are not yet useful for detection that can be connected to your alarm system There are too many false alarms associated with birds and small animals like dogs and cats.

Telephone Auto Dialer

Most units automatically connect to a central station. Others are programmed to dial 4 or 5 telephone numbers consecutively as you desire. A line seizure unit is necessary to keep the intruder from inhibiting the dialer by occupying the line. The central station units are only as effective as the quality of the service. Some are much faster than the police. Many local police and fire departments do not allow dialer hookups to their stations because of false alarms and the fact that the dialer ties up one of their lines until it


CARPET SIMULATED COVER
COPPER SCREEN
PRESSURE SENSITIVE MAT.
INSULATING MATERIAL (PERFORATED)
LOW VOLT. ELECTRIC SOURCE
COPPER SCREEN
SELF-CLOSING DOOR MECH.
DOUBLE DOOR AIR-LOCK SECURITY ENTRANCE
WIDE-ANGLE OPTICAL VIEWER
2" SOLID WOOD DOOR
1" METAL DOOR
NARROW WINDOW
DBL. KEY DEAD-BOLT
DBL. KEY HARDENED DEAD BOLT
SIDE VIEW DEAD BOLT LOCK-UP RELAY [SOLENOID OPERATED]
MAGNETIC DOOR POSIT INDICATING SWITCH
MAGNETIC DOOR POSIT INDICATING SWITCH
A
B
PRESSURE SENSITIVE MAT
PRESSURE SENSITIVE MAT
MAIN ALARM SW.
SOLENOID DOOR LOCK SCHEMATIC
POSITION INDICATOR
CONTROL BOX
AIR LOCK ENTRANCE
WITH ELECTRIC DOOR LOCKS

disconnects. Keep in mind that digital signal dialing units will not actuate a regular auto dialer without an electronic circuit to convert the signal. Regular, non-digital control panels will provide the proper contact closure.

Automatic Fire Protection

Halon gas extinguishers are available for use in buildings that are generally unoccupied to guard remotely against fire. The fluobrene gas is nonpoisonous and starves the fire of oxygen. Its use is generally prohibited in areas that are permanently inhabited by people.

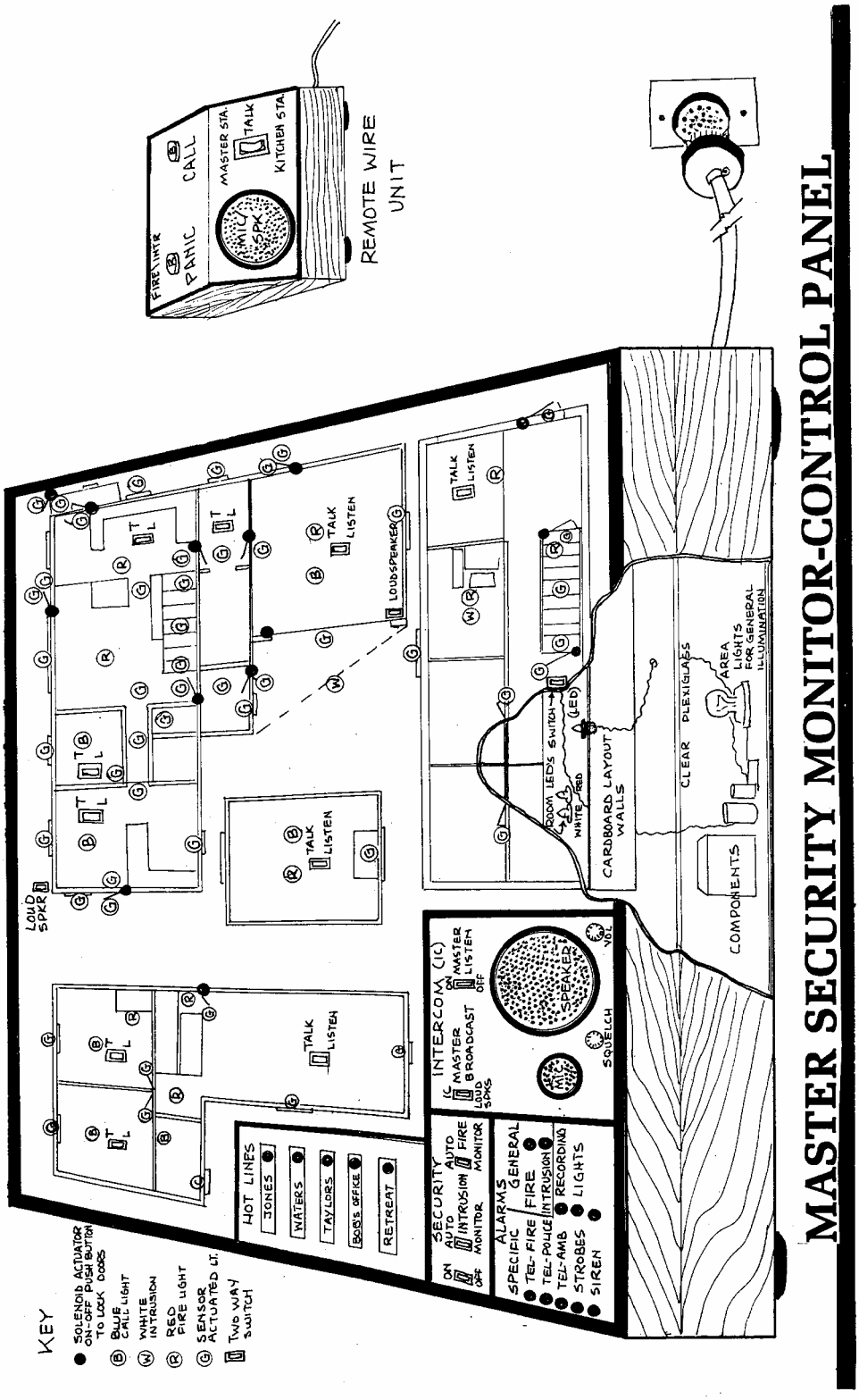
Solenoid Operated Dead Bolts

Doors can be programmed to lock or unlock on command or based upon certain situations. Burglars can even be trapped in an airlock entry or other room by special solenoid operated locks. In the following illustration, I have detailed an airlock entry that not only serves to keep out air drafts, but to control two doors electronically. With appropriate polycarbonate windows, an intruder could be trapped in this enclosure by dead bolting both doors electronically--a nice help in doing a citizens arrest without direct confrontation. There are automatic fogging or pepper spray canisters that can render an intruder immobile in a room. A *room fogger* composed of harmless glycerin has been developed by a British firm that can also be used as a safety device to keep your home from being quickly vandalized before police can arrive. It quickly fogs a room with glycerin so that intruders cannot see. It is also harmless to furnishings and decor. See the Recommended Sources for contact information.

A Custom Survival Security System

I have attempted, in the past few years, to design a security system that would overcome some of the major conceptual liabilities of conventional systems. The biggest complaint I have about normal systems is the lack of position information on the nature and the direction of the threat. There is nothing more disconcerting than being awakened in the middle of the night by a blaring siren alerting you to the fact that you have an intrusion (or possibly a false alarm). The mere fact that you do not know which it is puts you into a position of having to find out. In order to do so, you might have to expose yourself to a dangerous situation. The original system designed in the first edition of this book was a special master panel that could do several essential functions (see illustration):

1. A lighted MAP DISPLAY on the face of the unit showed the floor plan of the home with all sensor positions indicated by light emitting diodes (LEDs).
2. SWITCHES for all intercom, listening stations, and door and shutter operations were also located on the map display in the position where the actuation of the switched unit would take place.


MASTER SECURITY MONITOR-CONTROL PANEL
REMOTE WIRE UNIT
FIRE INTR
PANIC
CALL
MIC
SPK
MASTER STA.
TALK
KITCHEN STA.
KEY
SOLENOID ACTUATOR ON-OFF PUSH BUTTON TO LOCK DOORS
B BLUE CALL LIGHT
W WHITE INTRUSION
R RED FIRE LIGHT
G SENSOR ACTUATED LT.
TWO WAY SWITCH
HOT LINES
JONES
WATERS
TAYLORS
BOB'S OFFICE
RETREAT
SECURITY
ON
OFF
AUTO INTRUSION
FIRE MONITOR
ALARMS
SPECIFIC
TEL-FIRE
TEL-POLICE
TEL-AMB
STROBES
SIREN
GENERAL
FIRE
INTRUSION
RECORDING
LIGHTS
INTERCOM (IC)
MASTER BROADCAST
LOUD SPKR
MASTER LISTEN OFF
SPEAKER
VOL.
SQUELCH
MIC
TALK
LISTEN
LOUD SPKR
LOUDSPEAKER
ROOM LEDS SWITCH
WHITE
RED
(LED)
CARDBOARD LAYOUT WALLS
CLEAR PLEXIGLASS
AREA LIGHTS FOR GENERAL ILLUMINATION
COMPONENTS

3. FIRE ALARM sensors were connected to red LED's to see the position of any fire in the home. Switches for actuating extinguishers were located on the map display where the extinguishers were located.
4. Buttons actuated DIRECT DIALING TELEPHONE LINES for 911 emergency.
5. Alarm response switches for sirens, flood lights, automatic door locks, etc., were also convenient to the main panel.

The concept of the unit is to give a homeowner "real time" information about the nature, position, and direction of the intruder. He is awakened by a soft tone, rather than an alarm so that he can calmly prepare to analyze the detection information. The owner may listen in to the area of the intrusion to confirm or deny. If he went to the expense of video cameras, he could aim the camera at the area and check it out, all from the safety of his secured master bedroom. Each of the children have their own intercom station which has listening capability as well. They also have built-in silent or audible panic codes to relay when they are in trouble.

The system was never practical from a commercial point of view because of its custom nature. Every unit would have to be designed with a custom floorplan of the home in which it was installed. Naturally, the price would have been high. A few electronic buffs who read about it no doubt were able to put it together by combining parts of existing intercom systems and relocating the switches to the map display. But because of the complexity and very custom nature of this system, it is unfortunately not feasible for anyone but the electronic hobbyist to pursue.

OTHER SECURITY EQUIPMENT

Automatic Tear Gas or Fogger Canisters

These units, called room "foggers," are specifically designed to keep your home from being vandalized or robbed by determined criminals who disregard your security system, or who have isolated your home by cutting telephone and power lines. These can be actuated automatically by your security system when you are away from home or you can use them manually from the safety of your secured master bedroom or security shelter. Once a room is fogged with pepper spray or glycerin fog, the person is either immobile or blinded temporarily. Tear gas foggers are almost unavailable due to liability problems. However, the glycerin fogging system (from England) does not harm or immobilize the burglar or vandal, but it does stop his activity due to his inability to see. At best he can grope around for the door and leave. The fog leaves no residue after it dissipates.

Fence Alert

All types of fencing can be turned into a large intrusion detector around your home. You can even divide up the perimeter into zones if you wish. GTE Sylvania puts out a very sensitive and reliable unit called "Fence Alert." There are others on the market as well

that utilize a special coax cable along the fence. Detection of movement on the fence can be located with an accuracy of 10 feet.

Automobile Alarms

There are numerous types on the market which offer a variety of techniques. I list a recommended product in the "Recommended Equipment and Sources" section for each separate technique that I prefer. The most effective alarms disable the ignition or otherwise make it almost impossible to get your car moving. One of the simpler disabling units also has an integral hidden hood latch which prohibits someone from tampering with your engine in vengeance. Several units also offer paging transmitters alerting you of potential theft. Units that sound the horn must be coupled with a system that is not subject to false alarms. Otherwise, you will be tempted to disable it. One of the more sophisticated units monitor the "at rest" position of the car and set off an alarm when someone enters and sits in the seat or starts the car moving. Another has a small ultrasonic unit which cannot be foiled. Some of the latest monitor the electrical system. You set your dome light to come on when the car door is opened so that any opening of a door or starting of the car will cause the alarm to actuate. Certain expensive or popular cars are prime targets for theft. If yours is one of those types, a good alarm will save you a lot of grief.

Privacy and Surveillance Equipment

There are several companies in the nation that market expensive equipment for counter surveillance, surveillance, and privacy. I will discuss briefly some of the more important functions they perform (see "Recommended Equipment and Sources" section for listings).

Telephone Scramblers

The best of the government equipment for tapping telephones cannot be detected by any electronic means. These highly sophisticated units put back into the line every bit of electrical energy taken out during the wire tap. There is no way to detect something that is electronically identical to the original impulse. If you must discuss things of a very sensitive nature, you will have to spend the several thousand dollars required to buy a pair of scrambling telephones. The price is coming down with new technology, but it is still high. Don't buy any system approved by the government or marketed by national companies like AT&T. Their scrambling systems have all been compromised by government and have built-in electronic "trap doors" so that government can still monitor your private conversations.

Tracking Transmitters

If you suspect that you may be a target for terrorist or criminal kidnapping for blackmail purposes, the purchase of a few miniature transmitters and a tracking directional receiver is advisable. The small, thin battery powered transmitters are carried on your person, and the unit is actuated by a small pressure switch when you are in danger. Transmitters can be placed on your vehicle as well, in case it is stolen or used in the kidnapping. The tracking receivers can be taken aloft in an aircraft or used in a car to locate the victim.

This is especially useful if you want to protect your wife and children who are most vulnerable, and who cannot be protected at all times without great inconvenience.

The newest types utilize GPS tracking signals from satellites. A nationwide monitoring system is now in place that can locate your vehicle anywhere in North America. There is a monthly fee to pay, just like a central station monitoring fee.

Debugging Equipment

There are many types of surveillance transmitters which may be placed in your vicinity to monitor conversations. Some passively eavesdrop and send their transmissions only periodically in short coded bursts, to avoid detection. A new laser beam technology aims at your window from outside and reads the vibrations of the window pane as you speak. These are hard to defeat, but they must be directly in front of the window in order to receive the reflected beam--so keep an eye out for persons or vehicles parked in that line-of-sight direction outside your window. A rigid foam blank placed inside the window opening can cut this vibration down by 80% and if you speak softly, such laser devices can be defeated. Turning up loud music is also effective unless they electronically remove the music signal from the tape.

It does no good to have a scrambling telephone if the room where you are using it is bugged. Most of the government's best telephone taps don't withdraw any electric current from the lines and thus are not detectable by normal equipment. Taps done at the telephone company level, or by capturing microwave or cell telephone frequencies are also not detectable.

For this reason, do not waste your money on the cheap bug-searching equipment. The only type worth your consideration can not only search for a transmission signal, but also can make the electronic components of the passive unit reflect a radar-like signal that will reveal its location. The same type of equipment is available to warn of a tape recorder in your presence, even if turned off.

Surveillance Equipment

Sometimes there are legitimate reasons for your listening in to persons who may be a threat to your life or assets. Discrete listening, miniature microphones, no bigger than your little fingernail, are available with miniature transmitters so sensitive that they can pick up a whisper better than the human ear can. Special miniature, 9 volt batteries are used to keep the size to a minimum. Long play Gyre video recorders can be attached to special low light level cameras for watching suspicious areas of your business where thefts or embezzlement may be occurring. Briefcase-mounted, long-playing tape recorders that are voice actuated can be of assistance to you in gathering evidence against someone who is attempting to intimidate or threaten you. Miniature video cameras are also common today, and can be hidden in a myriad of innocuous household items.

Computer Encoding

Your computer data can be safeguarded by special random code generators which are virtually unbreakable. PGP (Pretty Good Privacy) is one free market technology that was given away to the world just to keep the government from cornering the market. Do not

rely on any system approved by the government. They will always have a "trap door" built into the software or hardware to help access your code.

Security Geese

Some innovative rural folks use geese as an improved watch dog. They make lots of noise, and give the impression that the place is lived in. They can scrounge for food for a week at a time and thus allow you more choices than hiring someone to watch after the place. They work day or night, and are ideal in a retreat with no electrical power. They have teeth, and are not particularly afraid of men. One dog can be poisoned or shot, but it's pretty hard to get rid of a flock of geese. Geese are very territorial and, if placed in a large fenced yard, will guard their territory vigorously. Best of all they are cheap to buy as goslings and don't cost much to feed. On the downside, you have to keep them off your decks as they leave ample droppings that will stain and make a mess. If you have a dog, you have to train it not to chase the geese.

PREVENTING VANDALISM ON PROPERTY WHEN UNATTENDED

Here are some interesting ideas from some of my friends on the Internet:

- Put out one or two cheap miniature web cameras and have a PC running all the time transmitting video shots to your website – which you can access from anywhere. It can update pictures minute by minute or hourly just like the videos you see of a bank or convenience store robbery. A video would identify the bad guys, and then you could at least prosecute them. Also, you could use the web cam to see the status of your house and feel comfortable. You'd at least know when something bad happens. You can also link up all kinds of other things to be published on a web site: your house's temperature, when someone drives up your lane, etc. All it takes is a knowledge of this technology and a few dollars.
- In lieu of the video, you could put in FAKE video equipment... or at least put up signs that the premises are being monitored by video camera. That would scare off most amateurs or first time offenders.
- Get an old pair of BIG work boots. Get em muddy and set them on the front porch. This will give the impression that a big, manual-labor type man lives there.
- Of course, there are the standard city precautions, like lights on timers and that sort of thing.
- Make friends with your neighbors. Spend some time with them. Help them out. Go to church together, if appropriate. If they like you they'll keep an eye out for any strangers around your place.
- Keep geese in the yard and have one of your neighbors feed them once a week.

- Make the property blend in, or look like there's nothing there to steal in the first place.
- Have nothing valuable in sight.
- Bar the windows and secure the doors, but don't make it apparent or people will wonder what you have in there that you're trying to protect.
- Plant thorny bushes under windows and near entries.
- Light the perimeter if you're within sight of another residence.
- Leave indications that people live there (change the clothes on the line every time you visit).
- Make sure any mail or papers don't accumulate.

Watching Over Your Place While Gone

You can rarely rely on others to "watch over your place" even if they live next door. If the "watch person" doesn't have a clear view of the property and the road leading up to it, or if he isn't home almost constantly, the chances are slim that he will be able to prevent something. It's OK to set up such an arrangement, but don't depend on it, or blame him if he lets something slip through. Better yet, keep a noisy dog on the property and have the watch person feed the dog daily – that helps to keep a lived in look. I partially disagree with Gary North's comment that, " if vandalism is a risk, you are in the wrong area." Obviously you should avoid areas that already have a vandalism problem. That's a given. But you cannot guarantee that any area won't eventually be subject to it. It only takes once to damage your home. So, always prepare for it.

There are two basic strategies to pursue – the open door strategy, and the hardened exterior strategy. I've used both with clients with excellent results. Here's how they work.

Open Door

This is only good for places of below average worth and condition. You leave the door closed but unlocked. You open the windows and staple heavy plastic over the outsides to keep out the weather. You create a hardened secure room where you place all the things you don't want stolen or hurt. In older homes, which don't merit the expense of a full high security room, you can conceal the basement, close up stairway entrances with hidden doors, seal off and conceal any window wells, and make it appear as if it is a single story home. It takes some ingenuity, but it can be done with many homes. This strategy is only good if you expect to leave the home for long periods of time. You don't want to go through the hassle of bringing things back out of hiding too often. When you do come back, you may have to sweep out some garbage, erase some graffiti off the walls, but generally it can be made livable again fairly quickly.

Hardened Retreat

This is more complex, and I don't have the space or time to go into all the details – you still need a hardened, concealed, underground storage room to keep all your valuables, in case they breach the exterior. All nice homes that are left unattended need some

hardening as well as surveillance cameras/computer, TV, or alarms. Doors need to be metal utility doors with armored, pick-proof deadbolts and metal door jambs. Windows need to have 3/8" acrylic storm windows, which are impenetrable without a chain saw. Exterior should be brick, masonry, or stucco on the lower levels so that walls can't be cut through. Bulletproofing, by the way, is most easily achieved by putting 1/2" and larger gravel in the wall cavities as previously described. Even on a 2x4 wall, packed gravel will chew up multiple 7.62 rounds without degradation to the gravel. Insulate inside with foam board to replace the lost insulation.

I know that most of you realize that the hardening option is quite costly. As a compromise, go with conventional exterior construction, but use a flimsy back door (locked) which can be easily breached – keeps them from breaking out precious window glass. Use security cameras to record the action, as well as alarm systems to warn neighbors or police. You still must have a concealed security room to ensure that your best stuff doesn't get taken.

Here are some other interesting options for warding off vandals in a non-lethal way: For those of you that are interested, there are 2 kinds of shells you can use in a shotgun that are non-lethal. One is a pepper spray shell good for 8-30 foot range with an 8 foot spread at 25 ft, and the other is a solid rubber slug to knock the wind out of an attacker.

HIGH SECURITY SHELTER AS AN INTEGRAL PART OF YOUR SECURITY PLAN

It is always important to have a place to retreat or escape to if your defensive posture in your home becomes untenable. You'll sleep a lot better when out of town if you know the wife and kids have a safe room to go to when they can't or won't confront an intruder. Make sure the shelter has a vault door or bullet proof steel door with a batter-proof locking system. If you don't have a vault door, you should install U shaped brackets on the metal door jambs so that wood or steel bars can be place across the door in two places, high and low. Make sure you have communications equipment inside with an antenna hidden in the attic of the house where it can't be seen or tampered with. Remote controlled pepper spray canisters poised to spray on the person outside the secure door can be effective if they are trying to torch open the door. Last, make sure you have an escape tunnel out of the shelter so you can escape if need be.

Chapter

10

High Security Shelters

The multi-purpose high security shelter is the core security element in a preparedness home. It provides long-term cool storage of food as well as security for people, equipment, and valuables. If concealed, as it should be, it provides security against illegal government confiscation of supplies (which they have been known to do in many periods of history). When designed and built properly it provides a fireproof and earthquake-proof room that can give you an outlet to safety if you are trapped in the home during such an event. It also provides a place to hide from intrusion if you do not want to confront the intruder with armed force. Thus, there are a broad range of threats that can be mitigated by a shelter. But all of these threats can be mitigated to some extent by other means and precautions. There is one threat, however, that cannot – the deadly threat of nuclear fallout during a widespread nuclear war. To keep yourself from getting radiation sickness, you must have massive materials overhead to shield you from the effects. There is no other alternative. Some people erroneously think that wearing a white plasticized suit, like they see in the movies, protects against radiation. Not so. Others think that taking a few potassium iodate pills will protect them. Not against radiation. Nothing but shielding works – at least 12 inches of concrete, or 6 inches of steel, or 2 inches of lead. The house above you looks like paper to the high speed gamma radiation. Let me summarize for you some of the estimated effects of nuclear blasts and fallout that will help you determine what you can prepare against and what you can't. I want to make it clear from the outset that I don't recommend living in any area that is a potential blast area. If you are near a nuclear target area, you must relocate. After you read the section on blast effects, you will see why. Besides, building a shelter to withstand these pressures and these forces drastically increases the cost.

NUCLEAR BLASTS

General gauges of damage according to size:

1 MEGATON (Mt) BLAST: The fireball will be 400 feet in diameter initially and 1 mile wide 10 seconds later. The flash occurs for 11 seconds and light is no longer visible after a minute. The blast will rise 25,000 ft high at its maximum expansion where it is about 12 miles wide. The dynamic wind pressure within six miles exceeds 100 mph. Within 5.5 miles a normal house will collapse. At 3.6 miles most cars are damaged by the blast

wave. The severe danger area is 8 miles within 30 seconds. Thermal heat wave effects go out to 11 miles (igniting dry paper, leaves, and houses closer in).

10 MEGATON BLAST: The final cloud is 20 miles high and 50 miles across, maximum. The severe danger area is 20 miles within 1.5 minutes. The thermal heat wave effects go out to 10 miles.

20 MEGATON BLAST: This is equal to 20 million tons of TNT, or 1000 times as large as the bomb dropped on Hiroshima and 130 times as powerful (not 1000 times). For a ground burst, most buildings and homes within 10-12 miles of ground zero would be destroyed. The blast hole would be about a mile across, 600 feet deep, with a 20 foot mound of earth and rock surrounding the crater. Without any hills or mountain surrounding the blast area, most other homes and buildings would be somewhat damaged as far away as 50 miles. Broken windows could occur as far away as 300 miles. There will be 44 seconds of heat and light in the burst.

Above 50 MEGATONS the damage effect hardly increases with any increase in the size of the bomb (contrary to anti-nuclear propaganda).

Effects of Weapons Air Burst	**Weapon Yield**				
	l Kt	**l50 Kt**	**1 Mt**	**l0 Mt**	**20 Mt**
Fireball max size	22 ft	158 ft	3400 ft	8450 ft	1l350 ft
Crater width (inner lip)	126 ft	530 ft	950 ft	l800 ft	2300 ft
Crater depth	28 ft	l40 ft	2l0 ft	420 ft	530 ft
Range of lethal initial radiation	.5 mi	1.2 mi	1.6 mi	2.5 mi	3 mi
Range for 1st degree burns	.5 mi	5.5 mi	l0 mi	24 mi	3 mi
Range for charred skin	4 mi	3.5 mi	8 mi	18 mi	23 mi
Range for 2% buildings gutted by fire (2 psi blast pressure)	.8 mi	4.2 mi	8 mi	17 mi	22 mi
Range for l0% buildings gutted by fire (5 psi blast pressure)	.4 mi	2.2 mi	4.3 mi	9.3 mi	12 mi
Range for fatal wind pressure	.2 mi	1.6 mi	3.3 mi	8 mi	l0 mi
Duration of severe blast (4 psi)	.3 sec	1.8 sec	3 sec	7 sec	9 sec
Arrival time of blast (4 psi)	2 sec	l0 sec	20 sec	42 sec	53 sec
Range of devastation for above ground bldg. (12 psi)	.3 mi	1.3 mi	2.5 mi	5 mi	7 mi
Range of severe blast damage (4 psi)	.5 mi	2.6 mi	5 mi	11 mi	13 mi
Range at which all windows broken (1 psi)	1.3 mi	7 mi	13 mi	28 mi	36 mi

ANALYZING YOUR PROBABILITIES

While the futility of preparation may seem obvious to those who picture themselves in a blast zone, most people do not live in blast zones, and need only prepare against radiation effects. Thus, the "worst case" scenario that is so often touted by disarmament advocates is already suspect. This is how I think things are going to unfold, and why nuclear war is coming:

I. All indications are that the US government is purposely undermining our military abilities (through unilateral disarmament) and setting us up for a Russian nuclear first strike. In 1997 President Clinton issued a secret order to the military (PDD-60) to "absorb a nuclear first strike" and "not rely on launch-on-warning"--our most potent deterrent to a Russian nuclear strike. What's in it for the US globalists who are trying to engineer the next war? I believe they will use war to force the rest of the world into their New World Order, just as they used WWII to start the process. But the rest of the world will not expend the money and effort to build a New World army while the US military is policing the world. So, with the US military obliterated, NWO leaders can jolt the rest of the world into blindly following globalist mandates, supposedly for their own survival. When the war is over (and it is winnable, though costly in lives), national sovereignty will have ceased to exist.

II. Threat-wise, most major cities are not primary targets since Russia will have to concentrate on destroying all strategic military targets, while still keeping a reserve of nuclear weapons for other battles. I believe Russia will keep at least half its weapons in reserve to make good on its threat with Europe (submit or get nuked) and to guard its rear against China, an "ally" that Russia doesn't trust--and for good reason. I don't think there is any reason for Russia to waste weapons on American cities or nuclear power plants. These are not strategic targets that can project power back towards Russia.

III. Let me describe why Russia must someday attack the US. Russia is still a socialist basket case, economically. Socialism never has worked and never will. The so-called democratic and free market reforms in Russia are only a sham, and were only intended to embitter the Russia people against the West. In order to survive and continue to maintain superpower status, a nation like Russia has to control and plunder other productive societies. They want Europe, and cannot have it as long as the US is the policeman of the world. In short, Russia does not want to destroy Western economic power, only disarm it. The Soviet hierarchy is composed of criminal minds, but they are not stupid. They do not intend to destroy the world that feeds them – at least the Europeans. If I am right, Russia will strike at strategic targets – meaning those that allow the US to project military power overseas. If these are destroyed, the US becomes a third world country for several years and cannot interfere with Russian blackmail of the rest of the world.

IV. As a theological aside, I don't think God will permit the entire destruction of the world by nuclear exchange (even if that were possible, which it is NOT). I predict a severe chastisement of the evil in the world, but not total destruction. Neither do the globalists, who are planning for this war, want total destruction.

They simply want the US military decapitated so that the rest of the world has to band together in a one world government to beat the Russians, and then, in the aftermath, control all nations with the police power they have gained through war.

V. China will, I suspect, switch sides sometime during the prosecution of the war (through prior secret agreement with the West) in order to ensure that Russia is defeated. In the process China will garner massive military aid from the West and will become the new tyrant of the world when WW3 is over and a New World Order is established. As part of the secret pact with the Western NWO leaders, I think China will be allowed to take Taiwan and perhaps much of Southeast Asia

General Nuclear Target Areas in the United States

For more specific information on target areas, see *Strategic Relocation – North American Guide to Safe Places* for maps and additional military details. Here is a general idea of the targets:

PRIMARY targets: Prime military targets are those a nuclear power must destroy in order to prohibit effective US retaliation. Only strategic targets qualify – meaning targets that if not destroyed, would allow the US to project its military power overseas and retaliate. These include missile silos, the 4 major US naval complexes (San Diego CA, Seattle WA, Norfolk VA, and Jacksonville FL), the B-1 bomber bases, B-2 bomber bases, B-52 Bomber bases, all command and control bases (especially Colorado Springs, Omaha Nebraska, and Washington DC), all Space Command satellite communications and control facilities, and all long-range refueling aircraft and their bases.

SECONDARY targets: Prime support complexes, either military or industrial, for the manufacture of weapons and missiles. This would include all the weapons development laboratories, all the weapons storage depots (some are in major metro areas like Long Beach, CA.), and the critical weapons factories (unfortunately some are tucked away in the midst of major metro areas like Kansas City, MO.).

TERTIARY targets: Other critical support elements such as oil refineries, nuclear power plants and other suppliers of less critical military parts.

If your city doesn't get hit but other secondary targets do, stay close to home and monitor your shortwave radio. It is doubtful that any US-based radio stations will be operating – but many European stations will still be on the air. Most have English language broadcasts. If you are in a city of less than one million and you are fairly certain it does not have sensitive industry (like armament production of nuclear warheads, rocket motors, missile guidance systems, etc.), you should have a below-ground or an earth-bermed fallout shelter. You can probably assume you will not be an actual blast target. But you must be prepared for fallout to arrive at some point, since the prevailing winds in the US blow from west to east. If no stations are broadcasting, you can assume all the electric utilities and antennas have be damaged by an EMP (Electro Magnetic Pulse) strike. All nuclear powers are prepared to begin a nuclear strike with numerous atmospheric detonations that cause huge magnetic waves that damage electric components and communications. Keep a portable radiation meter with you and watch for distant flashes from potential targets in your area. You must have a meter. Radiation

is invisible. Don't count on seeing the radioactive dust particles. Those that come from far distances are too small to see.

In summary, all homes should prepare for fallout. It can strike from many miles away and due to wind changes, no one is guaranteed immunity. Before discussing shelter design and construction, let me detail for you the effects of fallout.

NUCLEAR RADIATION EFFECTS

FALLOUT

Fallout differs from the initial radiation released from the nuclear explosion itself. The initial radiation is very powerful and will penetrate two feet of concrete and four feet of dirt within 5 miles of a blast. We generally can discount most of its effects, however, since if you are in that blast zone, you will probably be dead anyway. Residual fallout *outside the blast zone* is our major concern since that's where the survivors are – and we want to keep these people from the invisible dangers of radiation sickness. Fallout occurs mostly in a ground detonation as tons of earth and rocks are pulverized by the blast and drawn up into the mushroom cloud, becoming radioactive themselves. These drift downwind and descend to earth in accordance with their size and weight, and land upon the ground and on houses that are downwind from the blast area. We will generally be concerned only with those particles that are heavy enough to fall within six hours of the blast. The others that are small and lightweight will have lost much of their radioactivity by the time they reach the ground (which sometimes takes months). Weapons that are detonated high in the air have very little residual fallout. In a nuclear first strike I would expect about half the detonations to be ground blasts, trying to hit hardened military storage bunkers and missile silos.

Radioactive Particle Types

There are various different types of particles that make up what we call "fallout" from nuclear explosions. The types of particles that emanate from an air burst are mostly gamma rays, while a ground burst will induce radiation into many normal earth particles – some of which may have lasting effects. Gamma rays are relatively short-lived, but are very dangerous while present. Except for the material exposed directly to the blast, fallout will not cause any radiated material to become radioactive. Induced radioactivity happens only when powerful quantities of neutrons irradiate ground particles during a ground blast. Common salt in the ground can become a radioactive sodium isotope because of neutron irradiation if it is close to the explosion. This is a major reason that ground bursts are so "dirty." Hiroshima and Nagasaki sustained air bursts and suffered very little fallout. Radioactive dust from an explosion is a contaminate and can be removed by cleaning the dust off clothing or food cans. The food will not be radioactive. But one has to realize that during any cleaning process you are being exposed to the zapping rays of the gamma radiation. You must limit your exposure to as short a time as possible. Gamma radiation is extremely penetrating and the only protection is mass shielding, as will be explained shortly.

Remember that things that are exposed to the radiation from fallout particles do not, in and of themselves, become radioactive. Animals and human beings can only be contaminated by being exposed to the radiation, ingesting the particles, or by carrying the particles on their bodies. That is the reason for filtering all water and air in a shelter. Certain particles (strontium-90, cobalt-60, and cesium-137) are particles that become radioactive for a long time and eventually can be ingested by growing plants, but this is not common, except in the aftermath of a nuclear war. It is one of the long-term effects that has to be dealt with long after you emerge from your shelter.

Other particles are Alpha and Beta particles. Beta particles (high speed electrons given off by radioactive particles) are much less penetrating but may induce surface skin burns in heavy concentrations. Alpha particles (nuclei of helium) are the least penetrating, but alpha emitters present a serious ingestion hazard and a long-term threat. Lastly, remember that there is no safe way to determine safety from radiation except with a radiation meter. Radiation measurement by an accurate meter that has a scale of .3 Rads per hour to at least 1,000 Rads per hour is the *only* way to determine safety.

VOCABULARY

Here are some words you need to know to be conversant in this subject:

ROENTGEN: Measurement of gamma radiation present.

RAD: Measurement of how much radiation is absorbed by the body.

REM: Measurement of damage to the body (these terms are essentially interchangeable with RAD and designated by an R designator before the number.)

INITIAL RADIATION: 99% of the radiation produced by the bomb that is dispersed in the air within one minute of the blast. If you are close to the blast, you will be affected. Whether or not the blast or the initial radiation will kill you is uncertain. But either way you don't want to sit there and watch a nuclear blast. It's like looking into an X-ray machine, only much worse.

GAMMA RAYS: Photons that originate from inside the nucleus, but without any mass. Similar to X-rays but a high frequency and far more penetrating.

BETA PARTICLES: High speed electrons that originate from a nucleus–very light weight, but not much ionizing effect. They are stopped by clothes though they will get lodged in the fabric and cause prolonged damage. Change clothes immediately after being outside in radiation. Wash down your body and make sure the water goes down a drain. Beta burns will penetrate the skin about 1/8 inch deep, but you will recover. Beta particles do more damage if ingested.

ALPHA PARTICLES: These are nuclei of helium, which are large in size and travel very slowly. They have little penetrating power due to their size. They will not penetrate paper or your skin. Damage usually comes through breathing them into the lungs. They cause severe ionization effects with everything they come in contact with.

IODINE–131: A radioactive particle with a dangerous life of about 80 days. When ingested it seeks out the thyroid gland. Potassium iodide or iodate is taken to keep the thyroid from absorbing any iodine-131 that may be ingested.

FLASH BURNS: These happen only when you get directly exposed to the thermal heat of an actual blast. A 10 second exposure in a 20 megaton blast will give you a second degree burn. Eye damage can occur to your retina as well. Be careful never to look at a nuclear explosion.

RADIATION DOSAGE EFFECTS

Generally, you must receive 200 cumulative Rads in one week to experience significant radiation illness. The following guide is generalized for normal healthy people. Persons with weak immune systems will be affected much worse.

- 0-25 Rads in a week – no effects.
- 25-80 Rads total, cause loss of appetite, some nausea. Blood cell damage begins.
- 80-120 Rads total cause some nausea, diarrhea, vomiting, fever and infection, but will recover.
- 120-180 Rads total cause same symptoms as above but more severe. Onset within a day.
- 180-250 Rads total. Same as above, more severe yet, with internal bleeding and cell destruction.
- 250-400 Rads total will be fully incapacitating. How permanent the effects will be depends upon the immune system's ability to fight off infection and the body's ability to rebuild the damaged cells. People who are weak may die with this dosage. Those who recover will do so within a month or two. This dose will be fatal to up to 50% of the general population due to bad health and nutrition.
- 400-600 Rads in a day will cause death in 80% of people of normal condition within one month. Only those in excellent health will survive if they have access to cleansing herbs and vitamin and mineral therapies (to assist the body in the removal of dead cells and the rebuilding process).
- 600-800 Rads in a day will cause radiation sickness within 4-6 hrs of exposure and will result in the death of all but a few individuals.
- 800 and above will probably result in death of all exposed.
- 1000 R to 5000 R results in rupture of cells in all parts of the body. Everything starts to leak. You get bloody diarrhea, fever, and overloading of toxins and dead cell material. You will begin to get sick within a few minutes to a half an hour. Death comes in about a week. Exposure higher than 5000 R brings death within a couple of days and is very painful. The nerve cells are heavily damaged.

Mitigation of the Effects

PERIODIC EXPOSURE TO RADIATION: To a large extent, radiation exposure is cumulative. Just how cumulative (in low dosages) depends upon your body's ability to quickly remove toxins and dead cells. Damage repair is the key. Cleansing and antibiotic herbs and vitamins are essential. Foods should be *eaten raw and never in high quantities* so that the bodily systems are not burdened with food processing (you won't feel like eating anyway).

THYROID IODINE BLOCKING: Potassium iodate or iodide does not stop damage or protect you against radiation sickness. It is only a method for blocking the absorption of radioactive iodines into the thyroid gland when particles are ingested by eating or drinking. Take a 130 mg dose (and no more) of potassium iodide or iodate (KI) 1/2 hour to one day prior to radiation exposure. If you have ingested some iodine-131 take some KI anyway, but it will be a race to see which gets to the thyroid first. The thyroid absorbs this harmless version and thus excludes any further absorption of radioactive iodines. This does not protect any organ other than the thyroid and is not a panacea medicine against fallout damage to cells, only to the ingestion of radioactive iodine into the thyroid. Radioactive iodine is removed almost entirely by an activated charcoal filtration of water. So use a filter on every source of water that enters the shelter (that wasn't stored there originally).

USING A RADIATION METER AS A GUIDE TO LEAVING A SHELTER

There are two basic kinds of meters – dosimeters and survey meters. Dosimeters are little portable units that measure the dose of radiation that the person receives over time. These are very important for people who regularly work around nuclear equipment such as power plants or naval vessels powered by nuclear power. The dosimeters must be read at regular intervals and then recharged with a special master unit for the next interval. I prefer the survey meters for fallout situations. While they won't tell you what accumulated dosage is, they will tell you the exact radiation level so that you can take immediate action to avoid it. We can tally accumulated doses by jotting down the daily average radiation levels and adding up the results. There are a few older radiation meters on the used market, which do not have current calibrations, but which will be within 10% of original accuracy. When dealing with high doses of radiation, a perfect calibration of the meter is not going to make a lot of difference. Make sure the meter you get can read up to at least 1000 Rads/hr. The used meters, if you can find them are much more economical. See the "Recommended Equipment and Sources" section for recommendations on meters.

Most of the best meters have optional external probes available. This provides a monitoring head to your meter than can be placed outside your shelter to measure how bad it is. The downside is that they cost almost as much as the original meter (since the measuring device is the most expensive part). It isn't really necessary to have an outside probe. What really is important is what is coming at you during the fallout crisis – and

this we measure inside the shelter. Multiple that times your PF (protection factor) and you have a close approximation of the conditions outside. When the radiation isn't detectable on the inside of your shelter, just crack open the door and stick your hand and meter out for an outside measurement.

All broad-ranging survey meters have different scales that are selectable with a switch. Make sure you read the instructions so as to correctly determine the scale in which your meter is reading. For example a read of 3 on the meter can either be 3, 30, 300, or 3,000 depending on which scale the meter is set to. If your scale switch is set to 10x, that means you multiply the reading on the meter by 10 to get the results. A reading of 3 would equal 30 on the 10x scale. On the 100x scale a reading of 3 would equal 300 and so forth.

Here are some guidelines for how much exposure you should tolerated outside a shelter under various low levels of radiation:

- .5 or less Rads/hr: Safe to leave, but keep your meter handy in case new radiation arrives.
- .5-3.0 Rads/hr: Leaving the shelter for a few hours per day is permitted. You should sleep inside, however.
- 3-10 Rads/hr: One hour or less outside shelter. Two hours in a basement or masonry building without a concrete ceiling.
- 10-100 Rads/hr: Ten minutes or less outside, only in emergency conditions.

Guidelines For Action Without A Radiation Meter

Fallout in concentrations high enough to require a fallout shelter will always occur when you are downwind of the explosion, and will depend upon the wind speed. If you do not experience visible fallout particles (you will see dust in the air or falling) within the time the wind moves it your way, the particles may be too small to see. If you are downwind of an explosion, always assume that fallout will be arriving soon. You must still stay inside the protection of a building and try not to breath any outside air. Try to find a basement space. Even though you may not see the fallout, it is still there in some amounts and should be considered deadly. Remember, fallout in any form during the first day of an explosion is the most dangerous. After the first day, fallout will have gone down almost 80%. The rate of decay is much slower after the first day, but if you have to move to better shelter, wait for at least two days, and don't breath outside air without something over your mouth to filter it. If you use one of those white paper face mask filters over your mouth, hold it with your hand to make a tight fit – otherwise it will leak around the edges. After a couple of weeks, you may take a chance on venturing out. But remember that other fallout from targets further away could just be arriving. Make sure you always wear a tight-fitting face mask if you do any work in the area so that you don't breath in radioactive particles.

There is a "rule of 7/10" that can help you estimate the dissipation of gamma radiation. After 7 hours the radiation is reduced by a factor of 10. After *7 times that period* the radiation is reduced *another factor of 10*. For example. In the first 7 hours of a radiation dosage that began at 1000 Rads/hr, it would end up at 100 Rads/hr. In the next 49 hours

(7 times longer) the radiation would be down to 10 Rads/hr. After another 7x the time (2 weeks) the radiation level would have dropped to 1 Rad/hr. Don't think it is still safe to wander around. Remember, this stuff is cumulative. A day outside in 1 Rad/hr is going to give you another dose of 24 Rads.

RECOGNIZING RADIATION SICKNESS SYMPTOMS

Light exposure causes nausea, vomiting, headache, and dizziness. Diarrhea is next. With heavier exposures cell damage exceeds the vascular system's ability to remove the toxins and waste material. Blood will be in the urine. Infection sets in. The blood cells themselves are damaged and cannot cope. Even new blood cell production is impaired. Many people die from contracted illnesses rather than the radiation itself, much like AIDS

NUCLEAR PREPARATION: GENERAL PRECAUTIONS NEAR A BLAST AREA

Never look out a window during a nuclear explosion. The oncoming shock wave will burst the window in your face. Run out of a room that has windows and into a hall or basement. Wait two to three minutes for a blast wave to hit before trying to go outdoors to enter an external shelter. The initial blast wave travels about 1 mile per five seconds before slowing down. If no blast reaches you within two minutes, it is over 25 miles away and you will not be hurt by the effects (except by glass particles). Persons 100 miles away may have to wait as long as 7-10 minutes before hearing the blast, but they will not receive any damage or immediate effects.

If you are in a car, stop immediately, and duck down below the dash board in order to get as much shielding as possible. If you have any choice, in the process of stopping, try to pull over so that some building is between you and the blast. The building will shield you from most of the effects. As soon as the blast effects pass, shut down your ventilation system and try to drive out of the area without breathing any of the outdoor particles. It will be a long while before authorities are able to close off the freeways, but they are only safe to travel on if you are near the edge of the city where there are no more concrete barriers on both sides of the roadway. If you get on a freeway within the city and a traffic jam occurs, you will have no way to escape, except on foot. If you stay in the residential areas (assuming no major damage) you can probably keep going.

If you have a sense of which way the wind is blowing, try to drive out of the downwind area of the blast. This will allow you to travel without being within the heaviest fallout pattern, and will even allow you to leave the safety of the car and go on foot – if there is no fallout in the area. The wind direction is actually fairly easy to see if you look at the mushroom cloud (don't do this while it is still giving off light). If the cloud is starting to blow your way, change course to go to the right or left of it, whichever gives you the highest probability of avoidance of the coming dust. If your home is in the direction of the falling dust cloud, forget about going home even if you have a shelter there (unless

you can get there with certainty before the fallout begins to descend – probably less than 10 to 15 minutes). I always carry some type of face mask in all my cars in case I ever have to go outside when it is dangerous to breathe. This is very cheap insurance.

SHELTER FACILITIES

In a basement multi-purpose shelter, we have the advantage of being able to install apartment-like facilities, unlike the more rudimentary shelters only made for nuclear war. Below, we will discuss the basic layout and features of a working shelter. The essentials are as follows:

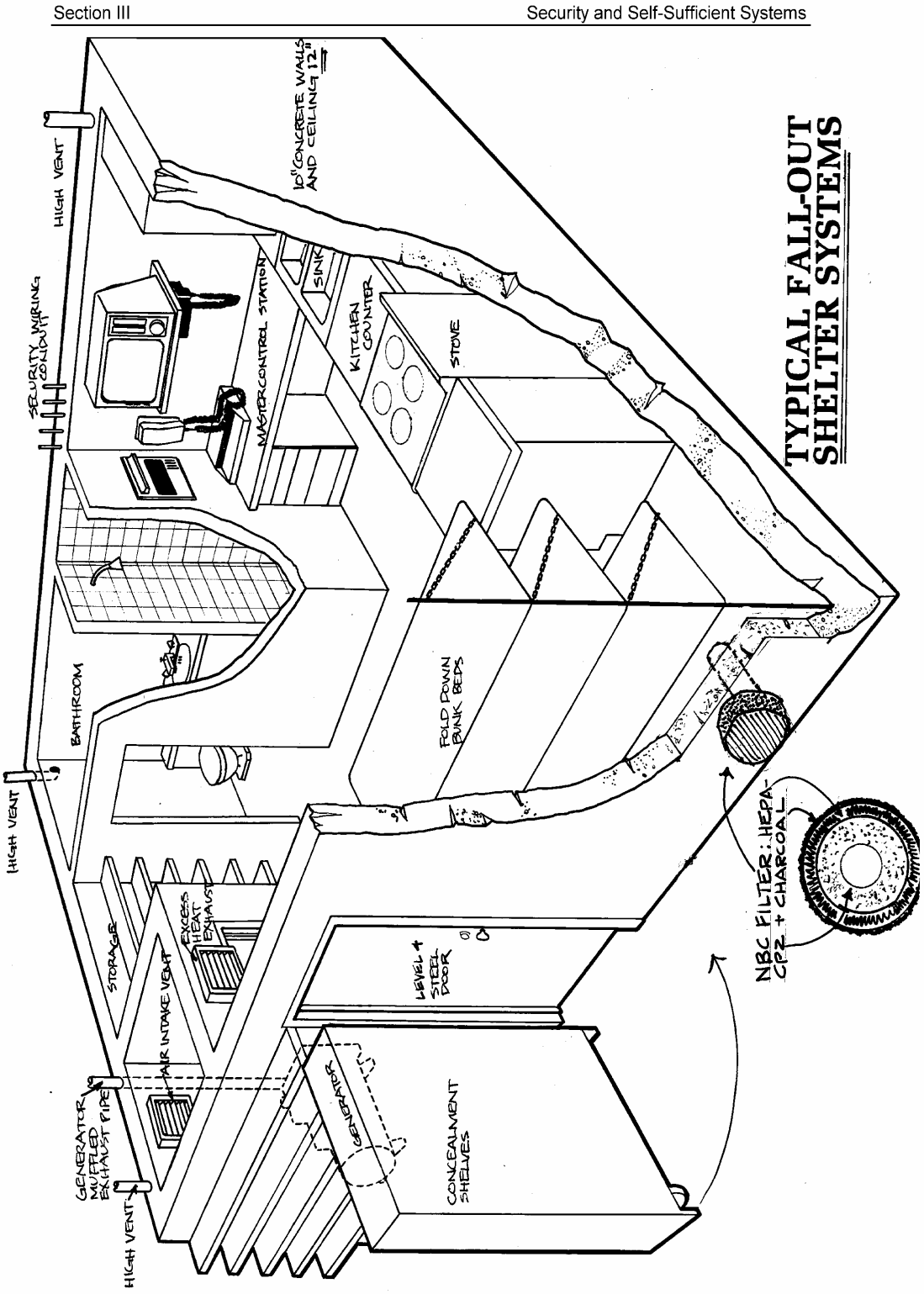
- Combination living, eating, kitchen area
- Storage room, including a tool area
- Bunk room
- Bathroom
- Generator/mechanical area (optional)

Combination Living/Kitchen Area

This main living area occupies the largest room in the shelter. It should be equipped with adequate seating, kitchen/laundry, entertainment, and administration facilities.

Kitchen and Laundry Facilities

A single counter along a wall constitutes the entire kitchen. It should have a double, deep laundry type sink designed especially for handwashing of all utensils and clothing. A clothes wringer should be installed next to it, or on a barrel which will collect the gray water for later use for flushing toilets. An under-counter refrigerator or portable electric icebox should be nearby. I never use full size refrigerators in a shelter. I prefer the small 4 cu. ft. models by GE or Sanyo that only use 150 watts of power at 110 volts AC. This is small enough to run off of an inverter. They also fit either under a counter or on top. A small countertop camp stove for propane use is sufficient for cooking. A built-in RV type gas stove top is better if you have interchangeable jets for both natural gas and propane. The deep kitchen sink can be used effectively for cleaning clothes. However, the most labor-intensive task is wringing out wet clothes. Make sure you have a manual wringer.


TYPICAL FALL-OUT SHELTER SYSTEMS
10" CONCRETE WALLS AND CEILING 12"
HIGH VENT
SECURITY WIRING CONDUIT
MASTER CONTROL STATION
SINK
KITCHEN COUNTER
STOVE
BATHROOM
FOLD DOWN BUNK BEDS
HIGH VENT
STORAGE
EXCESS HEAT EXHAUST
AIR INTAKE VENT
LEVEL 4 STEEL DOOR
NBC FILTER: HEPA-CPZ + CHARCOAL
GENERATOR
GENERATOR MUFFLED EXHAUST PIPE
HIGH VENT
CONCEALMENT SHELVES

The only kind made nowadays are chammy (chamois) wringers used by car washes. These can be special ordered at most auto parts stores.

Table or Expanded Counter

This provides space for eating and a work or play surface. Most shelters are not large enough to accommodate a separate table, which requires surrounding chair space as well. Most often, I will design a table that is an extension of the kitchen counter, or a folding drop leaf type of table hinged to the wall.

Comfortable Seating

Unpadded chairs are only comfortable if you have a table to work around. Bench seating along a wall should have a horizontal seat sufficiently curved to provide comfort and to inhibit sliding forward. Large sofas and plush chairs are usually too space consuming to use, but folding futon type padded foam seats are adaptable and have the added advantage of being able to be made into beds if necessary. The only type of couch I would put in a shelter would be a hide-a-bed or trundle bed type that provides sleeping facilities as well as sitting comfort.

Recreation and Diversionary Facilities

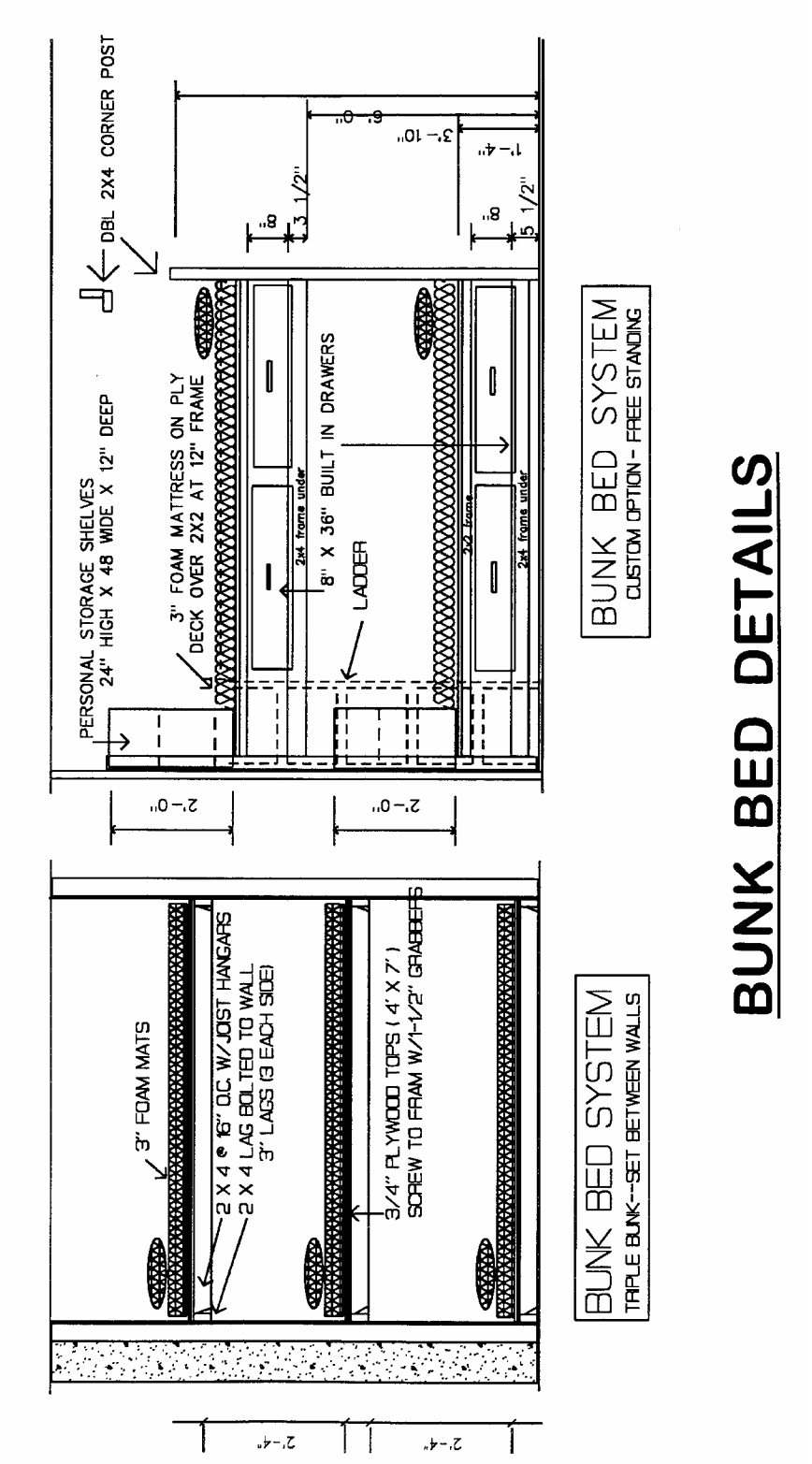
Mental activities are important toward keeping a healthy emotional atmosphere during a confined period. Put pictures on walls, especially of active, outdoor themes. Instead of throwing away your outdated TVs, computers, stereos, and VCR, recycle them to the shelter for a second life. Of course, board games, puzzles, and a well-stocked library are important. Make sure you have plenty of how-to-fix-it and skills books so that you can be learning to cope with the broken down world that will meet you when you finally emerge from your shelter.

Command Center

This area should contain the security system master unit, which is a copy of the master bedroom security panel indicating the position of intrusion throughout the house as well as switches to activate alarms or passive defensive measures. This central admin. center should also have the telephone, radio receivers, scanners, transmitters, intercom, security lighting, shutter controls, door lock controls, and the stereo and TV with video recorder for entertainment. Not everyone will have all these items in their shelter, but you get the idea – put all the electronic equipment in a central area. Special grounding cables will also be located on this wall to protect the equipment from EMP and lightning strikes. If the TV is going to be in this central electronic area, it should be located so that the greatest number of persons can watch the screen. I doubt whether much news will be available during a nuclear crisis, but at least videos can be shown for entertainment. Most news will come via the shortwave radio from overseas stations.

Sleeping Bunks

These can be fixed bunks, the fold-down variety mounted on the walls, or sofa-bed types. You can even use futons (Japanese foam mats) for sleeping on the floor. Stacking bunk



BUNK BED SYSTEM
CUSTOM OPTION - FREE STANDING

BUNK BED SYSTEM
TRIPLE BUNK--SET BETWEEN WALLS

BUNK BED DETAILS

racks should have about 24" between bunks, vertically, to avoid claustrophobic annoyance. My favorite design is cheap and simple one (see Bunk Bed illustration). Take an end portion of the shelter and make a bunk room 10 feet wide by 7 feet long. On either side of a central doorway you will put a rack of bunks made from 4x8 sheets of plywood, cut down to 7 feet long. I have found that the 4 foot wide ply bunks are wide enough to sleep two people. In an 8 foot ceiling, place the first bunk at 36" off the floor, the second at 60," and then add a third spot on the floor under the first bunk by putting down a 4x7 foot piece of foam. This allows you to sleep 12 people in this small room. In most shelters with this bunk design, the bunks are fixed 2x4 frames attached to the walls which are used as storage shelves until people move into the shelter. The storage boxes are then stacked against a wall in another area of the shelter, or can even be placed outside the shelter in the basement storeroom if they are items that will not be needed in a short-term shelter crisis.

Bathroom

For shelters designed for more than 4 people, I strongly recommend a full bathroom facility with tub/shower combination. The tub is essential for medical and sanitation care of disabled persons. In basement homes, with few windows, a downstairs bath in the normal living area can serve for the shelter occupants once fallout levels have gone down about 90% – since the limited time exposure in a quick trip out of the shelter will not be very harmful (after the radiation drops to a low level after the first week or so). Under most conditions you can expect a drop in radiation to 50% after two days, and 90-95% after two weeks (assuming no new fallout arrives from more distant targets upwind of your location).

A portable chemical toilet is the minimum in sanitation needed for a shelter. Makeshift use of floor drains or plastic bags are far less than satisfactory due to odor and bacteria escaping into a confined area. A marine toilet, like the kind used on yachts, is capable of manually pumping the waste effluent up as high as 8 feet – allowing you to tap into plumbing sewer drains at the basement ceiling level when there are no sewers at the basement level. If you lack access to a sewer line near the shelter, a holding tank built under the basement slab will suffice for a limited duration crisis. Make sure you have a 4-inch diameter access pipe leading to this holding tank from outside in the yard so that it can be pumped out when necessary. Naturally, gray water should be saved for flushing toilets or drained to a french or rock drain under the floor and not into the holding tank.

Proper ventilation of the shelter bathroom is essential. I always design one of the exit vent pipes into the bathroom space. Never draw inlet air that is destined for other rooms from the bathroom.

Decontamination Entry Areas

Decontamination is a needful process for shelter life. Although not depicted on the shelter illustration (since it is within or next to a basement) all full sized shelters should have a type of air lock entry which contains a drain, a small seat, a hose and some clothes hooks. Washdowns of persons coming in from a fallout environment should occur there, and be done by the person themselves, unless ill. Make sure that all the fallout particles

are washed down the drain. If the particles go into a sump or drain directly under the slab, the slab has to have the same 12" minimum thickness that the ceiling has to avoid radiation contamination. Since this is costly, make sure you route the drain lines away from the shelter rooms.

Shielding the entry door: you should always build radiation shield walls around the entry door. These L-shaped walls keep radiation that comes through the shelter door from hitting people inside. If you design a small one-room shelter with no room for a shield wall, preposition in the shelter some 12" concrete block with the voids filled, and use these to stack in front of the door, temporarily. This can only be done once everyone is inside the shelter – you don't want to have to unstack all those blocks to let someone go in or out.

Storage Facilities

In a one or two room shelter, all of the storage will be along walls or in storage cabinets under all bench seating and bunk beds. In larger shelters, you can dedicate an entire room to storage and build an intricate system of multiple shelves and isles to maximize storage. The tool bench is usually in this room.

Repair Tools

For generator and electrical equipment especially. Make sure you have some electric diagnostic tools, especially a good digital volt-ohm meter and a separate amp meter. Learn how to use them. My booklet, *10 Packs for Survival* has numerous storage lists to assist you in stockpiling tools and supplies.

Medical Facilities

A fully stockpiled cabinet containing supplies mentioned in the **Tried and Proven Natural Remedies** section, page 34, should be available. A lot of people worry about trying to stockpile medical drugs. I prefer to rely on the sound and proven natural health remedies – herbs and homeopathic preparations, in combination with careful use of vitamins and wholesome foods. If one of your members has the training to perform minor surgery or other remedial aspects of medicine, you should provide a padded table with good lighting for medical use.

Water Storage Facilities

As mentioned earlier, at least one in-line pressurized water tank should be within the shelter walls. Do not rely solely on external water sources or tanks where the inlet line may be broken or discovered by others. Cistern construction details are in the chapter on Plumbing and Sanitation Systems.

Generator and/or Battery Room

This must be separate from the rest of the shelter so as to control heat and vapors as will be covered in a later chapter. It should also be sound-insulated. Generators give off significant quantities of heat, which can be used to heat the shelter or be discarded. Only in hot, humid climates have I found it necessary to dump the heat to the outdoors. Most

mild or cool climates keep a basement shelter in the 60 degree F. range, which is somewhat cool for full-time living comfort. Such a shelter can handle all of the residual heat from a generator when used on a twice daily schedule. Be careful not to oversize a shelter generator. Generators should be used at 80% of their capacity or greater when run, both to conserve fuel and to produce a good waveform of electricity. This is why I always tie a generator in with a battery bank so that the generator can be charging the batteries at the same time it is charging up a refrigerator or freezer, or running a furnace fan. If you are sizing a generator to run a very large house, it is best not to try and place such a generator in the shelter area. The noise, heat, and vibration will be too hard to manage in small controlled spaces.

Sound Insulation

Carpeting and carpet foam hung on walls can be used with excellent results. Specialty sound foam is listed in the Recommended Equipment and Sources section, but is expensive. A cheaper alternative is waffle shaped mattress pads stapled to the walls, with the finger projections toward the living space. Care must be taken not to destroy the heat sink effect of the masonry so that overheating does not occur.

Separate Vault Room

If you have a supply of valuables for which you want a higher degree of protection, you may want to implement a concealed vault within this larger vault room. This can be as simple as a floor safe under the carpet, or a separate concealed room outside the shelter walls. This should be able to be accessed in privacy in case others are in the shelter whom you may not want to know about this additional vault. Locations can be in any place of concealment, not just on the same floor level.

Radiation Monitoring Equipment

See the “Recommended Equipment and Sources” section. Make sure you get a meter that will give you ratings from .3 Rads to 3000 Rads/hour. Most meters designed for the nuclear hazard industry are calibrated only in fractions of R. If you want to follow the radiation trends, better have a meter that tells you more than when it’s safe. Psychologically, it is bad not to have any idea of when you can leave the shelter. A meter that only reads the low range can lead to extreme anxiety if conditions are poor in the shelter, and the radiation level never seems to decrease. You want to be able to tell how fast the radiation is dissipating. Remember too, that even after the radiation reaches a safe level to exit the shelter, keep making regular checks to ensure that new radiation hasn’t arrived from a more distant target.

LAYOUT AND DESIGN OF THE SHELTER

For small homes, the best overall solution is to construct the entire basement with a 12 inch concrete ceiling. Thus, all facilities in windowless portions of the basement become potential security facilities. In such installations, I usually prefer that the entire basement remain concealed. I do not recommend this for basements where extensive full-time

living occurs due to the need for windows. A windowless, underground basement with overhead shielding allows for the emergency accommodation of many people in relative comfort – especially since multiple compartments can be designed into the floor plan.

Compartmentalization in a shelter is essential to avoid the psychological problems of people getting on each other's nerves in a stressful environment. This is compounded if all the persons are not under the command and leadership of the head of the house, or if the leadership is permissive. Undisciplined children and moaning, diseased or ill persons can make shelter life unbearable for even short periods if you don't have the ability to separate people. At a minimum, all in-house shelters should be at least 8 ft wide and 16 ft long with three compartments: one small one for sanitary facilities and two other more or less equal-sized rooms; one for sleeping and the other for common functions. Prefabricated shelters, designed and built on the principles of a mobile home can be more compact, but not by much without serious stress.

In the ideal situation, I prefer a separate room for a full bath, a separate storage room, a generator room (if used), a sleeping room, and a common area. Additional features are an airlock main entry and a tunnel emergency exit. One of the most important areas to plan for in a shelter is a shop tool area. Having tools inside a shelter is essential for the inevitable repairs and makeshift adaptations of wiring and equipment necessary once inside. This can be as simple as a countertop area with a wood top. Make sure that shop supplies are stockpiled along with other essentials.

Suggested Locations

The placement of the shelter in the floor plan, for privacy and security reasons, should not be obvious or conspicuous. Generally, the best locations follow the strategy of putting the shelter in a portion of the basement where one would not otherwise expect a basement to be. The least expected location is under the garage. No one expects a basement under the garage concrete slab. If the garage is attached to the home, this allows the basement shelter under the garage to be next to the normal basement. This facilitates concealed entrance schemes wherein the basement becomes the primary entrance. I usually design a mechanical or storage room along this joint wall between basement and shelter – rooms where it would be natural to have a storage cabinet system to conceal the shelter door.

Another excellent place for a shelter is under a cement front or rear porch. The cement slab can be thickened to 12 inches and it will not be obvious there is living space below. A cutaway drawing of this under-porch shelter is in the Shelter Construction Details section later on in this chapter.

Having a garage or home structure above the shelter allows you to place cabinets or even a fireplace system in the vicinity of the shelter. These cabinets or chimneys, with hollow chases, can be used as alternate entrances from the upper floor levels, as well as vent pipes or even generator exhaust.

If the shelter must be within the basement proper (not under the garage), use one whole end of the basement so that it appears that the home has only a partial basement. This isn't as concealable as a basement that is placed outside the normal foundation walls, but

if separated by a concrete wall that is partially visible, it will make people think that the basement ends at this wall.

Building a Shelter Under a Normal Wood Floor

When building a shelter under a portion of the house where plumbing pipes penetrate down into the basement ceiling area, we need to decide how to route the pipes so they don't interfere with shelter construction. We can either predetermine (with exactness) where the pipes are going to penetrate the concrete ceiling of the shelter and pour the shelter ceiling accordingly, or we can build the shelter ceiling below the wood floor so that the plumbing pipes can run between the floor joists until outside the shelter area. This means we need to pour a 7 foot high basement support wall instead of the normal 8 foot walls. Thus, the concrete ceiling will be below the normal roof floor joists and allow the plumber to install conventional plumbing between the floor joists. Sometimes it is an advantage to run the pipes into the shelter (by penetrating the ceiling), even though it may cost more, so as to be able to connect up to these drain lines later on when you outfit the shelter.

If the shelter is going to be under a portion of the main house and there is no plumbing involved, we can allow for the normal 8 foot high ceiling in the shelter. In this option, the concrete shelter ceiling is built at the same height as the basement ceiling floor joists elsewhere in the house. To make sure the transition from the wood main floor to the concrete floor is not noticeable, finish the shelter ceiling slab at the exact level as the floor joist tops. Then when the plywood subfloor goes down on those floor joists, the plywood can continue on over the cement (using construction adhesive) and the whole floor system will be at the same level, and appear as the same material.

Concealed Entrance Examples

Always use concealed entrances into the shelter, such as double-walled cabinets, closets, or shelves on rolling pivots (as illustrated). Two concealment schemes are illustrated, types A and B. There are numerous other ways to do this, but these will get you started thinking in the right direction. I will give some very detailed instructions on these two systems because they have to be custom built.

PIVOTING CABINET

TYPE A: The concealed cabinet on the right, labeled "A," is of the pivot hinge type. The cabinet swings outward to gain access to the high security shelter door behind. Type B on the left is a fixed cabinet with a sliding back for access and will be described later. The door to the shelter, in this drawing, is a bulletproof plate of tempered steel fastened to a reinforced steel utility door. Building such a door is covered in the Security chapter.

The concealed cabinet in A is made very rigid, like a box, with standard hollow doors on the front and caster wheels on the bottom in two places to help bear the weight of moving a loaded cabinet. The two difficulties in building such a cabinet are the hinging mechanism and the concealed locking mechanism. I will briefly describe them so you can understand the drawing. There is a close-up of this pivot cabinet mechanism on the following illustration to assist you.

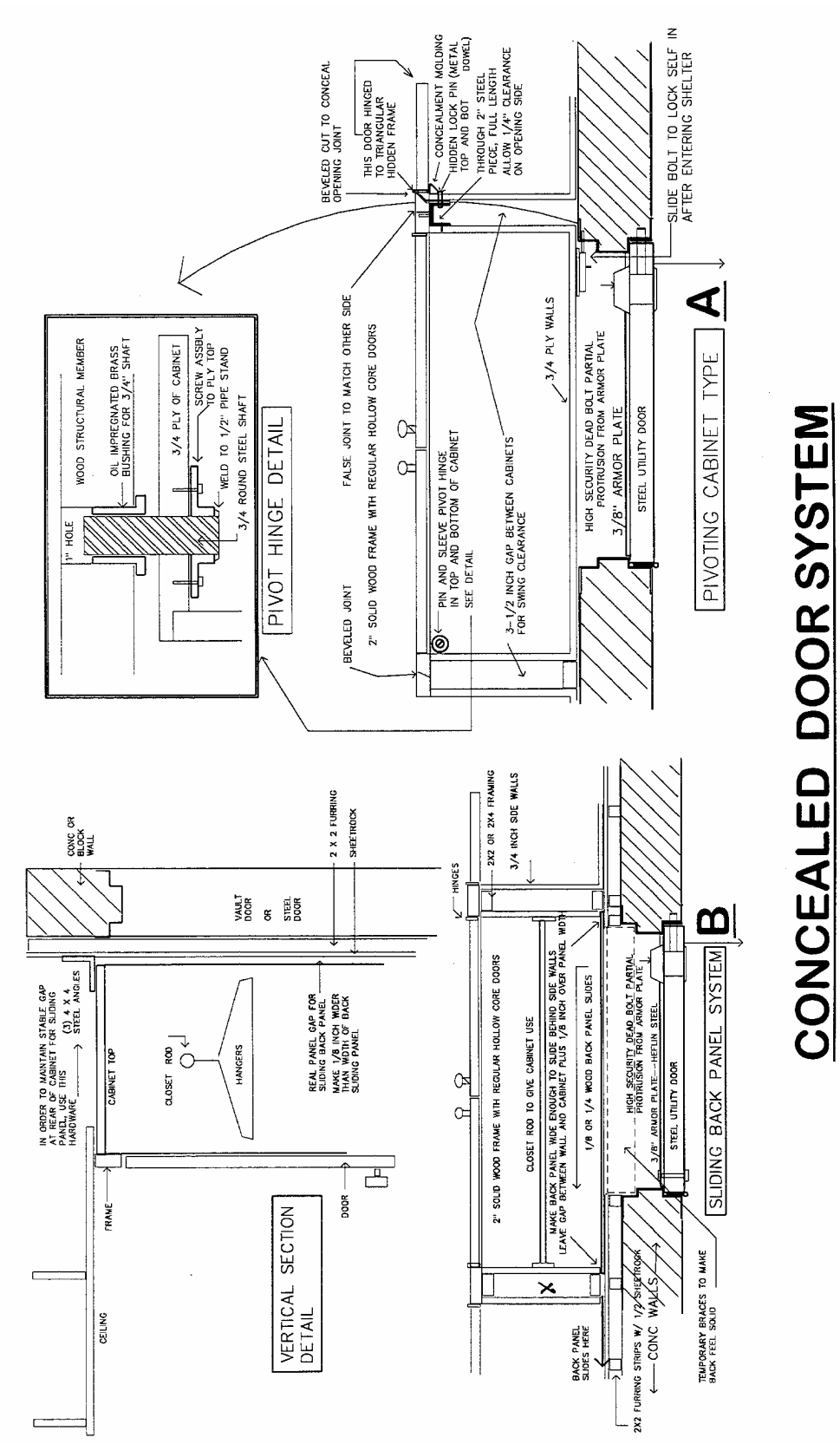
SLIDING CABINET

TYPE B: This one is easy by comparison. It is simply a matter of building the side wall structure of the cabinet (marked with an "X") so that it doesn't contact the back wall. This side wall of the cabinet is only attached at the top and the bottom–not at the back. Now the back paneling of the cabinet is free to slide into the cabinet space next to it. Use paneling that has small grooves spaced every 4 or 5 inches so that you have something to grab onto to slide it back and forth. The other side wall of the cabinet interior should also have a gap at the rear so that when the cabinet back is slid into place the joint is concealed.

Hinging Mechanism

There are no regular hinges in the design of the moving cabinet itself because they would be noticeable on the front. Instead, we use a pair of concealed brass bushings above and below the cabinet (set into the ceiling and floor, respectively) to provide the pivot points. These brass bushings can be purchased at any bearing supplies store listed in most large cities in the yellow pages. We want a pair that fits a solid 3/4-inch steel shaft, which is a standard piece of steel available at any metal supply house. The two brass bushings go into 1-inch holes in the position shown on the drawing. The pivot point merely has to be in this front corner area of the cabinet. The exact location is not critical – only that wherever you choose must be the same point for both top and bottom of the cabinet.

Drill a small pilot hole (about 1/8 inch diameter) in the bottom of the cabinet floor to help you locate where to drill into the concrete below. Put the cabinet in place and use a long nail to punch a mark on the concrete below where the pivot point will be. The top bushing will go into a piece of plywood screwed to the floor joists above concrete floor. So mark this position at the same time, by using a similar pilot hole and nail, and then slide the cabinet out. Drill or chisel out a hole to fit the lower bushing and cement it in place into the concrete with epoxy, being careful not to get any glue on the inside bearing surface. Then drill a hole in the top plywood at the marked point to receive the top bushing. Glue it in place with epoxy as well.


CONCEALED DOOR SYSTEM
PIVOT HINGE DETAIL
1" HOLE
WOOD STRUCTURAL MEMBER
OIL IMPREGNATED BRASS BUSHING FOR 3/4" SHAFT
3/4 PLY OF CABINET
SCREW ASSBLY TO PLY TOP
WELD TO 1/2" PIPE STAND
3/4 ROUND STEEL SHAFT
BEVELED CUT TO CONCEAL OPENING JOINT
THIS DOOR HINGED TO TRIANGULAR HIDDEN FRAME
CONCEALMENT MOLDING
HIDDEN LOCK PIN (METAL DOWEL) TOP AND BOT
THROUGH 2" STEEL PIECE, FULL LENGTH ALLOW 1/4" CLEARANCE ON OPENING SIDE
SLIDE BOLT TO LOCK SELF IN AFTER ENTERING SHELTER
FALSE JOINT TO MATCH OTHER SIDE
BEVELED JOINT
2" SOLID WOOD FRAME WITH REGULAR HOLLOW CORE DOORS
PIN AND SLEEVE PIVOT HINGE IN TOP AND BOTTOM OF CABINET
SEE DETAIL
3-1/2 INCH GAP BETWEEN CABINETS FOR SWING CLEARANCE
3/4 PLY WALLS
HIGH SECURITY DEAD BOLT PARTIAL PROTRUSION FROM ARMOR PLATE
3/8" ARMOR PLATE
STEEL UTILITY DOOR
PIVOTING CABINET TYPE A
VERTICAL SECTION DETAIL
CONC OR BLOCK WALL
VAULT DOOR OR STEEL DOOR
2 X 2 FURRING
SHEETROCK
IN ORDER TO MAINTAIN STABLE GAP AT REAR OF CABINET FOR SLIDING PANEL, USE THIS HARDWARE
(3) 4 X 4 STEEL ANGLES
CABINET TOP
CLOSET ROD
HANGERS
REAL PANEL GAP FOR SLIDING BACK PANEL MAKE 1/8 INCH WIDER THAN WIDTH OF BACK SLIDING PANEL
CEILING
FRAME
DOOR
HINGES
2X2 OR 2X4 FRAMING
3/4 INCH SIDE WALLS
2" SOLID WOOD FRAME WITH REGULAR HOLLOW CORE DOORS
CLOSET ROD TO GIVE CABINET USE
MAKE BACK PANEL WIDE ENOUGH TO SLIDE BEHIND SIDE WALLS LEAVE GAP BETWEEN WALL AND CABINET PLUS 1/8 INCH OVER PANEL WIDTH
1/8 OR 1/4 WOOD BACK PANEL SLIDES
HIGH SECURITY DEAD BOLT PARTIAL PROTRUSION FROM ARMOR PLATE
3/8" ARMOR PLATE - HEFLIN STEEL
STEEL UTILITY DOOR
SLIDING BACK PANEL SYSTEM B
BACK PANEL SLIDES HERE
2X2 FURRING STRIPS W/ 1/2 SHEETROCK
CONC WALLS
TEMPORARY BRACES TO MAKE BACK PEEL SOLID

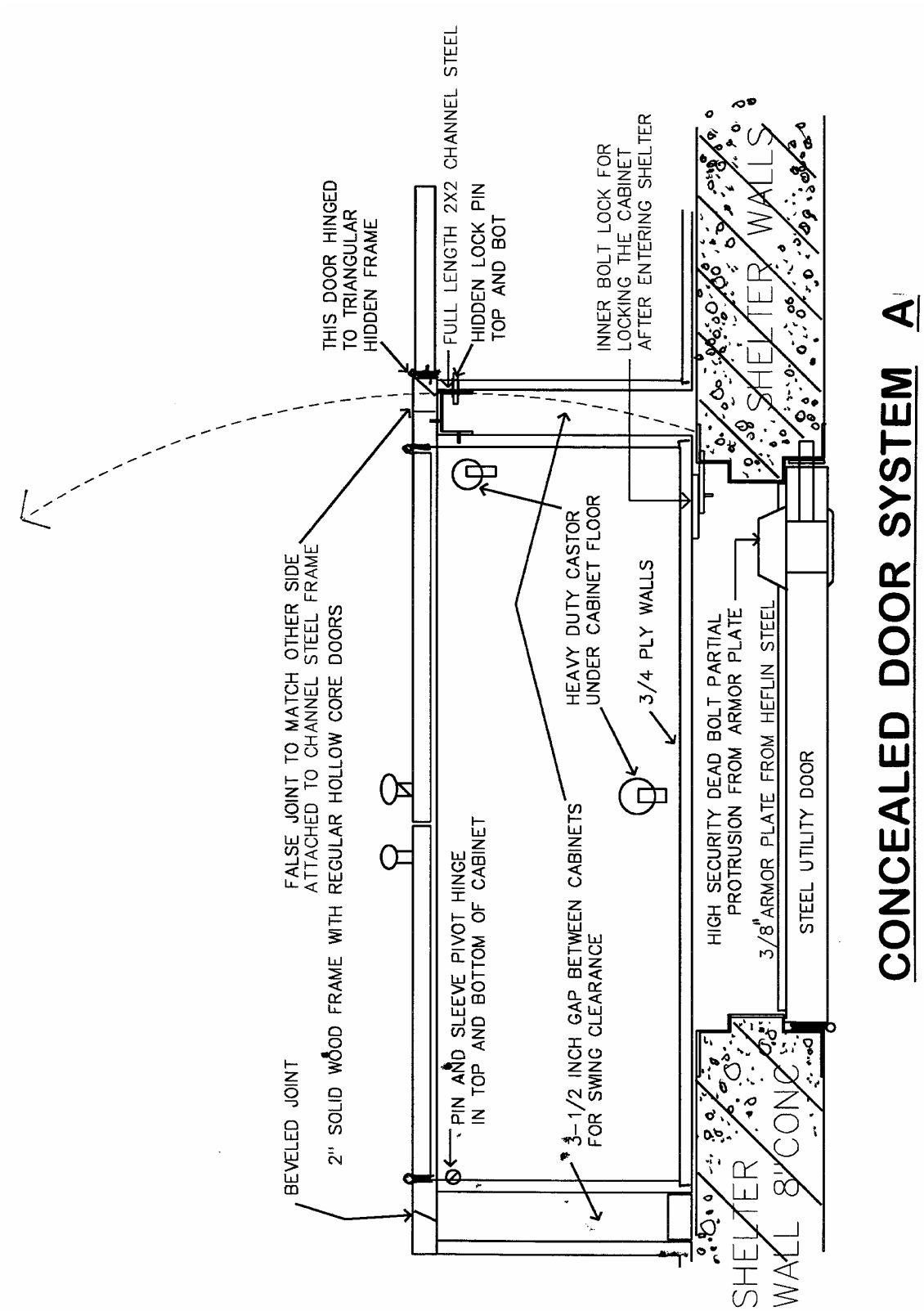
At this point, we need to build the two rotating pivot pins out of the steel shaft and fit them onto the cabinet top and bottom. We will do this by cutting pieces of the shaft to length and having them welded onto a flange that we can screw onto the cabinet. These two short steel shafts will go inside the bushings and provide the hinging mechanism for the cabinet. First, the bottom one: the 3/4-inch diameter steel shaft is cut to length by measuring from the undersurface of the bottom of the cabinet floor to the cement, while the cabinet is sitting on its caster wheels. Build the cabinet so this shelf is high enough off the floor to accommodate the small caster wheels you will be using (usually about 2-3 inches of space). The wheel heights are the determining factor for what height the cabinet sits above the floor. This wheel space under the cabinet will be concealed in the front by a cabinet facing that will go almost to the floor, leaving a 1/4" gap so as to not scrape the floor when the cabinet swings out. If the wheel space under the cabinet is 2 inches, for example, then cut the steel to about 3 inches long so that the steel will protrude down through the bushing set into the cement.

Now find a *steel pipe base* at the hardware store (the kind used for making pipe railings) to use as a flange. You can also have a welder simply butt weld the shaft to a 1/4 inch square of steel. The pipe base is a convenient, commercially available flange. The threaded hole in this 1/2" pipe base is about 3/4 inches inside diameter. For the bottom pivot, insert the 3/4" steel shaft into the pipe base until flush with the bottom and then have it welded in place. You can also glue it with epoxy if you don't have access to a welder. You may have to ream out the threaded pipe base a little if the steel shaft doesn't go in easily. Now you should have a short and strong pivot welded to a flange that can be screwed onto the bottom of the cabinet.

When the cabinet is put back into the correct position, the steel pivot shaft will now drop into the bushing hole. You should make sure when you build the cabinet itself that you don't build it so close to the ceiling that it doesn't allow room to lift up to get the bottom pivot in its hole. Remember that this bottom pivot sticks down further than the cabinet wheels, so there must be an equal amount of gap at the top to compensate – otherwise you won't be able to get the bottom pivot in the bushing hole. Build all the cabinets to the right and left with the same air gap at top and bottom so that the movable cabinet doesn't look any different than the others.

To secure the top part of the cabinet with its corresponding pivot shaft, put the cabinet in its proper place – bottom pivot set – and then drill out the small pilot hole you previously used to mark the top bushing position. You now want this pilot hole to be expanded to a 3/4-inch diameter so that the upper steel pivot can go up through this hole and engage the upper bushing. When you make the pivot for this part of the cabinet, take a good look at the "Pivot Hinge Detail" illustrated. You will see that this pivot shaft is going to be attached to the *interior side* of the top of the cabinet and not from the top side (which you cannot get to when the cabinet is in place). So this top pivot shaft needs to be long enough to go up through both the hole in the top of the cabinet plywood and also through the upper bushing.

We are going to install the top pivot from inside the cabinet to make it convenient to take the cabinet out if we need to. So, when you put the shaft into the pipe base for welding or



CONCEALED DOOR SYSTEM A

gluing, it must have the protruding part sticking out of the back side of the base, as illustrated. Now, when you push the pivot up through the hole in the cabinet and through the bushing, you can screw the unit into place and the cabinet is ready to pivot.

When you build the series of cabinets on the wall, notice in the illustration that there is a 3-1/2 inch space between the pivoting cabinet and the fixed cabinet next to it. This is essential to allow the rear corner of the cabinet to swing out without rubbing against the side of the adjacent fixed cabinet. Make sure all the cabinets have this same thickness between them so they all look the same. Notice as well the special angle cuts on the cabinet facings. The angle cut on the facing near the pivots is to make sure the two facing surfaces don't rub against one another when opening. The angle cut on the right side (which swings open) is there so that the hinges on the adjacent cabinet still have a triangle of facing to attach to.

Locking Mechanism

The locking mechanism is effective and simple. The cabinet is unlocked by a secret 1/4-inch steel pin that is only accessible from the cabinet next to it. This pin engages a 1/4 inch hole drilled in the piece of steel channel that runs the full height of the cabinet (in the space between the two cabinets) and that provides support for the face frame on the front. Since the pin is not inside the cabinet being explored, it is very difficult to find. Further concealment is accomplished by hiding the pin in the same horizontal position as one of the shelves in the adjacent cabinet. Just lay the shelf on its supports and do not secure it with screws. This way, the pin in the side of the cabinet is completely invisible until you raise the shelf up slightly on one side to expose the position of the pin. When the pin is withdrawn the pivoting cabinet is free to move outward. The only trouble with this system is that the pin cannot be put back in to lock the cabinet once you are inside the shelter. So, we install a couple of sliding dead bolts on the back of the cabinet as shown, so that once you are inside, no one can open the pivoting cabinet unless you let them in from inside.

Privacy Strategies

Privacy in the placement of the shelter can involve several layers of security, depending on the amount of valuables you desire to keep secret and secure. There are various special techniques or "super ruses" that can be implemented to make it almost impossible for the uninitiated to gain access to the security shelter. These techniques are secret and it would be unwise and counterproductive if I were to write them in this book. The basic principles to use, by which you may derive your own ideas, are as follows:

1. Allow the intruder's curiosity or sense of the search to be satisfied early in finding a secret room or storage place that is in front of, or covering, the final concealed entrance. Having a cheap safe in the normal part of the house can also divert an intruder's attention by letting him think he has "found" what you value.
2. For higher levels of protection, the manner of entrance into a maximum security area must be beyond the realm of conception of the ordinary mind, such as entering the shelter from either the floor above or from someplace below.

3. Never use a visible vault door for the final secret entrance – it is a sure sign that something valuable lies beyond. When using a vault door, conceal it well. If you have more than one vault chamber, conceal the door to the next chamber so that if they penetrate the vault door, they think they have found what they were looking for (principle #1).

I do reserve my most sensitive concealment techniques for the custom designs I do for people. Once again, this is not so much to make people pay for custom design work, but to safeguard these techniques from being overused or from being made public. Often, the particular layout of a house or its cabinetry demands a custom solution anyway. Only about half of the homes I do work for lend themselves to stock concealment solutions.

BUILDING YOUR SHELTER

The shelters designed into the preparedness home or retreat should be more than preparation against nuclear fallout. The multiple purpose design criteria I recommend allow the shelter to serve the following services:

1. Nuclear fallout and minor blast protection
2. Concealed and secured storage of critical supplies
3. Protected retreat area from criminal or vandal attack
4. Fireproof room for safety from fire entrapment
5. High security vault area for valuables
6. Secondary discrete exit and entrance from the home
7. Soundproof privacy chamber for communication and control

Not everyone needs all of the foregoing features, and less costly shelters can be designed for single purpose use. I attempt to be realistic in my outlook since no one can afford to prepare against every potential crisis. We must read the signals that are available, calculate the odds, crank in the fact that the Supreme Being who put us here has certain purposes to accomplish (despite the evils of men), and then do the best we can.

Nuclear Blast Doors And Valves

Blast valves are special spring loaded valves that close upon any sudden inrush of air. The overpressures that radiate outward from a nuclear blast cause these sudden blasts of air. They pass over almost instantaneously, however, and are mostly a danger to buildings exposed to the blast effects above ground. Blast doors are heavy flanged doors that are built to resist these effects so that the door is not dislodged or deformed. Some blast doors have a built-in blast valve on the front. If you want more specifics on these technical and expensive items, I will refer you to the *Nuclear Defense Issues Handbook* in the bibliography. I will not detail them here since I do not believe they are needed except in hardened military target areas, which you should avoid at all costs.

Caps On All Air Vent Pipes

This is important when you must de-mount your ventilating fan and close off your air vents to prevent smoke or other threats from contaminating your shelter air. During such

close-up periods, you will be able to breathe normally for up to a day or two. The build-up of carbon dioxide will actually inhibit your breathing before you reach oxygen depletion. One solution is to install battery-operated carbon dioxide scrubbers that remove this gas from the air. Sadly, however, there is nothing made small enough nor economical enough for use in a shelter. I will keep searching for something so check my Online update on my website. The other solution is to have oxygen bottles stored in the shelter. Of course, as a last resort, you can always enter your escape tunnel and get a fresh source of air. If the exit is carefully concealed amid rocks that allow for some air movement, you could derive a near continuous source of air some distance away from the house.

Blast And Security Doors

The main door on the shelter should be blast and projectile resistant – not so much for a nuclear blast but to resist explosions or forced entry. Normal utility metal doors are usually made of 16 or 18 gauge mild steel and are not strong enough to be resistant to bullets, forced entry, or a sudden pressure blast from a nearby nuclear blast wave. Most utility doors are simply a sandwich of thin sheet metal over a foam or honeycomb paper core. There are a few manufacturers of utility doors that also build reinforced or bulletproof doors. I list them in the "Recommended Equipment and Sources" section at the back of the book. Sadly, the only one who makes a full bulletproof door is so overpriced as to be nearly twice the cost as a full vault door from Liberty Safe – which is a much more complex door. I keep searching for cheaper alternatives, and will post all my newest finds to my website listed in the Recommended Equipment and Sources section. At my suggestion, Liberty Safe will build for you, as an option, a bulletproof steel plate on the front of their vault door system. This option will give you both the massive strength of a vault door locking system and a bulletproof front – priced far cheaper than bulletproof doors by CECO corporation. An outward opening vault door as mentioned, also serves as a blast door since the door cannot be blown inward due to the heavy steel flanges around the perimeter.

For you do-it-yourself guys, the cheapest way to build a bulletproof door is to first buy a 14 gauge or 12 gauge reinforced utility door with a matching heavy duty 14 gauge door jamb. To cast the door jamb into the concrete wall during the pour, be sure and specify a "cast in place" masonry door jamb. Then order a bulletproof plate (3/8" tempered steel) from Heflin Steel in Phoenix, Arizona and bolt it to the front on your utility door with hardened 3/4 inch stove bolts. You can even do some welding on the side seams to make it absolutely tamperproof. But here's a hint. Make sure you give Heflin a cutting diagram and let them cut all the holes in the door plate you will need. Once the steel is tempered, you can't drill through it even with a titanium drill bit (unless you heat it up to bright orange with a torch). You will need to specify exactly the location and diameter of the dead bolt and door knob holes, as well as the holes at each corner to install the stove bolts. On the doorknob area, make the armor plate hole the same size as the hole in your utility door. You will be remounting the doorknob on the outside of the armor plate. But on the dead bolt, you want the armor plate to go over and around the dead bolt to give it extra support so it cannot be knocked off with a sledge hammer. Details on how to do this are in the Security chapter.

For added resistance of forced entry on the foregoing type of door, I recommend two dead bolts instead of one. Place each dead bolt about half-way between the door knob and the top of the door and bottom of the door. In this way the doors cannot be buckled in at the bottom or top as with normal doors. Finally, add weather stripping to the door's edges in order to seal out sound noises and to keep gas or smoke from coming in around the bottom edge.

Sewer System

If you are building for new construction and have plumbing designed into your normal basement, plan on installing a basement level sewer system – either public sewer or septic system. Public sewer lines are always lower than basement levels so it is natural to make such a connection if you have access to the public sewer. While septic systems can be placed deep in the earth to accommodate a basement system, they are about a third more costly due to the extra excavation. Naturally, if you have a sloping lot, place the septic system on the lower levels so that you can drain the basement level without a deep excavation. If you only have sewer line access in the basement ceiling, try to design the sewer line so that it exits the home either going through the shelter or parallel to the basement wall next to the shelter. This will facilitate a short connection from the shelter bath to the sewer line.

Use a 1-1/2-inch ABS plastic drain line from the marine toilet to lead upward and over to the elevated sewer line. Remember, if this is a do-it-yourself connection, you must construct this pipe so that it leads upward and approaches the sewer line from a few inches above the sewer and then drops down to it, connecting at a 45 degree angle pointing toward the direction in which the pipe exits the home. This is to ensure that you don't make an opening in the sewer pipe in the bottom half where other sewage will be flowing. It also ensures that sewage flowing from the other portions of the house isn't tempted to go into this pipe as it exits the house.

The last possibility for alternate sewage connections to an elevated sewer is the use of ejector pumps to take basement waste from toilets, grind up the solids, and pump it up to a normal main floor sewer system. The only drawbacks with these systems are the occasional replacement of the pump (which is installed in a sump under the basement floor) and the fact that you need utility, generator, or inverter power to operate them. They can be run off of inverters and battery banks since they are only on for a few moments at a time – but they will draw about 1800 watts when they turn on, so your system has to be big enough to accommodate this short power drain.

If you have normal sewer lines in your basement shelter, be sure to use one of the very low flush toilets, so as to economize on water – especially if you have to use waste gray water from sinks to manually flush the toilets. Have plastic wrap available to seal up the toilet bowls in case you run low on flushing water and want to keep accumulated odors to a minimum between toilet uses.

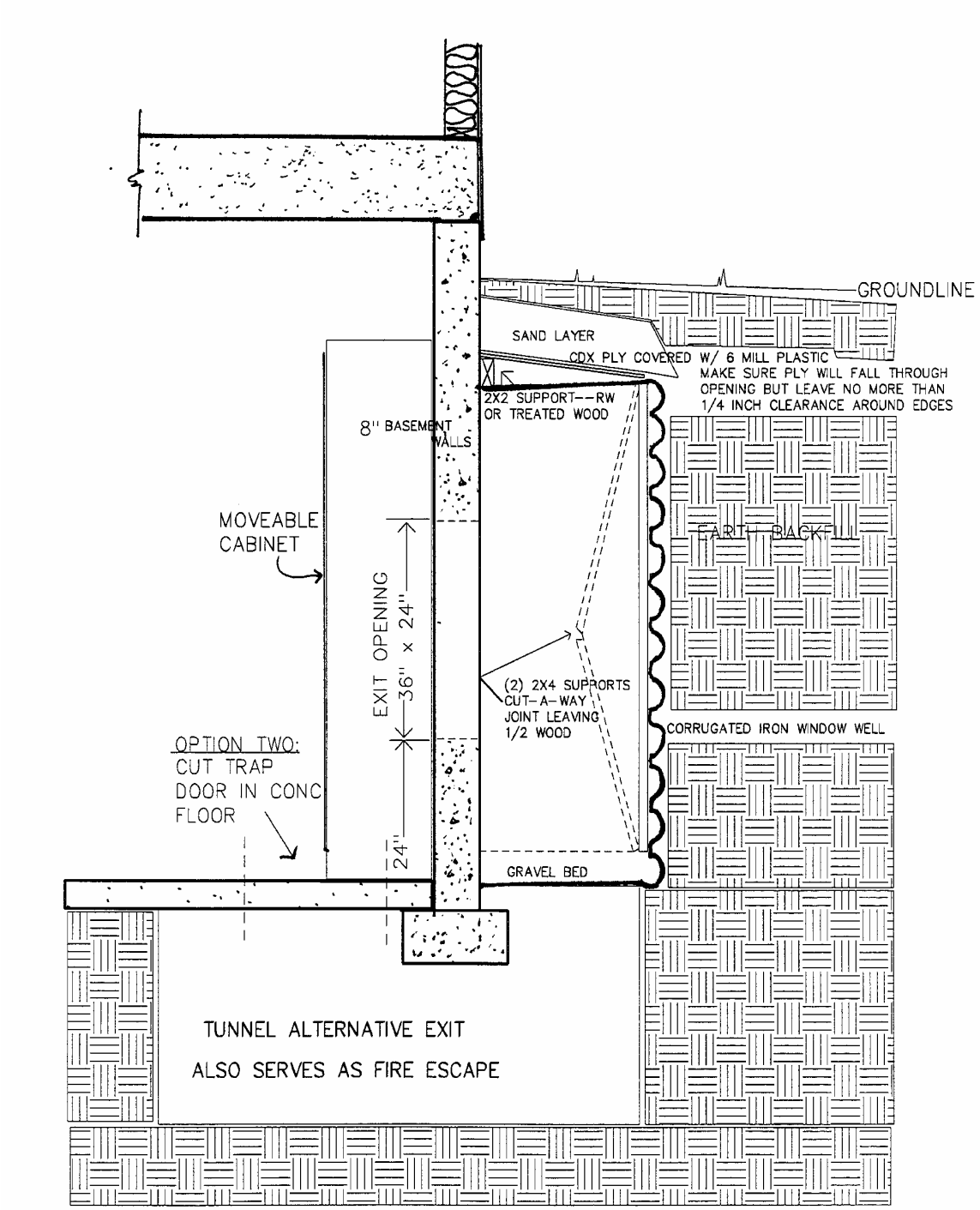
Secondary Exit Tunnel

Every shelter must have a secondary escape exit. When we lock ourselves into a concrete box, it is nice to have an optional way out for several reasons. If you are hiding from armed intruders who may know where you are, they may decide to simply wait for you to come out, or take their time to breach your security door. A portable gas cutting rig can cut through most vault doors (except those that have special linings that explode under the heat of a flame and extinguish the torch). In a case where the door is in danger of being breached, you will want to sneak out the exit and then try and draw them out of the house. In other scenarios, if the house burns down around you, or is destroyed in an earthquake or hurricane, the main exit door may be blocked and you will have to use the alternate exit. The alternate exits are also a good emergency source of air when a fire forces you to close off your normal system of ventilation. Since it is an underground tunnel, it is almost always immune from damage close to the home. If possible, tunnel exits should lead to a downhill section of the property. In this way, smoke from a fire will almost never enter the tunnel.

Your tunnel entrance should have a locked steel door as it enters the shelter just to make sure that no one can enter the shelter if they discover the tunnel entrance. Exits can be built into a side wall of the shelter and connect directly to a culvert pipe, or you can form a hole in the cement floor and tunnel under the footings to connect to the culvert pipe exit. Many homes will not have enough open land around them to warrant a tunnel. In this case, it is well to design a *sand trap exit* just outside your house (see illustration).

Sand Trap Exit.

A small opening (at least 2x2 ft. and no bigger than 3x3 ft.) is made 1 foot off the floor of the shelter in the outer concrete wall. This can be sawed out with a concrete cutting diamond saw if it was not built into the original construction. An excavation is made on the outside wall and a corrugated metal window well is attached on the outside of the basement, reaching from the footing to at least 1 foot above the opening you have just cut out of the wall. A treated piece of plywood is cut to the shape of the inside of the window well and installed at the top (resting on a horizontal 2x4 that spans the top of the window well next to the concrete wall and a couple of “break-away” 2x4s placed vertically inside the window well). In this way, one edge of the plywood is capable of falling inward into the well space. They plywod top is then covered with thin 2 mil plastic sheeting, which is covered with sand and a few inches of dirt where it joins the normal ground line. The entire unit is then filled back in with dirt so that the sand trap exit is concealed.



SAND TRAP EXIT DETAIL

Notice that the metal top of the window well must be below the normal ground level to allow for the sand and dirt above the trap opening. Do not let the contractor put the window well at the normal height, or it will be too high.

Open by pulling out break-away supports, and letting the plywood roof fall inward. Do not stand directly underneath as you do this. The sand and plywood will lie in the bottom area of the window well and assist you in climbing out. Prior to usage, it is not possible to detect since it is covered with sand and earth outside. It can even be covered back up after use by retrieving the plywood, reinstalling it, and covering it up with earth.

Alternate Exit Concealment Schemes

There are many different ways to conceal exits as they emerge from the ground. One of the best is to have one of your local air-conditioning contractors provide you with a used shell of an old evaporative cooler or of an air-conditioning outdoor unit. Instead of pouring a normal concrete pad as an outdoor base for the unit, pour one with a hole in the center for your tunnel exit. Then attach the shell of the air-conditioner over it, with one side hinged, and with a suitable inside locking latch so that it can only be used from the inside. With filter screens in place, the entire exit tunnel can serve as an air intake. The only drawback to this arrangement is that its concealment is not foolproof. The only truly foolproof way to gain concealment is to provide an exit that does not penetrate the ground until use. The best of both options can be incorporated by having a sand-trap type of exit under the air-conditioning shell. This way, when it is used, the newly opened exit is still not visible to others (since the hole is concealed under the cooling shell). Another way is to attach a large false metal duct through the hole as if it were taking air into the house. Naturally the duct is removable only from the inside.

Another method which can allow for discrete entrance into and exit from the shelter is under a large, raised planter box. The wooden structure surrounding the planter covers the hidden entrance, and also allows for discrete observation of the area around the exit (if the planter is covered with horizontal slats that have small spaces between the slats.

Typical tunnel materials are 36” oval or round metal or ABS plastic corrugated culverts or concrete culverts. I prefer the oval shapes if you can get them since they allow movement in a low crouching position. Full headroom tunnels are useful if you want something to double as a concealed weapons practice range. But even that can be accomplished with a 24-inch round tunnel if the tunnel exits at chest height out of the shelter.

Nuclear Protection Factor

While no substance blocks all gamma radiation completely, we can design our security shelter to give us a defined level of protection called the protection factor (PF). PF is an expression of the amount of reduction of radiation exposure we can expect from a given shielding material. The PF is derived by taking the “halving thickness” (thickness of any material required to cut radiation levels by half) and multiplying as many times as it takes to achieve the desired reduction. For example, consider the following halving thicknesses of common materials:

CONCRETE:	2-1/4 inches
EARTH:	3-3/8 inches
STEEL:	3/4 inch
WOOD:	8-3/4 inches
WATER:	4-3/4 inches
LEAD:	1/4 inch

Using concrete as an example, 1 layer of 2-1/4 inch concrete will reduce the radiation to one-half, which equates to a PF of 2. A second layer of equal thickness will reduce the radiation AGAIN by half, cutting it to one-fourth, and is equal to a PF of 4. If we want a protection factor of 100 which absorbs about 90% of all radiation, we would need about 6.5 times the halving-thickness of the material for shielding.

The following thicknesses of material each yield a PROTECTION FACTOR OF 100:

- 15 inches of concrete
- 22 inches of dirt
- 4-3/4 inches of steel
- 57 inches of solid wood
- 30 inches of water
- 2 inches of lead

Construction of a shelter to these specifications would only be necessary near a potential target area where you could expect heavy fallout and some residual blast effects. In this case you would need this much PF to survive the initial radiation of the weapon itself. More distant areas will not receive nearly as much direct nuclear radiation from the explosion.

Normally, we design shelters to provide a minimum fallout protection factor of 40. This will reduce incoming radiation in the most exposed area of the shelter by 70%. The PF of 40 will be achieved by a 12" concrete ceiling over the shelter plus some minor protection from the wood and other light building materials of the home or structure above the shelter. Most other areas of the shelter near vertical walls will offer much more shielding because of the earth on the outside. Where earth is back-filled against the shelter walls, the thickness of the concrete need only be 8 inches. The earth provides almost all the radiation shielding. This is why during periods of high initial radiation, you ought to spend the first day sitting low on the floor up against one of the basement walls in your shelter.

PROTECTION FACTOR OF 40 (the minimum):

- 12 inches of concrete
- 18 inches of earth
- 4 inches of steel
- 48 inches of wood

- 24 inches of water

Note that if your shelter is under your house, the sheetrock, wood, and roofing materials all add to your protection factor. Even large pieces of furniture help a little. Please note that PF is not a direct function of weight. It is a function of molecular density of the material. A pound of lead is far more effective than a pound of wood. But wood is much much cheaper than lead. Many architects have made the mistake of assuming that they can design a shelter using thin sheets of lead lining the walls as they do in X-ray rooms. But gamma rays are much more penetrating than X-rays. It takes more than 2 inches of lead to shield from fallout, and lead is way too expensive to use in these thicknesses. Concrete is the most economical mass to use for fallout protection in conventional construction.

Thus, in shelter construction (see detail illustration) we will use a concrete thickness that matches the thickness of 2x12 inch floor joists sitting on a silt plate (about 12-1/2 inches). If the top heights match, the subflooring can be laid over both to conceal the concrete portion of floor construction. If we overlay the concrete portion with fire resistant tile, we can either allow the tile to serve as a decorative floor surface, or recess the thickness of the concrete so that the non-decorative fire tile can be covered with the subflooring. Reinforcing steel in the shelter ceiling will almost always be #5 R-bar on 6" centers the short direction and #5 bars on 12" centers the long direction for spans of up to 16 feet. This provides some protection against moderate blast effects as well as earthquake resistance.

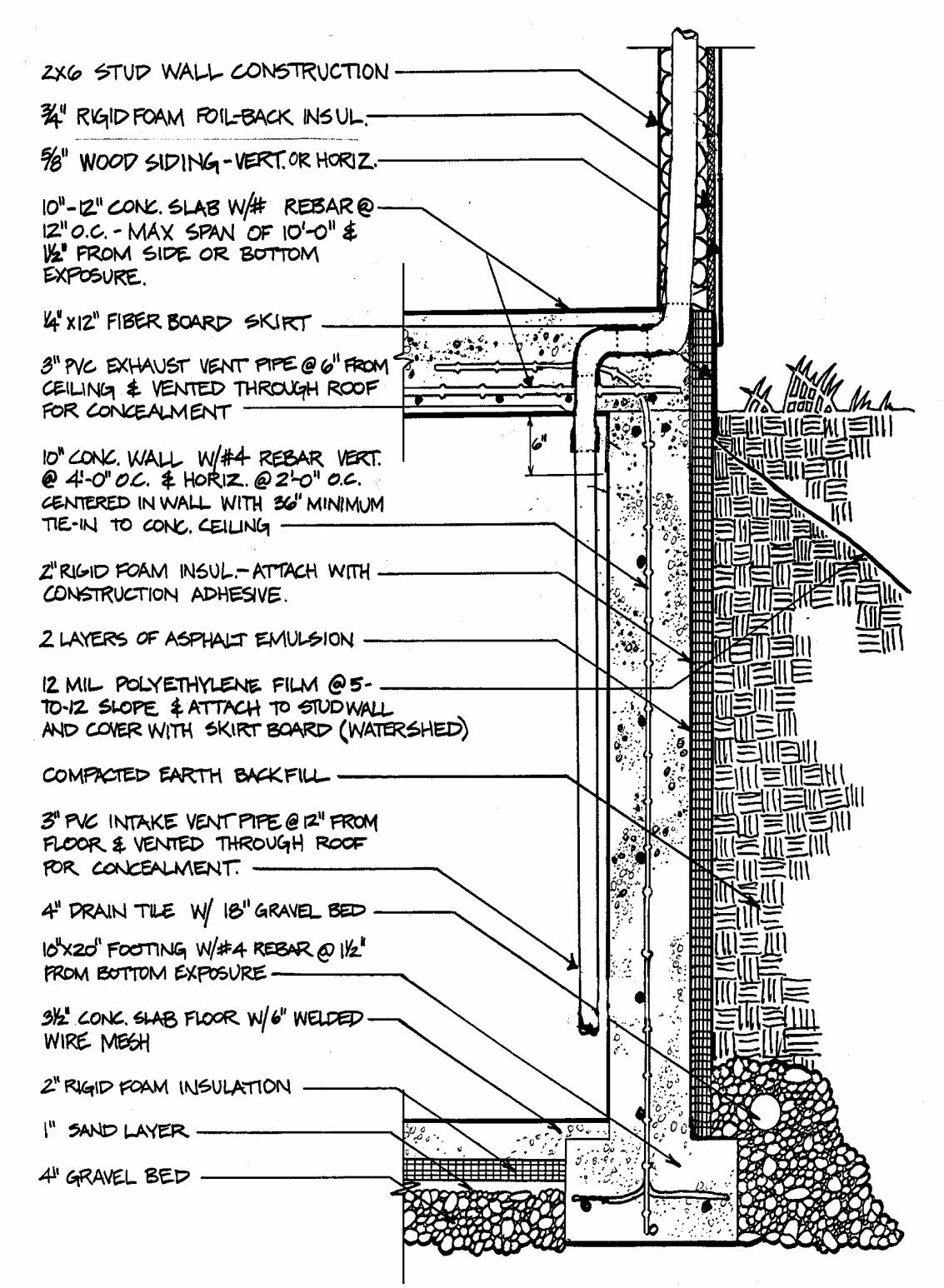
Without any live loading, a 12-inch thick slab can span almost 30 feet with this minimum reinforcement, but we want the shelter ceiling to withstand other live loads as well – especially if we place it under a garage parking slab. The overhead slab must be fully tied into the shelter masonry walls with #5 R-bar as well so that the entire structure works as an integral unit.

illustration "Fallout Shelter Construction Detail

Ventilation

A minimum of 1 cubic foot per minute (cfm) of ventilation per person is required in a small, confined area to avoid headaches from carbon dioxide buildup. Carbon dioxide buildup is a problem that develops sooner than oxygen depletion. Air in excess of 12 cfm may be needed to avoid heat buildup in summer, but this depends upon the number of people in the shelter as well as the heat absorption qualities of the walls. An underground shelter in complete contact with earth of 55 degrees F. or less will not heat up with body heat.

Each room of the shelter should have two natural convection type ventilation tubes in the ceiling which connect to the outdoors (see illustration). One tube terminates high on the ceiling and the other low near the floor. Excess heat in the room causes a natural cycling



FALLOUT SHELTER CONSTRUCTION DETAIL

of air exiting the high tube and entering in at the low (this is called a convection vent cycle). Both vent tubes must have airtight butterfly valves or caps to close them off during periods of high winds, blast, or fire in the surrounding area or even the structure above. Power ventilation systems can either be connected to these tubes or have separate venting through the home heating or a/c system. When shelters are constructed as part of a home or business (not in a nuclear target blast zone), I prefer to pull forced ventilated air from the basement of the house, forcing the house itself to act as the primary filter. The convection vents act as a backup. Multiple vents will ensure that if the house above is destroyed in a blast, some of the vent tubes will remain undamaged and not blocked by debris. Remember that with convection systems, when outside air is hotter than shelter air, no natural convection currents will flow – so we won't rely on them.

An air intake vent, when located outside the overhead structure should originate far enough away to be shielded from anticipated debris. For buildings, this is usually half the building's height. If this is not possible, we rely on the emergency escape tunnel for emergency air intake. Ducts must be resistant to collapse and corrosion, and be at least 3 inches in diameter. Pressure drop prior to the first primary filter should be less than 3/8 inches of water pressure (don't worry about this if your vent tubes are less than 20 ft. in total length).

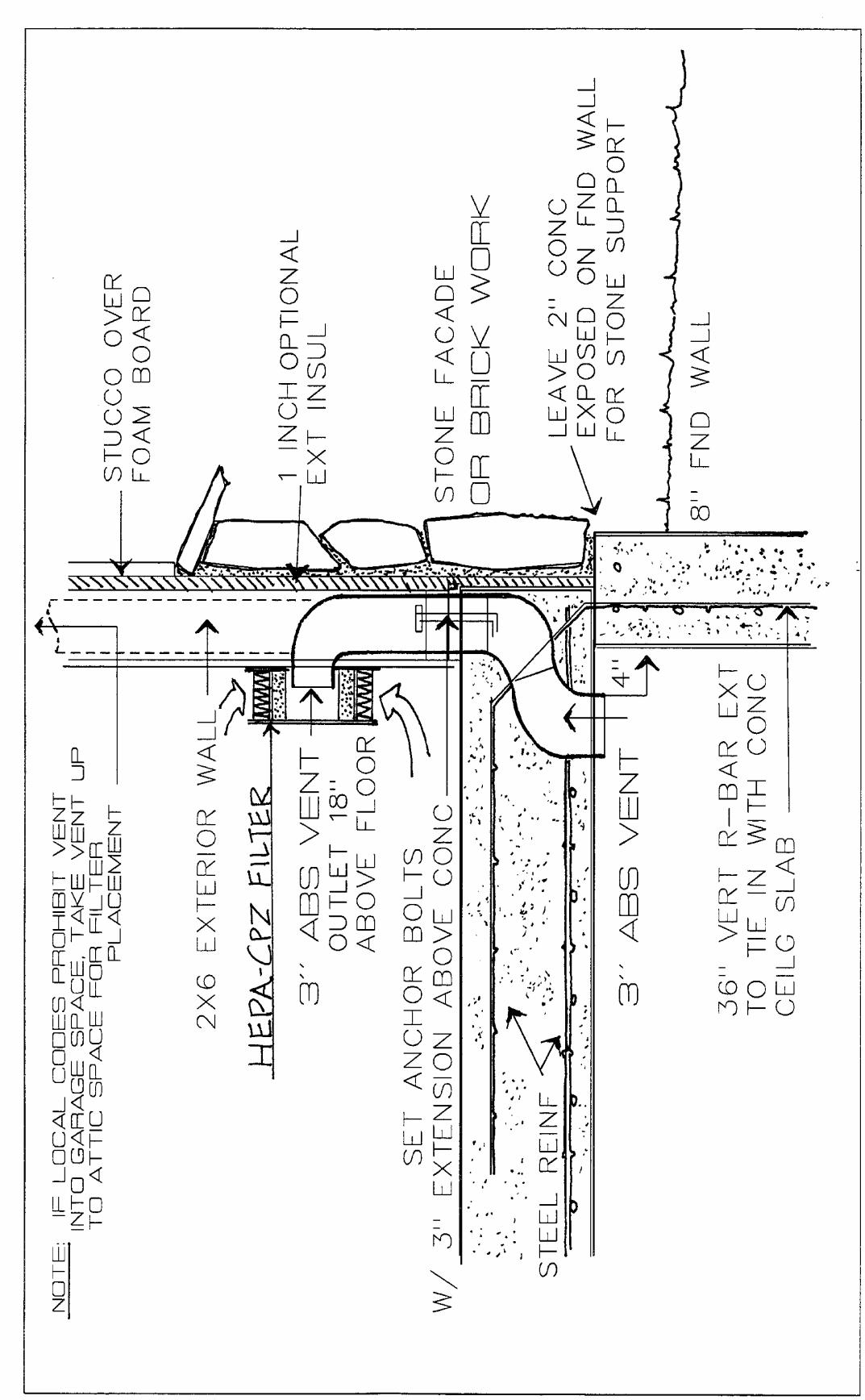
Filters

The primary filter should remove dust to 3 microns in size and is designed to prefilter air to any secondary particulate filter. This filter must be placed after any blast valve, should you install one, but ***always*** ***outside*** the shelter walls – otherwise the radioactive dust inside the filter will irradiate the occupants in the shelter. The most economical prefilters are circular automobile filters. In fact, they can act as primary shelter filters if you wish – but they only filter out particles, not chemicals or biological agents. These round cylinder-shaped filters, like the larger HEPA/CPZ filters, can easily be attached using a silicone glue process. As illustrated in the S-vent detail, simply attach a smooth backing plate to the wall around where the 3-inch vent pipe comes out of the wall. A good choice is 1/8 inch thin masonite board. Put a bead of silicone glue on the rubber seal around the edge of the cylindrical filter and press it onto the backing plate. Use a brace to keep it in place until set (about 2 hours). Now cut a similar, circular masonite cover (even smooth cardboard will do) and glue it on the front. This outer cover forces the intake air to be drawn into the pipe through the filter media as the arrows show. When the filter needs to be changed, simply pull it off the backing plate and glue on another.

Minimum capacities for manually operated, forced ventilators are as follows:

- 12 cfm for up to 7 persons
- 24 cfm for up to 13 persons
- 40 cfm for up to 25 persons
- 90 cfm for up to 50 persons

Chemical filters to counter any chemical or biological warfare agents should begin with a primary dust filter (a carbon filter fabric that keeps the expensive inner filters from



SHELTER "S" VENT DETAIL

clogging too soon) followed by a HEPA (High Efficiency Particulate Air) filter with a final chemical filter composed of CPZ (carbon, pearlite, zeolite) compounds. This combination filters down to the 2 micron level. The most inexpensive way to find a filter capable of NBC (Nuclear/Biological/Chemical) filtration is to use a high quality allergy filter such as used with the Honeywell "Envirocare" model floor units. These round, cylinder-shaped filters are actually 3 filters in one – all nested inside each other. The outer layer is a charcoal prefilter. Nested inside this is a HEPA filter and a CPZ filter. These are not cheap filters but will cost only a fraction of what the Swiss or British dedicated NBC filter units will cost. The cutaway shelter drawing at the beginning of the chapter shows such a filter. They can be installed with the same silicone glue technique as the auto filters. Make sure you glue each cylindrical filter (both HEPA and CPZ) even though they nest inside one another. See "Recommended Equipment and Sources" for sources.

Installing the Vent Pipes During Construction

It is very important to locate air vents properly during construction. It is wise to have a variety of venting options in the shelter. The first, or primary system, will consist of two 3-inch diameter plastic PVC or ABS pipes per room in the shelter that will go out through the thick concrete ceiling and into the perimeter walls of the structure on top. Usually this will be the garage, if the shelter is below it. The second type of vent will consist of one or more penetrations in the wall separating the regular basement from the shelter, which will allow us to tie into the existing furnace or A/C ductwork. This secondary system would not be used during a fallout emergency since NBC filtration would be lacking, but it serves a useful purpose of keeping the air in the shelter fresh during normal times.

The primary vent pipes will have an "S" turn in them as they go through the ceiling (two 90 degree elbows) of the basement shelter in order to allow the pipe to bend as it travels from the outside of the concrete slab top to a point sufficiently inside the supporting wall below that it will clear the concrete wall by 4 inches (see illustration). This 4" clearance is necessary to allow for the attachment of wall materials on the inside of the concrete and to allow room to attach a fan to the pipe. This S-turn also makes sure that there are no direct or straight holes in the ceiling through which radiation could find a direct path. Glue a PVC threaded cap fitting onto the end of the pipe as it penetrates into the shelter. This will allow you to attach a plastic screw cap whenever you need to seal up the vents against smoke or someone attempting to put a foreign substance down your vent.

The upper exits of the vents should be carefully planned so that they come up into the framed perimeter wall around the garage or room above. Make sure you lay out where the wood stud supports are going to be so these vent pipes do not conflict with the stud frame. In setting these plastic S-vents into the concrete forms, prior to the pour, glue up the pieces so the S-vent portions are rigid and then wire them to the R-bar so that they don't move during the concrete pour. I use a female hub on the bottom portion that will sit on the bottom plywood form so that after the concrete is hardened and cured and the form is removed, this hub is visible in the ceiling. I can then insert a pipe into this female hub to extend it down further into the shelter. If you do not use a female hub on the bottom, you must cut a hole in the plywood form and extend the pipe down through it

(which ruins that plywood for reuse elsewhere in the construction). The top part of the S-vent can just stick out of the concrete slab. A corresponding hole to match this protruding pipe is then cut in the sill plate that will go down on the perimeter of the new slab. I always do 2x6 framed walls on the rooms above a shelter so there is plenty of room to fit these 3-inch vents. A 3-inch plastic pipe is actually about 3-1/2 inches in outside diameter, so, with hub connections (4" outside diameter) these pipes won't fit within a regular 2x4 wall, which is only 3-1/2 inches net.

In areas where the code prohibits air vents coming into the garage (they are afraid you're going to asphyxiate yourself on car fumes), you must run these vents up into the attic area above the garage. This is actually preferable, since it allows you to install the large NBC filters in the attic where they are easy to conceal and to change in private. If your intake pipes come into the garage or other room in the home, conceal the filters inside an appropriate cabinet or counter.

Blast Protection

In general, blast effects as pertaining to a shelter are overrated in terms of danger. The shock wave of a nuclear blast is sufficiently narrow that it does not apply its total force upon a small inlet pipe leading to a shelter before it passes on. Because of the smallness of the pipe, the shock wave cannot enter rapidly enough in most cases to do extensive damage. Only in or near the actual crater area is blast a significant problem for even those in a shelter. Blast valves are designed to close upon the inrush of air due to the pressure of a shock wave. Doors leading to the shelter are more susceptible to damage from the shock wave due to their size. While the building above will most likely absorb most of the blast wave, you should install a vault-locking type of door in a shelter if you need blast protection. If your shelter has an airlock designed entry (with 2 sets of doors), vault lock the first door. Almost all vault doors are outward opening, which could present a problem if wreckage and debris block the door from opening. A handy tool to have in your shelter to help open a blocked door is a 10 ton hydraulic jack. Have a 4x4 timber available to lay on the floor and the nearest concrete wall opposite the vault door. Cut it to length so that the hydraulic jack just fits between the end of the timber and the door. Open the door and start pumping the jack handle. It will push open 10 tons worth of resistance on the door.

Escape Chimneys are necessary when there is no alternate escape tunnel and you live in a potential blast area. These are constructed of heavy reinforced concrete and allow you to escape upward through the pile of debris which may be over the shelter after a blast. As a practical matter, I almost always prefer horizontal escape tunnels, which are easier to build, easier to conceal, and far less susceptible to destruction by blast or fire.

Heat-Wave Protection From Fire

In a blast zone, or when you desire the security shelter to also serve as a fireproof room, the concrete walls and ceiling must be heat-shielded and insulated so that the intense heat of the fire will not cause "popcorning" or blistering of the concrete. It will also help prevent excessive heat penetration of the concrete which may overheat the occupants when ventilation ducts are closed. These two possibilities emphasize the need to have a

secondary exit from the shelter leading outside, underground. Ideally, a double-shell shelter should be constructed so that air can circulate between the hot upper surface and the inner surface to remove excess heat. This is not difficult to achieve in the vertical walls, but it is quite expensive on the overhead ceiling. The most economical treatment is to affix fire clay tile over the concrete ceiling portion (if the house is overhead). This is effective even if you conceal the tiles with a wood subfloor and carpet (which you should, for soundproofing as well). Then, suspend a foil-backed insulated heat shield from the ceiling with an airgap of 1 or 2 inches ducted to a couple of vent pipes. Rigid, foil-backed foam sheets of ureaformaldehyde foam, a non-toxic foam, will serve well. Steel sheeting, while more expensive, is resistant to heat damage and provides a little bit of additional radiation shielding as well. This shielding must also be insulated on the interior side to resist radiant heat transfer. Lastly, for best security against lack of oxygen in a hot environment, underground air tube vents must be installed that lead away from the house so as to draw cool air from at least two opposite sides of the property to ensure that air can be drawn from the windward side of the fire without smoke ingestion. Above all, keep gas masks or fire hoods in the shelter in case smoke becomes a problem and you need temporary relief while finding the exit. Keep in mind that gas masks do not filter out carbon monoxide.

Water Supply

The minimum water supply required is 3 pints per day for a person on a low protein diet and in cool conditions. In cool survival conditions a person can go for a couple of days without any water at all, but his systems are highly stressed at that point. Try to have on hand at least 15 gallons per person for a two week period including minor sanitation and minimal washing needs. Always plan on saving the gray water to use for final sanitation flushes of the marine toilet. Use added salt in the diet only in conditions where you are perspiring heavily and then no more than 1/4 tablespoon of salt per day. Otherwise water intake must be increased to compensate for high salt intake.

The water system of the shelter should be a multiple contingency system with at least one water storage tank (*cistern*) in the higher ground outside the shelter that will gravity feed into the shelter. A non-pressurized cistern (the most common) will get its water from filtered downspouts and rain gutters, or from a nearby spring or stream. This water, if underground and cool year-round, will be fairly bacteria free. But, as a precaution, one should always plan on adding an oxygen-based purifier to the water before use.

In addition, I like to have at least one *in-line water storage tank* in the shelter. One of the cardinal rules of a proper high security shelter is that you have all the essentials for survival *inside* the walls so that no one can cut you supply off from outside. That means you have at least a minimal supply of water, battery power, food, and communications inside the shelter. You can even store oxygen bottles to help out when closed up and cut off from your ventilation system.

With an in-line water system, all water flowing into the house will first go through this first tank in the shelter so that it always remains fresh. This tank should be of sufficient size to serve as the ultimate water reserve for the occupants. I recommend a minimum of one or two 50 gallon tanks. Used or new hot water heaters are the most cost-effective

way to install this kind of storage in the shelter. As with other in-line tanks, shut-off valves should be installed in all pipes entering and exiting the unit to guard against drainage of the tank if the lines should be broken in an earthquake or blast. Additionally, a bleed valve should be installed on top of the tank to allow air to enter if the inlet water pressure has dropped to zero and you desire the tank to gravity drain. Opening the pop-off valve that comes with every water heater is sufficient to allow air to enter in the top, and the water to drain out the bottom. I always keep a small length of garden hose (36-48") attached to the bottom drain so as to facilitate filling up water containers. The drains are so close to the ground, that without a hose, you would not be able to get a large container to take up very much water.

If sickness and disease are present, hot water for cleanliness and bathing is beneficial. One must not discount the psychological needs that hot water fulfills. It provides a sense of comfort and helps to eliminate stress. Water heating in the shelter can be done in a variety of ways. The preferred way is to have a solar water heater on the roof providing an independent source of hot water. If you have normal power, you will be able to tap into the normal electric or gas heater, if you have plumbed a regular hot water line down into your shelter. However using an electric generator to heat water is wasteful and impractical. The exception to this is if you have an external heat exchanger next to your tank and you extract the heat from the generator cooling system to heat the exchanger, which then heats the hot water tank. This is only practical if the generator is installed nearby in a sound reduction room. Other possibilities are the small, European type LP gas water heaters or even kerosene heaters. However, to operate an open flame unit in a confined shelter, you should make sure that adequate ventilation is available. Fortunately, the air convected out the shelter's top vents will act to draw in additional make-up air from the lower vents which will alleviate the oxygen depletion.

ELECTRICAL POWER

Because shelters are always windowless rooms, you don't want to be without viable lighting at all times. The safest way to maintain a source of energy for lighting is to have a solar-charged battery bank within the shelter, connected to high efficiency 12 volt fluorescent lights. Dedicated 12 volt lights will use much less electricity than running regular 110 volt bulbs run through an inverter. I always like to have the batteries powering my lighting system to be inside the shelter, even if I have a larger battery bank elsewhere. That way, no one can tamper with my essential lighting.

For 110 volt needs, use an inverter off the main battery bank to power radios, a VCR or television, or even a small shelter fridge. Most of these items can be purchased in 12 volt models as well – though the prices are considerably higher and the selection far more limited. For larger shelters, an in-house generator can be installed. It should be within the shelter or close to it so that it can be attended to during the crisis. If within the shelter, it too must have provision for forced ventilation to duct out unwanted heat, or to channel it into shelter heating or water heating. See the Alternate Electrical Power chapter. Small, hand crank generators are more a novelty than they are practical. I would opt for a battery system before depending on muscle power to generate electricity. Save your strength for pumping air.

Solar photovoltaic panels are a must to ensure your batteries will be recharged each day. If you live in a blast zone (not recommended) you must make sure your panels are attached with strong reinforcements to the roof or racks that you employ. Some people even opt to keep a portion of their panels in storage so they will be undamaged for use after a blast. This might also be wise in case vandals start going around looking to destroy people's alternative power systems. Thermocouple generators that run on any heat source are close to being on the market. I expect to see them in production after the year 2000. They have no moving parts and can produce amounts of electricity comparable to the small and medium sized generators. See Recommended Equipment and Sources section.

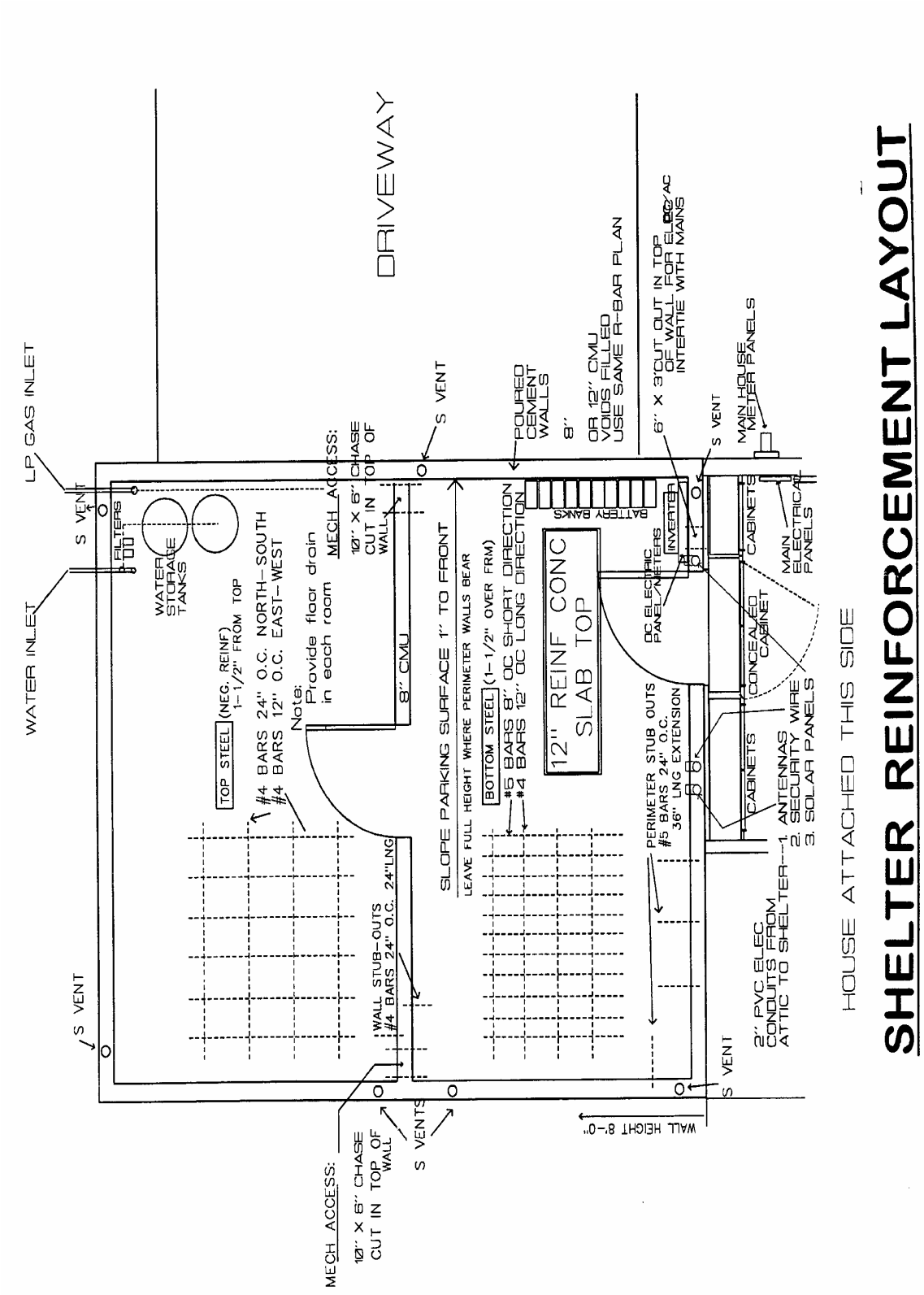
SHELTER CONSTRUCTION DETAILS

The following architectural details will help you to implement a high security shelter. The structural reinforcement shown is limited to a maximum 16 foot span (shortest direction). So, if you build a shelter that exceeds this dimension, you must have the ceiling reinforcement engineered for the wider dimensions.

The "Foundation and Reinforcing Plan" illustration shows a basement floorplan of a typical shelter before any of the wood framed subpartition walls are installed. The only wall is the center support wall, which is made from concrete. This plan is much like what you would submit to the building department. However, you would not label any of the conduit openings as being designed for antennas, etc. Let me point out the essentials that must not be overlooked. Since the shelter will be outfitted after the home inspections are completed (for privacy reasons), it is essential that the concrete contractor not forget to put in all the necessary holes and chases in the walls.

Pouring the Foundation

The doorways in these concrete walls are meant to have steel utility doors and steel jambs cast in place during the pour. Do not let the concrete man tell you it's OK to cast in wood frames for the doors and then install the metal doors afterward. This is much easier to do, but does not give you a strong door frame that is resistant to penetration. I list the doors and specifications of *cast-in-place* door jambs in the "Recommended Equipment and Sources" section. There are many types of door jambs and some companies don't provide *cast- in-place* jambs. Do not accept anything less than having the door jamb poured in with the wall. Great care must be taken by the contractor to brace this jamb so that it holds back the weight of the wet cement during the pour. The jamb must be 12 or 14 gauge to be strong enough, and it must be braced every 12 inches in all directions and in both sides of the jamb. If your contractor fails to brace properly and the jamb bows


SHELTER REINFORCEMENT LAYOUT
HOUSE ATTACHED THIS SIDE
DRIVEWAY
LP GAS INLET
WATER INLET
S VENT
FILTERS
WATER STORAGE TANKS
TOP STEEL (NEG. REINF) 1-1/2" FROM TOP
#4 BARS 24" O.C. NORTH-SOUTH
#4 BARS 12" O.C. EAST-WEST
Note: Provide floor drain in each room
MECH ACCESS: 12" X 6" CHASE CUT IN TOP OF WALL
8" CMU
SLOPE PARKING SURFACE 1" TO FRONT
LEAVE FULL HEIGHT WHERE PERIMETER WALLS BEAR
BOTTOM STEEL (1-1/2" OVER FRM)
#5 BARS 8" OC SHORT DIRECTION
#4 BARS 12" OC LONG DIRECTION
12" REINF CONC SLAB TOP
POURED CEMENT WALLS 8" OR 12" CMU VOIDS FILLED USE SAME R-BAR PLAN
BATTERY BANKS
DC ELECTRIC PANEL/METERS
INVERTER
6" X 3'CUT OUT IN TOP OF WALL FOR ELEC DC/AC INTERTIE WITH MAINS
MAIN HOUSE METER PANELS
CABINETS
MAIN ELECTRICAL PANELS
CONCEALED CABINET
PERIMETER STUB OUTS #5 BARS 24" O.C. 36" LNG EXTENSION
CABINETS
1. ANTENNAS
2. SECURITY WIRE
3. SOLAR PANELS
2" PVC ELEC CONDUITS FROM ATTIC TO SHELTER
WALL HEIGHT 8'-0"
WALL STUB-OUTS #4 BARS 24" O.C. 24"LNG
MECH ACCESS: 12" X 6" CHASE CUT IN TOP OF WALL
S VENTS

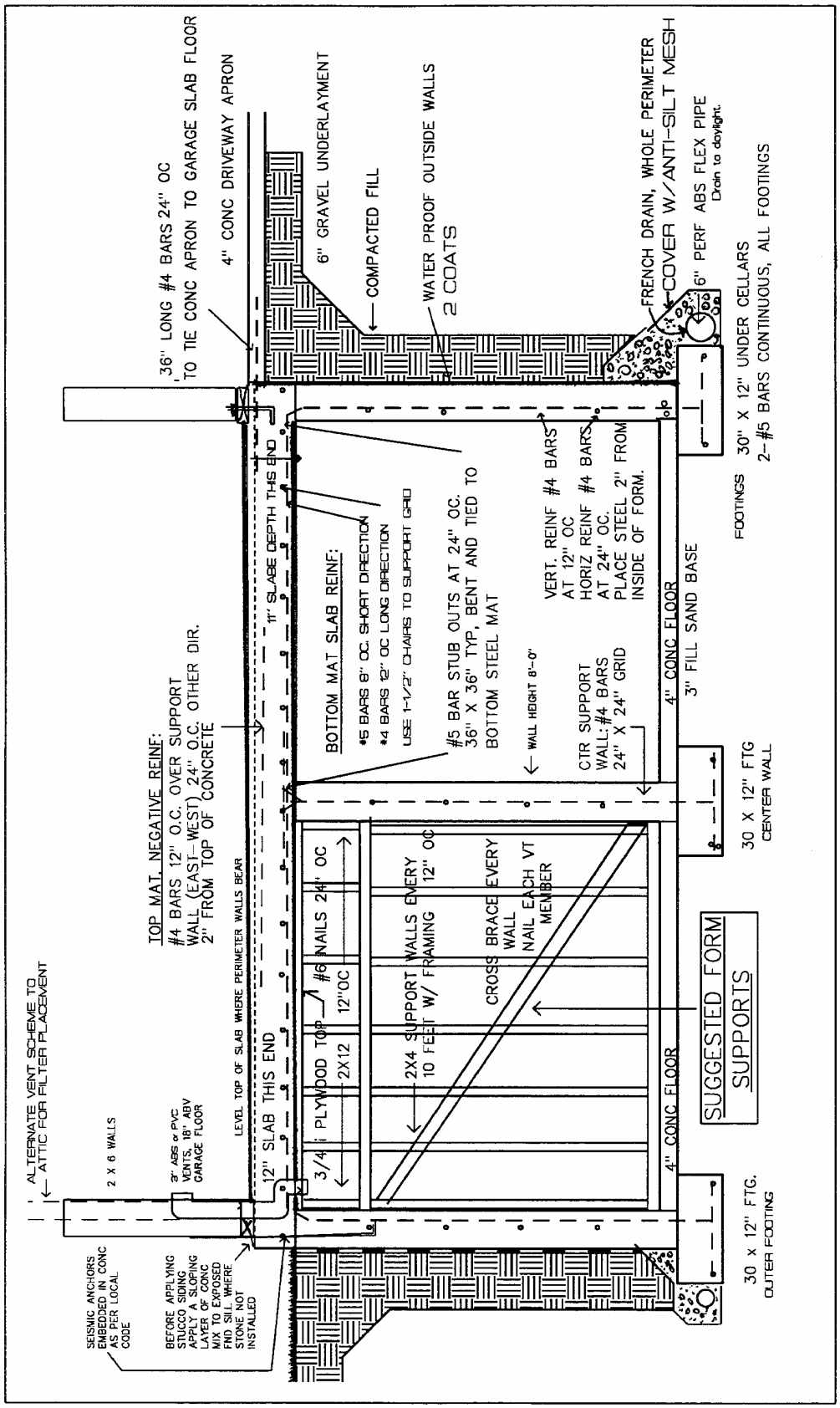
inward, the metal door will not fit – and there is no easy way to repair the problem!

The walls contain most of the cut-outs necessary for future installations. Notice that there are two 10-inch wide by 6-inch high chases in the top of this center concrete wall, at the far ends. This is to provide a passageway between the two rooms for ductwork, electrical, plumbing, gas lines, and antennas if necessary. Notice at the far side of the shelter, provision must be made in the forming for the inlet water supply and the inlet gas line for LP gas. Once the water tanks are installed there, the lines continue on toward the main house, at the bottom of the drawing, and must pass through the 10x6 chase previously mentioned. The wall that separates the main basement from the shelter has the most penetrations to worry about. The main electrical panels will normal go in the basement storeroom just outside the shelter door. So we need a large chase in the top of the concrete wall to bring electrical into the shelter to tie in with the inverter and then back out again to the essential electrical subpanels. More details on this setup will be given later. If the battery bank and generator are above the shelter in or near the garage, conduit holes must come down into the shelter to connect with the inverter and control panels. Notice in the center, there are two large conduits cast in the cement to provide for future antennas and 12 volt wires from the roof where the solar panels are installed. The S-vent locations are noted as well, and must be installed during the ceiling pour.

Reinforcement

The shelter is covered with a 12-inch thick reinforced concrete slab. Most codes require two layers of steel reinforcing on a concrete slab that exceeds 10 inches in thickness. This is to inhibit cracking and to provide negative reinforcing where the concrete is laying across the central wall. The lower mat of R-bar is #5 bars spaced at 8 inches on center the short direction and #4 R-bars on 12 inch centers the long direction. All of the stress is essentially supported by the #5 bars in the short direction. The #4 bars are to keep the slab together under stress or earthquake. This lower mat must be tied in with extensions of the R-bar that are in the vertical walls. These extra long vertical bars are bent over and wire tied to the ceiling R-bar so that it forms an integral whole. This bottom layer of R-bar must be spaced above the plywood forms at least 1 inch. Professionals use what they call “chairs” of different heights to keep the R-bar at the proper height during the pour. The top mat of R-bar is a much lighter grid of R-bar and is set under the surface of the finished cement about 1-1/2 inches.

The illustration shows a cross section of the same construction for the ceiling, as well as the supporting framework necessary to hold up the temporary plywood (or corrugated steel decking) form upon which the concrete is poured. Take note of the reinforcement outlined for the vertical walls and the perimeter drainage system. Also depicted here is the slope on the shelter ceiling that is necessary if a garage is to be built on top. The parking surface must slope slightly toward the garage door so that water dripping off the cars will not pool on the garage floor. If cracks appear in the concrete, this water could penetrate into the shelter and cause water damage. I always specify a waterproof coating on the garage slab so as to inhibit water penetration. The slope is achieved by making a taper of 1 inch in the concrete from back to front. However, the perimeter edge (6 inches wide) must not be tapered or the walls which sit on the perimeter will not be level.



SHELTER FOUNDATION AND REINFORCING PLAN

VAULT DOOR INSTALLATION

In the next illustration, I show a typical installation profile of the Liberty Vault Door. Unlike the steel utility door that is cast in place, the vault door will be cast in after the wall is poured. In this case the contractor will form in a wood jamb that will be removed after the concrete is set. It is important that the cement rough in opening for this vault door be 38 inches wide and 82 inches tall. The vault door sides will be drilled with 1/2-inch holes every 12 inches vertically, and corresponding holes will be drilled into the green concrete. Then 6-inch long by 1/2-inch wide hardened bolts will be installed and cemented into the concrete walls surrounding the door. Finally, the space between the vault door steel jamb and the concrete wall will be packed with cement mortar so that the door cannot be moved. Vault doors have a large 5/16-inch steel flange that extends beyond this rough in opening on the outside so that the mortared area cannot be seen or tampered with. This steel flange also keeps the vault door from be pushed through from the front.

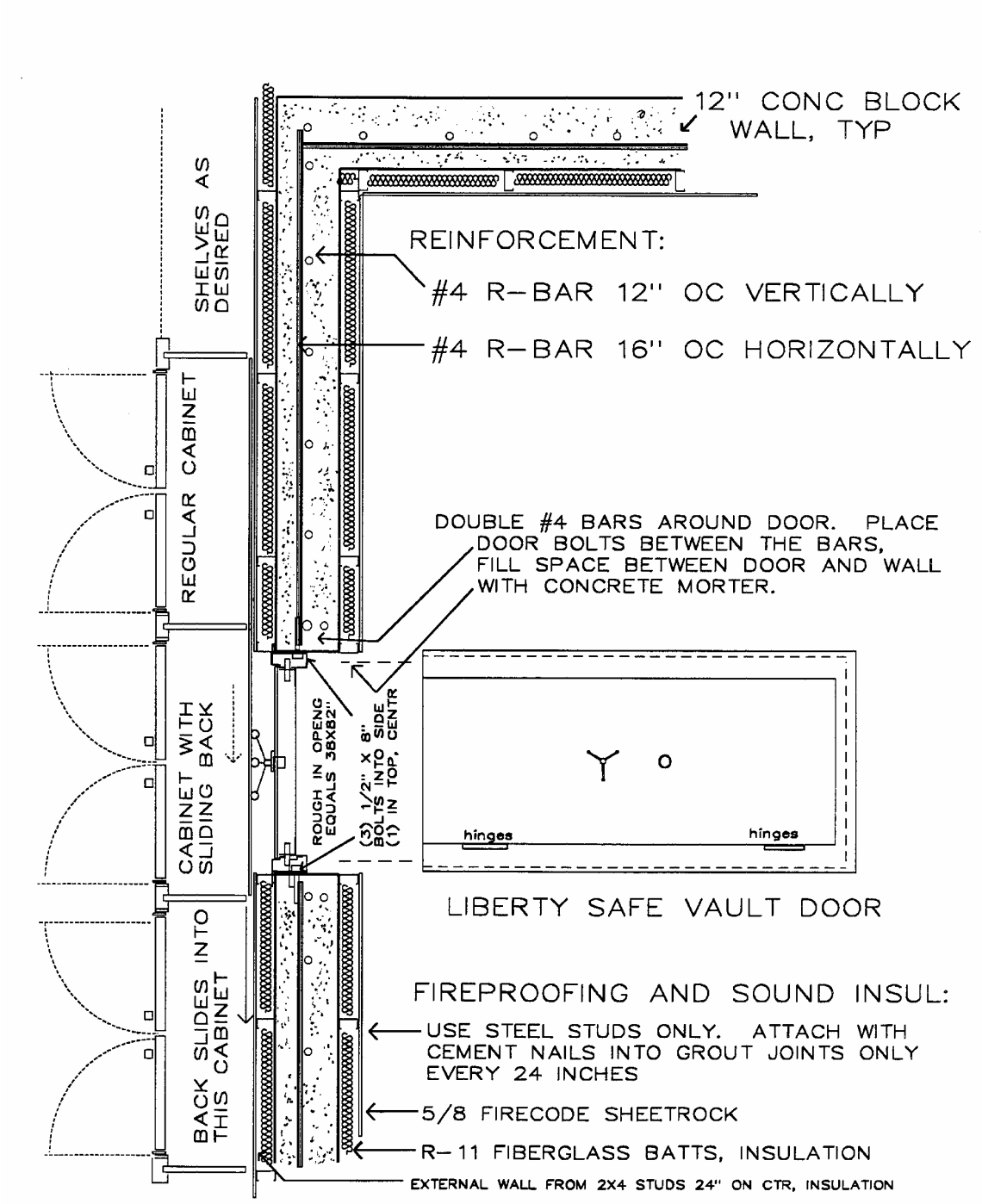
SHELTER UNDER A PORCH

The next drawing illustrates a typical cutaway section of a shelter structure using the cement porch as the ceiling. This is an ideal way to conceal a small shelter as most people would not expect to find a basement under the porch. There are a couple of features here that I should comment about. First, I show a vent going up through the 6x6 posts in the front of the porch. This is often necessary since a porch does not have the number of walls overhead sufficient to provide for all ventilation pipes. Instead of using a solid post for use a built-up post of 1x6 boards which will provide space inside for the vent pipe. The filter can then be placed into the attic space above the porch. Second, a wood chute opening is shown on the plans. This is to create a logical reason for the 2x2 foot opening in the end wall, which will eventually be the emergency sand trap exit. Having a small opening for bringing in wood to this storage area is quite logical, and so is the window well that will surround it. After inspections are complete, the sand trap exit can be finished or a tunnel can be installed under the window well opening.

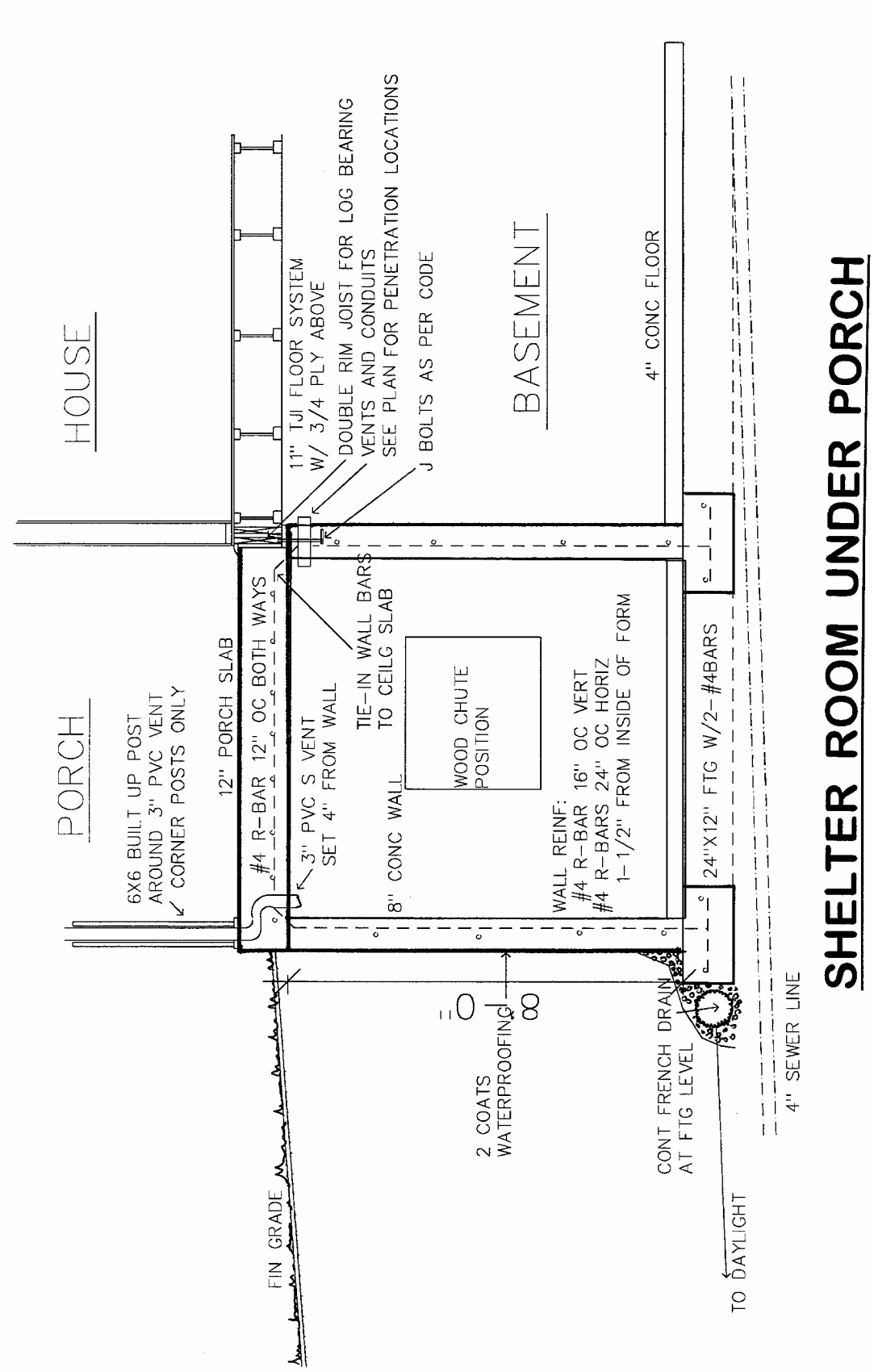
SHELTER BASEMENTS UNDER A MODULAR HOME

More and more people are choosing modular homes for rural retreats, especially in light of the cost savings provided by manufactured housing. The quality available in these homes has increased substantially in the past decade. However, there are several difficulties in putting these homes over a basement and even more difficulties in placing them over a shelter.

There are two major differences in construction among standard modular homes. I will discount the truly custom modular home, which is built from so many custom sections that the finished product cannot be distinguished from a custom-built stick-framed home. But in the typical modular doublewide home, which accounts for 90% of the current market, there are two types of framework upon which the homes are built and transported:



SHELTER WALL CONSTRUCTION WITH VAULT DOOR


HOUSE
PORCH
6X6 BUILT UP POST
AROUND 3" PVC VENT
CORNER POSTS ONLY
12" PORCH SLAB
#4 R-BAR 12" OC BOTH WAYS
3" PVC S VENT
SET 4" FROM WALL
8" CONC WALL
TIE-IN WALL BARS
TO CEILG SLAB
WOOD CHUTE
POSITION
WALL REINF:
#4 R-BAR 16" OC VERT
#4 R-BARS 24" OC HORIZ
1-1/2" FROM INSIDE OF FORM
11" TJI FLOOR SYSTEM
W/ 3/4 PLY ABOVE
DOUBLE RIM JOIST FOR LOG BEARING
VENTS AND CONDUITS
SEE PLAN FOR PENETRATION LOCATIONS
J BOLTS AS PER CODE
BASEMENT
4" CONC FLOOR
24"X12" FTG W/2-#4BARS
2 COATS
WATERPROOFING
CONT FRENCH DRAIN
AT FTG LEVEL
FIN GRADE
TO DAYLIGHT
4" SEWER LINE
SHELTER ROOM UNDER PORCH

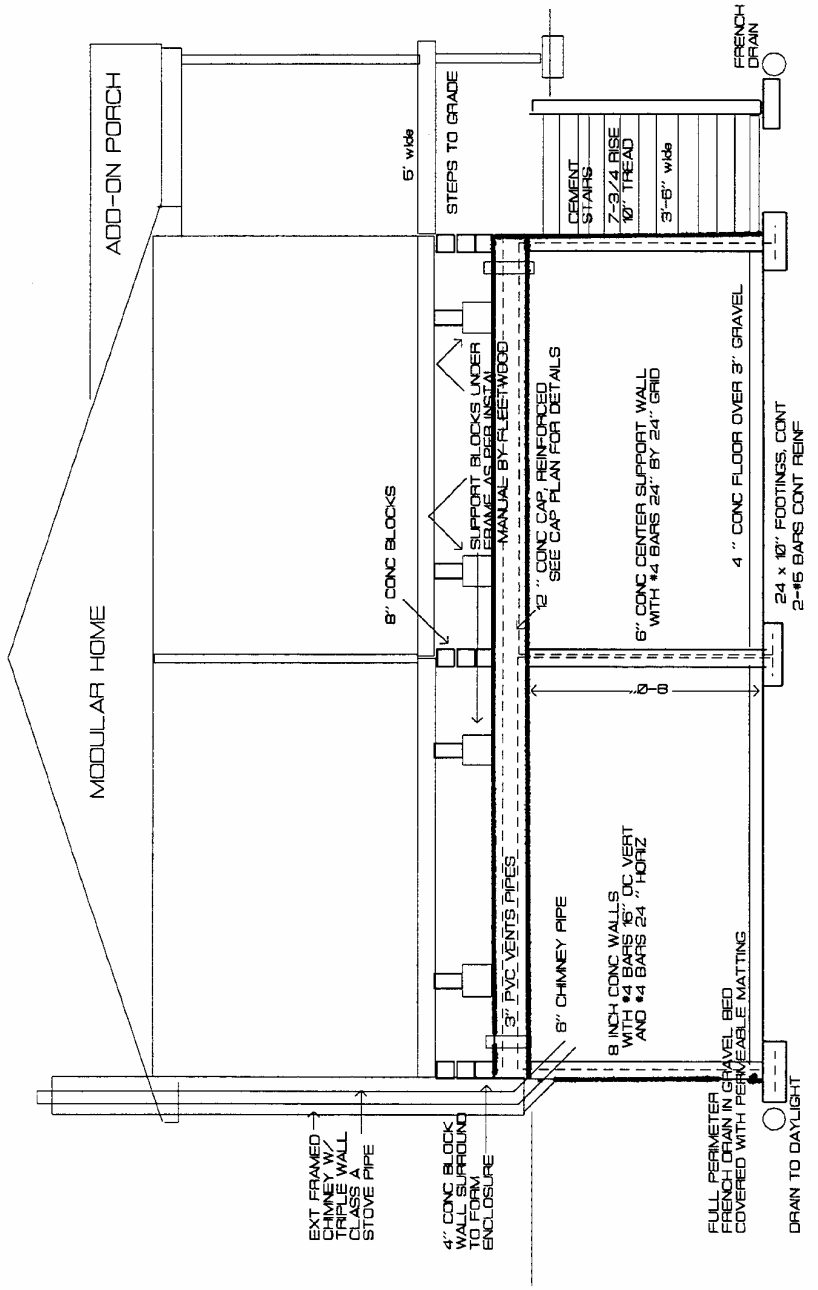
1. Both sections of the doublewide are built on twin steel I-beams which remain a part of the home when set in place.
2. Both sections are built with fairly standard wood floor joist systems, transported on a special trailer, and then lifted off onto the new foundation without any steel I-beam supports.

Both types use plumbing drainage systems that run underneath the floor joists and in between the steel beams. What this means is that none of these support systems can be set down on top of a basement shelter with a concrete ceiling. Either the plumbing or the I-beams get in the way. The first type presents the most problems with a basement. This is the oldest of the support systems and was designed to set down on a minimal foundation of cement blocks under the I-beams and around the perimeter of the modular home. In the first illustration in this series, we see that we must build a basement that has a concrete cap over the entire ceiling. The house with the I-beam superstructure is placed above it, with the same height as if it were set on a site without a basement. Thus, there is a crawl space between the basement and modular home's floor system. This makes it difficult to access the basement directly with stairs on the interior of the modular without penetrating the basement concrete ceiling. So, in this case we can build the stairs on the outside, where convenient. An interior staircase can be used if only part of the basement is used for a shelter (only the shelter portion needs a concrete ceiling), or if you go to the extra expense of building a concrete wall system around the staircase as it penetrates the concrete ceiling. Naturally, it would take a longer stair run to compensate for extra height of basement plus crawlspace.

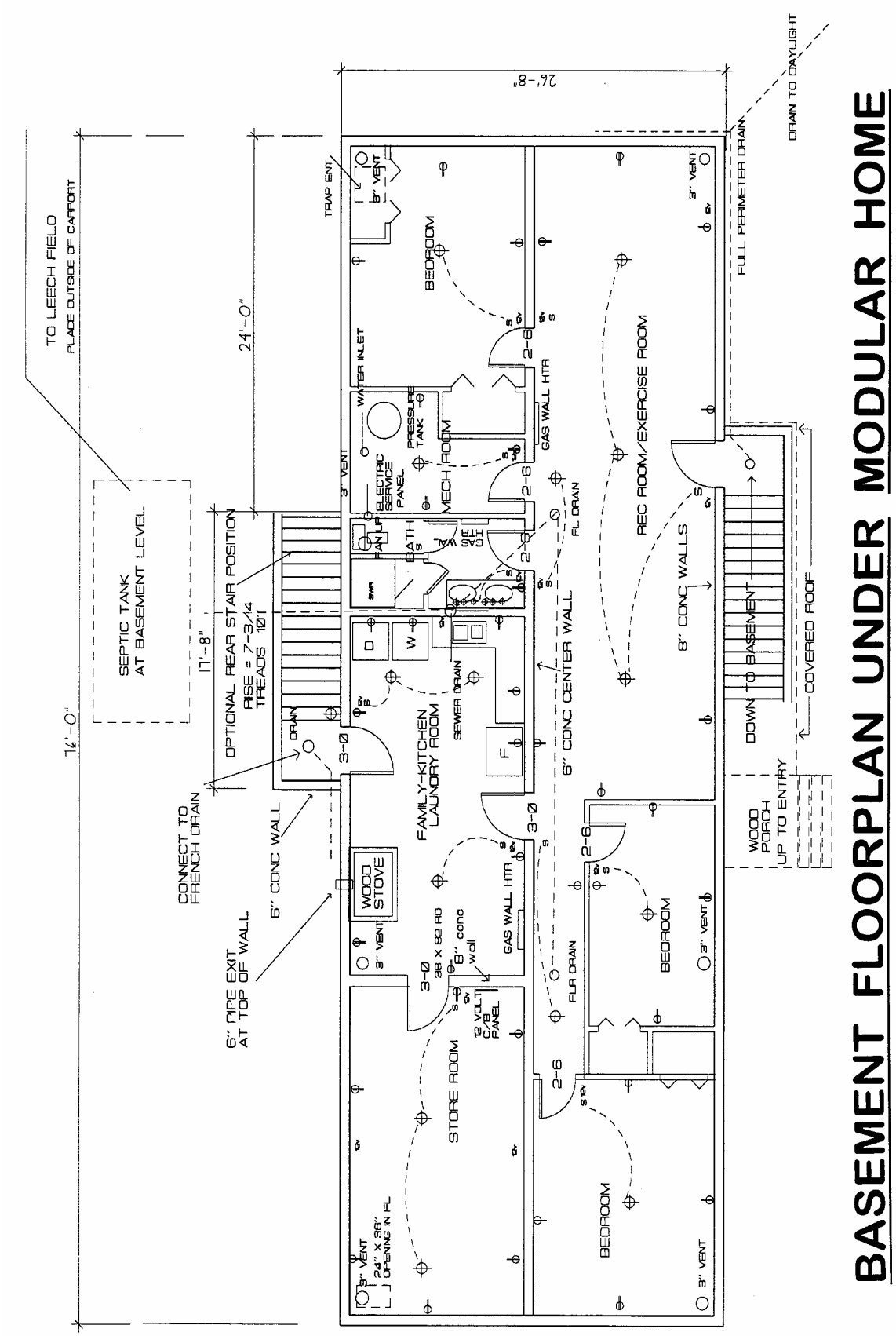
The second drawing is a floorplan of the basement under the modular home. Two stairways are shown but only one would be constructed. The plan has some constraints in that we must allow for roof penetrations to allow the plumbing, water supply, electricity and gas lines to be interconnected between the two levels. On the third drawing you see the reinforcing plan for the concrete ceiling of the shelter. Noted on the plan are the penetrations for water, electricity, and gas that correspond to the plan provided by the modular home manufacturer. Designing the basement to correspond with these penetration diagrams is important. It involves more than just placing holes in the concrete. The floor plan walls below must align with these plumbing openings to conceal the pipes as they drain down through plumbing walls and join with the basement sewer.

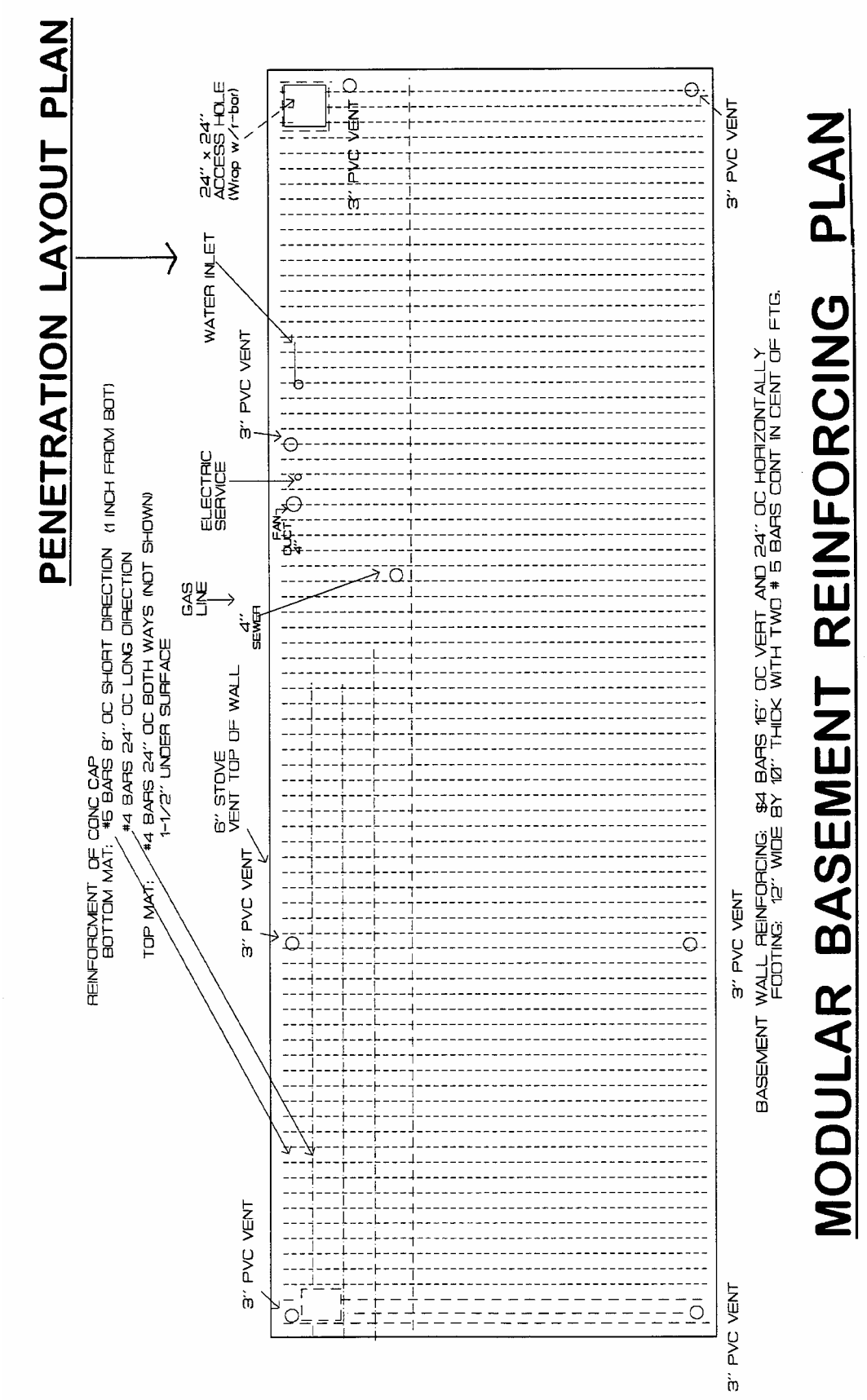
The second type of modular home is designed to be placed over a basement just like a normal home. If you imagine the floor plan as drawn, but without a shelter ceiling, such a plan would fit type-2 homes well. The main structural requirement is a central support wall to support the two halves of the modular home in the center where they meet. The problem arises when we want to place a shelter in a portion of the basement. There is no conflict if we want to stay to one side of the central wall or the other. But to have a shelter extend across both sides interferes with the modular's heat ducts, which like plumbing, extend down below the joists in a central trunk line – the same as is used in a regular basement when the heat ducts run across the joists rather than with them. Thus, for a shelter, we are forced to design it under a garage or carport rather than have it in the basement. The second type of modular structure does allow for a normal basement

MODULAR HOME OVER FULL BASEMENT SHELTER



BASEMENT SHELTER SECTION DETAIL


BASEMENT FLOORPLAN UNDER MODULAR HOME
TO LEECH FIELD
PLACE OUTSIDE OF CARPORT
SEPTIC TANK AT BASEMENT LEVEL
OPTIONAL REAR STAIR POSITION
RISE = 7-3/4
TREADS 10"
CONNECT TO FRENCH DRAIN
6" PIPE EXIT AT TOP OF WALL
6" CONC WALL
WOOD STOVE
FAMILY-KITCHEN LAUNDRY ROOM
STORE ROOM
BEDROOM
BEDROOM
BEDROOM
MECH ROOM
PRESSURE TANK
WATER INLET
ELECTRIC SERVICE PANEL
GAS WALL HTR
GAS WALL HTR
BATH
FAN/LT
SEWER DRAIN
FL DRAIN
FLR DRAIN
6" CONC CENTER WALL
REC ROOM/EXERCISE ROOM
8" CONC WALLS
DOWN TO BASEMENT
COVERED ROOF
WOOD PORCH UP TO ENTRY
FULL PERIMETER DRAIN
DRAIN TO DAYLIGHT
TRAP ENT
3" VENT
24'-0"
26'-8"
17'-8"
16'-0"


PENETRATION LAYOUT PLAN
REINFORCMENT OF CONC CAP
BOTTOM MAT: #5 BARS 8" OC SHORT DIRECTION (1 INCH FROM BOT)
#4 BARS 24" OC LONG DIRECTION
TOP MAT: #4 BARS 24" OC BOTH WAYS (NOT SHOWN)
1-1/2" UNDER SURFACE
GAS LINE
4" SEWER
ELECTRIC SERVICE
FAN DUCT 4"
6" STOVE VENT TOP OF WALL
WATER INLET
24" x 24" ACCESS HOLE (Wrap w/r-bar)
3" PVC VENT
3" PVC VENT
3" PVC VENT
3" PVC VENT
3" PVC VENT
3" PVC VENT
BASEMENT WALL REINFORCING: #4 BARS 16" OC VERT AND 24" OC HORIZONTALLY
FOOTING: 12" WIDE BY 10" THICK WITH TWO # 5 BARS CONT IN CENT OF FTG.
MODULAR BASEMENT REINFORCING PLAN

stairway to penetrate from inside the house – a distinct advantage over the steel I-beam design.

In summary, the modular provides much cost and time savings, but adds considerable expense when adding a shelter to the home. A full basement shelter is much larger than what is normally needed and very costly to build. Thus, the best overall option is to use type-2 over a full basement and then build a normal concealed shelter under a carport or garage slab adjacent to that basement.

BUILDING A SHELTER IN AN EXISTING BASEMENT.

Although I have a separate book and set of plans for building a concrete block shelter completely within and underneath the basement's wood structural ceiling (see *How to Implement a High Security Shelter in the Home*), I will cover one other alternative here for those who can use it. To achieve a shelter in an existing basement, it is often the most cost-effective alternative to simply wall off a portion of the basement with 12 inch thick concrete blocks (voids filled), and provide a concealed secure door.

Now all we need to complete the shelter is a concrete ceiling – which is the toughest part of the project. The *High Security Shelter* book tells how to construct this ceiling with reinforced concrete blocks, set on edge, horizontally over a form. But there is another way. If you have access to an area on the main floor of the home above your proposed shelter area, it is possible to pour a reinforced concrete ceiling in between the wood floor joists to create shielding. Most floors are at least 10 inches deep, which if filled with concrete will provide considerable protection. It is true, there will be some slight radiation leakage where the wood still remains in the floor, but this leakage would not provide a lethal dosage except in extreme cases.

This is most easily accomplished if the floor above has some form of removable floor covering – like carpet or vinyl. Remove the carpet or vinyl, and remove all the subfloor plywood so that the floor joists are exposed. If the plywood runs under a wall you will have to make a saw cut about 4 inches from the wall – just deep enough to cut the plywood but not the floor joists. Now take the plywood just removed down to the basement and temporarily screw it to the bottom sides of these same joists with grabber screws every 12 inches on center. Build a 2x4 support wall under the middle of the shelter room to support the floor joist above (which will soon be filled with very heavy concrete). Make sure that no portion of the supported floor span exceeds 8 feet without a support wall. Thus, for larger rooms, say, over 16 feet wide, you should build two support walls. These walls and the plywood will hold up the concrete when poured in from above.

Now, from above, on the main floor, place one continuous roll of black plastic over the entire floor, allowing it to go all the way down into each joist space. This is to keep the concrete from coming into contact with the wood. Place two #5 R-bars down inside this joist space after the plastic is in place, 1 inch from the bottom. Use little plastic or foam pieces to hold the R-bar off the bottom. This reinforcing will allow each concrete beam to hold up its own weight without relying on the floor joists. Be sure to place any electrical wiring that is in these joist spaces into electrical conduit. Don't forget to install

any new electrical wiring you may need for the shelter, as well as ventilation pipes, as previously described

Now pour the floor with cement. You will probably have to use wheelbarrows unless you have ready access through a kitchen patio door, or some window. Let the cement cure for two weeks and then remove the support wall(s) below and the bottom plywood deck holding up the cement and reinstall the plywood back on the main floor where it came from.

AVOIDING EMP DAMAGE

Electromagnetic Pulse (EMP)is only a real threat from a nuclear explosion in space. It is standard military strategy to use such explosions prior to any nuclear attack, so we need to expect them. The severity of the potential damage is not fully documented at this time, but some damage definitely will occur. Most of all I expect all normal utility power to be damaged severely – blowing out all major transformers and relays. Here are some things that you should know to ensure that critical electronic equipment is not damaged.

1. A regular lightning arrestor reacts too slowly to protect against EMP. You need one that reacts within 2 nanoseconds. Look on the specifications labels on any power strip you buy. Some will match this standard. The Recommended Equipment and Sources section will list several manufacturers that have equipment you can install on your incoming power lines to add protection to your whole house. It's not cheap – several hundred dollars. These units will divert any power surge of high voltage that comes down your lines and shunt them to a large grounding rod. This shunt is a special switch which goes into operation when the voltage spike hits. It does not ground normal voltage (or you would never have any power).
2. All grounded appliances in your home that are UNPLUGGED may be partially protected since the metal chassis will absorb some of the EMP and feed it to ground (if grounded separately and not through the plug). But the plug cord lying out in the open still puts your equipment in jeopardy. The plug cord will act like an antenna, picking up all EMP.
3. Portable electrical equipment run by battery should be stored in a metal box, like a military ammo can with a tight seal. This is the cheapest way to make sure your radios will work when you need them. The EMP cannot penetrate a closed metal box.
4. Use steel shielding around sensitive operating equipment with coils, making sure it is well grounded. In dry climates, grounding rods should have water (mixed with some Epsom salts) poured down and around where they are driven into the earth every six months or a year to make sure they make good conductivity with the earth.
5. Disconnect large radio antennas at the unit unless actually in use. During a nuclear war, connect them only briefly to listen for news. Shelters in a steel-reinforced basement room will have some attenuating effects on electromagnetic waves, but not enough to rely on. A quick and dirty test of a shelter's attenuating capability to is to turn on an FM receiver and see how well it picks up local FM stations within the shelter. Any significant reception ability of FM signals means you are not protected.

Put the portable radio (while turned on with the volume up high) in a metal box and listen to the difference. It should stop broadcasting.

GROUNDING

I will cover house wiring grounding in the the Master Electrical System chapter, but will also cover grounding of equipment in this chapter so that it will give you the complete details on shelter equipment problems. Proper grounding is the most critical aspect of both lightning and EMP protection. Grounding provides a path for electrical currents to travel toward the earth, which is the ultimate destination of all electrical charges. Lightning has both high voltage and high current. EMP has low current but extremely high voltage, and more importantly, an extremely high and sharp voltage spike. This instantaneous rise time in the voltage spike for EMP is the key to why EMP is so dangerous to electronic components. The EMP voltage spike coming down the line can travel through most lightning protectors before they have a chance to react.

PolyPhaser's book, *The "Grounds" for Lightning and EMP Protection*, is probably the best on the market on grounding solutions. It is easy to understand and fairly nontechnical.

Voltage and current spikes are surges of electricity that exceed the capacity of the electrical components in your equipment. The most important thing to do is to keep these surges from entering your home. This is difficult to do when you have things like antennas whose very job is to attract the tiniest of electrical signals. If we are going to try to protect sensitive antennas during operations, that requires a highly sophisticated device that can distinguish between small signals and these big surges and then shut down the path before the surge can enter. This is very difficult.

You can see why it is much easier to protect equipment by disconnecting it from the feedlines and power sources. But it does help to provide a proper equipment ground and add protective devices to your installation. When lightning strikes, it will always try to find the shortest electrical path to ground. Unless you disconnect your station equipment, your antennas will be providing that best path to ground. To prevent lightning from using your feedlines it is best to disconnect them where the feedline from the antenna connects to your through-the-wall connectors. These connectors from outside are attached to surge protectors bolted to a big copper plate which has its own ground rod and is interconnected to other ground rods. So if you disconnect from this connector on the copper plate, the surge will go to ground and not to your equipment. If you disconnect your coax and leave it lying on the floor, close to where it is connected to your radios, lightning can jump a gap of several feet to the equipment. The lightning has already traveled a long way through the air and a few more feet of atmosphere won't stop what we call "side flash."

Proper grounding is critical to lightning and EMP protection. Lightning and EMP contain pulses in a wide range of frequencies, so you must provide a low impedance pathway that is capable of handling many different frequencies as well as high current.

One ground rod is usually not enough. If you only use one, you will have to run a lot of long, thick cables to connect all equipment to this single source. These long cables provide numerous opportunities to side flash to other equipment nearby.

Ground rods should be made out of solid copper, copper-clad steel, hot-dipped galvanized steel, or stainless steel. They usually come in lengths of at least 8 feet and are 1/2 inch around.

Copper strapping comes in a number of sizes, but a strap 1-1/2 inches wide and 0.051-inch thick is the minimum recommended for ground connections. A copper strap makes a better lightning and RF ground than a wire because of its lower inductance. The woven or braided kinds are most effective and easy to work with.

Bare copper wire should be used for buried ground wires – it is less subject to corrosion than woven cable. The size you should use depends on the length of the run. I usually use #4 or #6 awg (American Wire Gauge).

Antenna Towers

Your antenna and tower are the prime points of surge entrance, so proper tower grounding is important. The goal is to establish multiple paths to the earth ground at the tower so that the strike energy is divided and dissipated. To establish multiple current paths on a tower, connect each of the tower legs and all of the metal guy wires to separately-driven ground rods. The ground rods must not be closer than 6 feet from each other. Bond the tower ground rods together with a #6 awg or larger copper bonding conductor (forming a “ring” around the tower base). In addition, connect a continuous conductor between the tower “ring” ground and the bulkhead panel (that big copper or aluminum plate) at the entrance to your radio shack in the home. All connections should be made using connectors and fittings approved for grounding applications. Use bolt or crimp connectors but not solder alone. Solder can melt when lightning strikes. I will use it though if I also have a clamping connector. I have found that the wires don’t corrode under the clamps if soldered first.

All grounding rods and wires around the home need to be connected electrically. This includes lightning rods, your electrical service ground from the utilities, your telephone, antenna system grounds, and underground metal piping. Ground rods used for lightning protection or entrance-panel grounding must be separate and spaced at least 6 feet from the electrical service or other utility ground so side flashes don’t occur. The purpose of connecting all grounds is to make sure the entire system stays at the same voltage “potential.” If you had a lot of separately-grounded equipment, one portion would have a different electrical charge than another during a surge and electricity could arc from one ground to another.

On antennas, ground the shield of the cable at the top of the tower as well as at the bottom. Several companies offer grounding blocks that make multiple ground connections easier. See the Recommended Equipment and Sources section.

Feedlines and Bulkheads

The feedline should also be grounded just before it enters the shack on a large grounded copper plate as previously described. Feedline lightning arrestors are available for both coax cable and balanced line. Most of the balanced line arrestors use a simple spark gap arrangement, but a balanced-line impulse suppresser is also available from several companies.

Arrestors for coaxial cable also come in several types. DC blocking-type arrestors have a fixed frequency range and must be selected for a specific application. You will use different types for antennas of different frequencies and different ones for solar panels as well. Their main advantage is that they present a high-impedance path to the frequencies found in lightning (less than 1 MHz) while offering a low impedance to signals created by your radio. This is very important so that the radio signals get through and the surges do not.

Arrestors that have DC continuity (the gas tube and spark gap types) are broadband and can be used over a wider frequency range of antennas than the DC-blocking types. In installations where the coax is used to supply voltages to a remote device (such as a mast-mounted preamp or remote coax switch), the DC continuity-type arrestor must be used.

Whether you use balanced line or coax arrestors, they should be mounted at the entry point to your shack – on what ham radio people call a "bulkhead." Install a 1/8-inch thick copper or aluminum sheet on the wall of your home where your radios are. Install a separate ground rod for this panel and connect it to the bulkhead with a short, copper strap. Also, bond this ground rod to the rest of the ground system. Then mount all protective surge arrestors, antenna switches and relay disconnects on the outside wall of the bulkhead. This makes sure they are all connected to a big ground rod so that surges won't enter the house.

Since disconnecting the equipment is the best protection, it is more convenient to install a feedline disconnect switch rather than unscrewing all your antenna connections every time (which wears them out). If you use a coaxial feedline, you can use a manual, multi-position coax switch, a remote coax switch or an in-line coaxial relay.

Surge Protectors

One area often neglected is power line protection. Inexpensive multi-outlet strips usually offer little or no protection against surges or transients unless the power strips are heavy duty and have quick reaction times. Check the label to make sure they react in *less than* two nanoseconds. Power line protectors use several different protection schemes, each of which solves a different power-line problem. Inrush current limiters keep the input current to the equipment's power supply from exceeding a fixed level. Transient suppressers (usually semiconductor-type devices) absorb voltage spikes that could damage sensitive digital IC's. Surge suppressers limit the input voltage on the line (usually by a clamping effect) to prevent damage. To protect your equipment against transients caused by lightning-induced voltage surges on the AC line, unplug the power strip at the wall socket. Don't depend on the built-in switch or wall-outlet switch. A

nearby strike can induce voltage surges that will easily jump the gap and overload the protective circuits.

OTHER SHELTER SYSTEMS

While I am an advocate of basement shelters, giving us the most usable space and easiest concealed access for the money, there are other options. There are both prefabricated fiberglass or concrete shelters, and tank or culvert shelters that are custom-made on site. All of these have the major disadvantage of being planted out in your backyard. Although they can have their entrance chimneys concealed within a building, most are placed on open ground. I feel that having to go out in open terrain to enter the shelter is a high security risk. The other disadvantage of prefabricated shelters is that their spaces are very cramped and the walls are not vertical. Fitting out such a shelter is very time consuming and costly to customize if your needs don't match the standard design.

Tank and culvert shelters are not as constricted in space as they can be built to be hundreds of feet long if necessary (especially the culvert pipe shelters). There is a lot of custom cutting and welding work necessary to fit and secure the entrance tunnels and ladder wells. While costs appear to be only slightly cheaper than concrete basement construction, on a usable space basis the concrete shelters come out ahead – especially if built in areas where basements are common. Contractors charge much more than necessary in areas where basements are relatively rare.

Another interesting alternative that is a compromise between the various shelter styles is the use of prefabricated concrete cisterns. There is a nationwide company that makes large concrete vaults in any shape or size and has various outlets all over the nation. One could put together several modular concrete cisterns with interconnecting openings so that they function as a multi-room shelter. Most cisterns are no more than 5 feet tall inside, but this company can make them any height desired. So for a price that is vastly cheaper than either tanks, culverts, fiberglass, or poured concrete, one could have the benefits of vertical walls and rapid construction all in one. The problems of joining and waterproofing can be addressed without too much difficulty. I list manufactures and suppliers of all these alternative shelters in the "Recommended Equipment and Sources" section.

Chapter

11

Using Solar Energy

My approach to the subject of solar energy will be significantly different here than in previous editions of this book. In the past, I spent considerable time outlining all of the various solar collection and storage arrangements that were possible. Here, I will narrow the field dramatically and give you my recommendations of what is most feasible in solar design for self-sufficiency. It is common with people searching for energy solutions to view certain aspects of self-sufficiency as the cure-all for everything. Many somehow feel that solar will solve all of their self-sufficiency needs. They will many times invest so much of their extra construction dollars in solar that there is nothing left over for the nine or ten other essential preparation areas. I am very much in favor of solar design, but let's keep in mind from the beginning that we are only talking about heat and battery charging, primarily. These are only two of many self-sufficiency needs. In climates with cold winters, heating costs are a significant part of monthly expenses, and I do not wish to minimize that. In fact, I believe that there are very few locations where some solar applications would not be applicable, especially for the heating of domestic hot water.

PASSIVE OR ACTIVE SYSTEMS

There are several active systems that are now very cost-effective, even as compared to passive solar. As a rule, active systems have usually been more costly to install and to run. While that is still true in some instances, generally, the cost of active systems has been reduced as compared to passive systems – mostly because building costs (especially labor) are not as conducive to the economies of mass production as is equipment production. This is not because active systems are any cheaper in total dollars, but because passive costs have increased more, along with the cost of building. Experience has shown that, except in certain ideal climates, passive solar must include considerable expense in insulating, shading, and heat storage mediums in order to perform satisfactorily. This has increased the cost significantly. In general, I still favor passive solar. However, in actual practice almost all of the solar homes I design have active

components, especially to achieve proper air distribution. Whenever possible, I specify passive thermosiphon systems for domestic hot water heating. I tend to reserve the use of active designs for space heating only where the temperatures tend to be so hot or so severely cold during long portions of the year that the glass in passive designs becomes a major liability. Additionally, I will specify active systems primarily for maximum security installations where large glass areas would leave a home too exposed, even with external security shutters. The collectors themselves may be vulnerable, but there are ways of designing shield walls or roof structures to conceal them. Security covers can also be designed that act to protect when closed, and when open, can act as sun reflectors if covered with aluminized Mylar coatings on the inside surface.

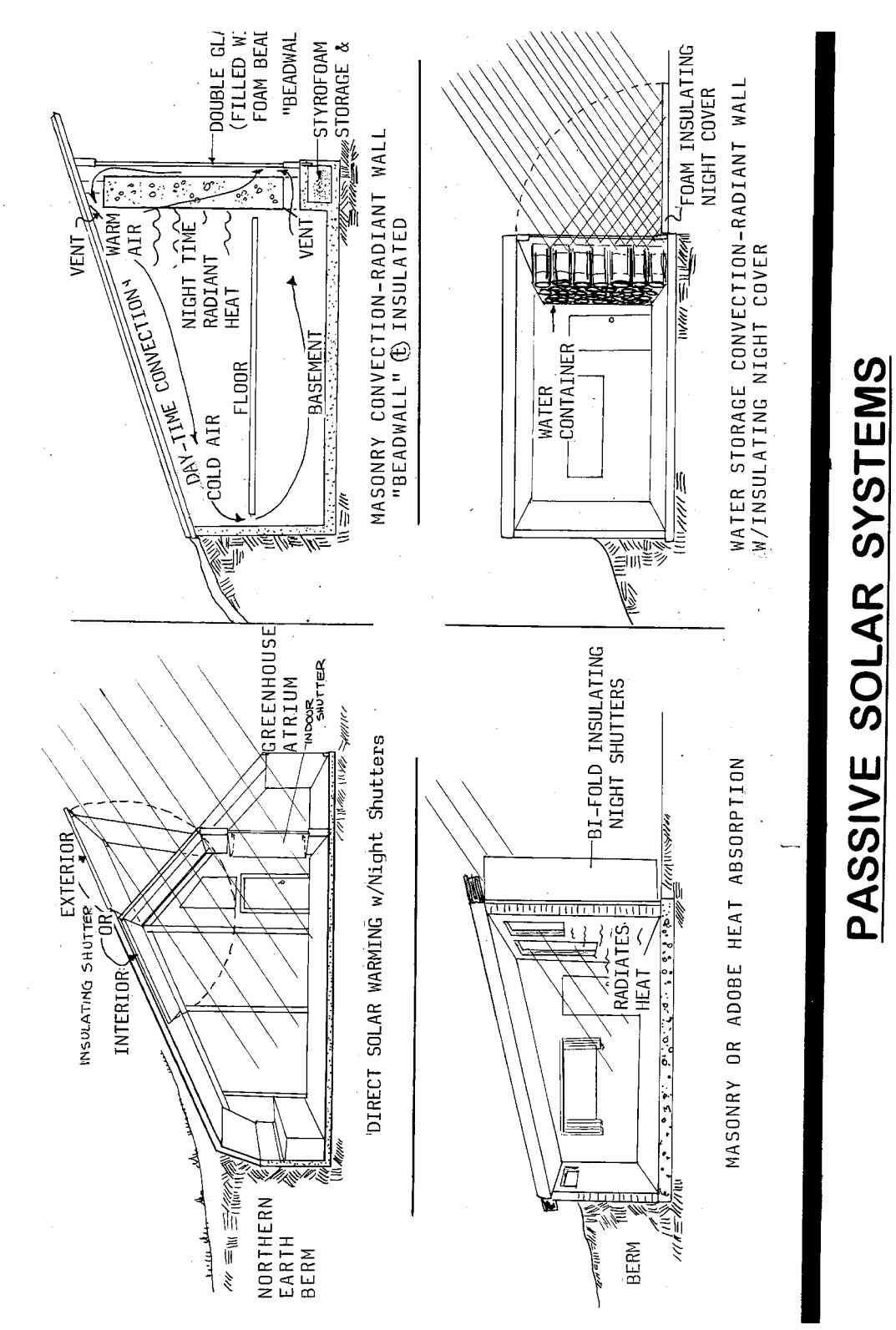
FOUR BASIC PASSIVE TYPES

In the accompanying illustration, I have depicted four basic types of solar design. The upper left shows direct solar gain. This is most often done by allowing the sun to enter vertical, south-facing windows and warm an insulated concrete floor. Having a masonry or tile surface to receive the solar heat is essential so that the stored heat can be re-radiated back to the room during the night. If you have a basement, you will normally have a wood-framed floor to deal with. How can you add heat mass to a wood floor? The best way is to lay down a 1-1/2 or 2 inch layer of cement over the wood subfloor (just like when doing a hydronic heating system) and then apply a tile surface on top to act as the heat mass. This is both attractive and practical. It holds the heat slightly better than a concrete slab due to the insulation value of the wood floor underneath. Tremendous sound insulation is also achieved between the basement and the main floor.

On the top right is the Trombe wall system. This is where we have a large thick masonry wall standing in front of a south facing glass wall. The sun shines directly on the Trombe wall which absorbs the heat and slowly releases it into the room throughout the rest of the day and throughout the night. One must design appropriate openings in the top and the bottom of the wall so that the room air behind the wall can circulate to the air space in front. These openings can be artistically designed to provide visual interest. At least one opening large enough to serve as a window is also preferable.

The view on the lower left shows an earth-bermed home with an adobe or masonry heat-absorbing wall on the south side. There is no glass covering, so the adobe absorbs the sun’s rays directly. In the desert southwest, the thickness of the wall is designed to allow the heat to penetrate into the house only in the evening. During the day the house stays cool. If we use this type of heat mass in colder climates, we need to use some type of insulating shutters to close off the outside wall at night to preserve the heat. This is why the Trombe wall was invented, so that the glass wall could serve to keep the wall relatively warm at night.

The last drawing on the lower right shows a water wall system. Water is one of the best and least expensive forms of heat storage mass. Shown is a crude setup of 55 gallon


PASSIVE SOLAR SYSTEMS
MASONRY CONVECTION-RADIANT WALL
"BEADWALL" Ⓔ INSULATED
DOUBLE GL
(FILLED W
FOAM BEA
"BEADWAL
STYROFOAM
STORAGE &
VENT
WARM AIR
DAY-TIME CONVECTION
NIGHT TIME
RADIANT HEAT
COLD AIR
FLOOR
BASEMENT
VENT
WATER STORAGE CONVECTION-RADIANT WALL
W/INSULATING NIGHT COVER
FOAM INSULATING
NIGHT COVER
WATER
CONTAINER
DIRECT SOLAR WARMING w/Night Shutters
GREENHOUSE
ATRIUM
INDOOR
SHUTTER
EXTERIOR
INSULATING SHUTTER
OR
INTERIOR
NORTHERN
EARTH
BERM
MASONRY OR ADOBE HEAT ABSORPTION
BI-FOLD INSULATING
NIGHT SHUTTERS
RADIATES
HEAT
BERM

drums stacked on their side to form a wall in front of the solar glass – much like a Trombe wall. Far more aesthetic are the long vertical glass tubes, ranging in diameter from 12" to 18" that can be filled with water (or even colored) to absorb the heat. Colored water absorbs the sun's rays better. Walls of water have the great advantage of allowing full light to enter. The most attractive systems are those where the pillars of water only cover about a third of the view, so that the room looks fairly normal and the view is preserved.

BASIC RECOMMENDED PASSIVE DESIGN

(See illustration.) A *module* is a word we use to describe a room plus equipment that functions as an entire system or entity. This house module is designed for use in the most common survival areas where we might experience significant cold in the winter and enough heat during the summer to require air conditioning. This design is a fully self-sufficient design meant to produce in most areas 100% of both heating and cooling needs. The actual shape of the roof can be modified significantly to accommodate other styles and is not limited to the shape shown here. This is not an inexpensive design. But then, you don't get 100% self-sufficiency for nothing. Either you spend the money up front and save in energy costs for the life of the house, or you build as conventionally and efficiently as you can initially and pay as you go later. There are some compromises in between which I will explain, but I prefer to start by giving you what I feel is the best overall solar system. In homes with specialty or classic styles, which will not tolerate the obvious external solar features of this module, you may have to use remotely-placed active panels that pump heat into the home's heating system.

The Design Strategy

The design concept of this home is centered around solving the major problems of passive solar homes. The difficulties are as follows:

1. Sloping greenhouse atrium walls gain too much heat in the late spring, summer, and early fall; overheating is severe due to lack of exterior shading.
2. Lack of insulating window coverings. Large, passive solar windows lose so much heat at night in cold areas that uncomfortable cold drafts prevail through much of the house.
3. Passive homes without heat storage have to dump excessive heat throughout much of the day and must use backup heat during a portion of the night. Direct sun on concrete walls or floors heats the air faster than it heats the storage medium.
4. Homes with excessive thermal masses of concrete take too long to achieve a stable temperature. Initially, one may think this is because they are not properly insulated, but most of the heat loss stems from direct contact with the earth through footings or basement walls (whose upper portions are often uninsulated and exposed to the cold).

5. Homes in severe hot climates with short, cold winters, that have large areas of insulated thermal mass, are sometimes denied access to the cooling effect of the cool nights by the same insulation.

Common Errors in Passive Solar Homes

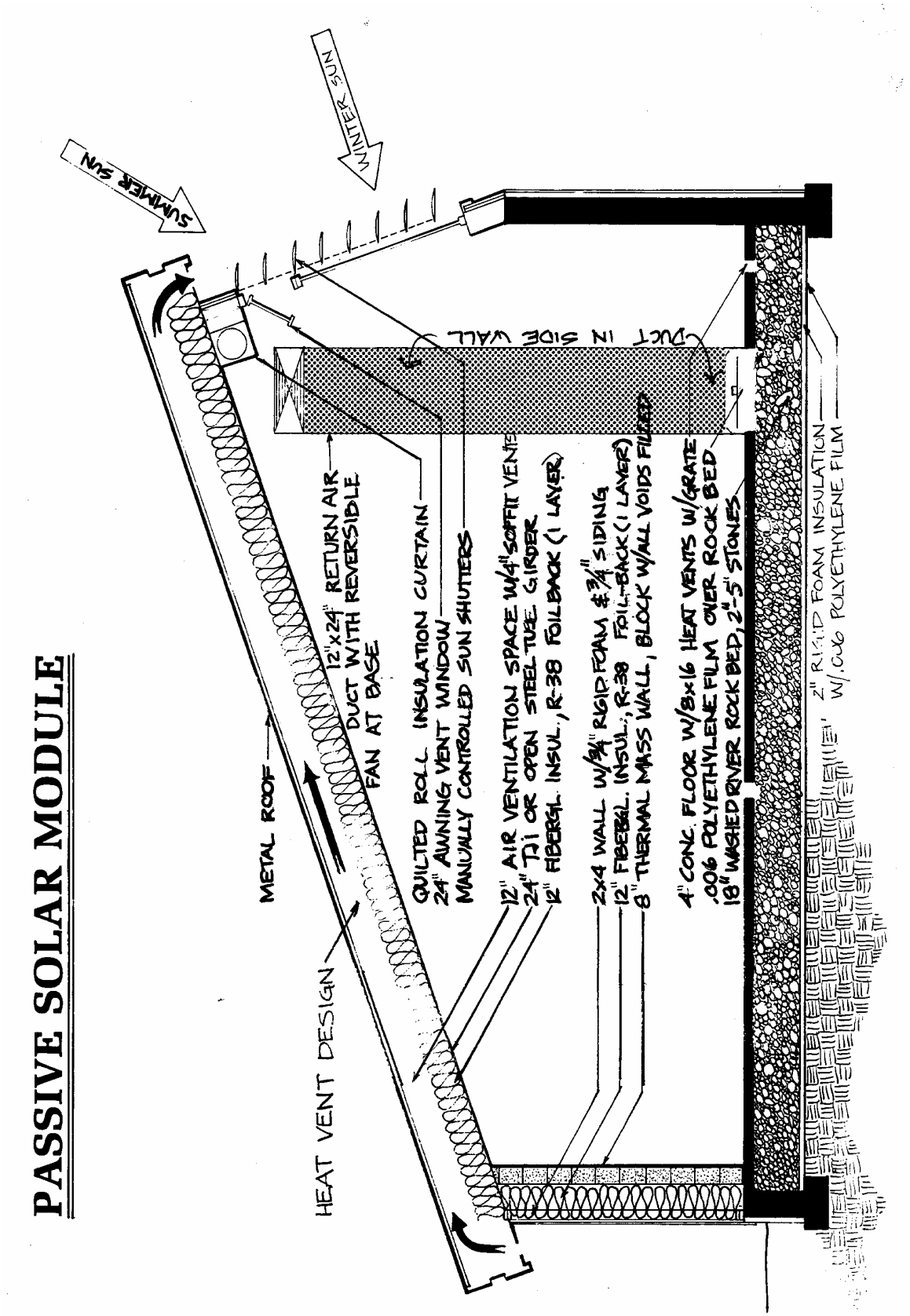
1. Windows facing considerably off true south.
2. Poor heat distribution due to relying on natural convection to carry excess heat from front solar rooms down hallways to rear rooms.
3. Lack of vents in high windows to dump excess heat, or lack of means to open windows conveniently.
4. Heat distribution ducts that are too small or uninsulated (especially in underground concrete slabs in contact with the ground).
5. Failure to match a design to the local climate.
6. Failure to avoid winter sun shading by buildings and trees.
7. Thermal masses covered with furniture and carpeting.

My Design Recommendations

In the solar module previously illustrated, the first decision was to employ some forced air movement to rapidly distribute hot and cold air where needed. Calculations help in determining optimum passive heat storage mediums, but results can vary by as much as 50% depending upon actual construction practice and the effectiveness of insulation placement. Additionally, no fixed passive system can cope with all of the changing weather and sun conditions which may vary considerably from year to year. I have opted for a combination active/passive approach. The results are well worth it and the risk to self-sufficiency is slight. Fans are not particularly high-draw electrical equipment and can be operated on generator, battery, or other alternate power sources. During cold winter months the living quarters of the home can absorb almost all the direct solar radiation coming through the high windows. However, I do attempt to design enough solar input to always have an excess during sunny winter days for storage against cold nights.

The Radiant Slab

As overheating begins, the thermostatically controlled fan pulls hot air from the high portion of the ceiling downward into the rock bed under the radiant slab, effectively storing heat for cool nights and cloudy weather. For most night heating purposes, the rock bed will simply radiate some warmth up through the floors. Note that the surface under the radiant slab area is lined with rigid foam insulation, and is waterproofed so that no moisture will enter. This is very important. I don't really recommend rock beds or cool tubes for humid climates since there is too much danger of mold and mildew build-


PASSIVE SOLAR MODULE
SUMMER SUN
WINTER SUN
DUCT IN SIDE WALL
METAL ROOF
HEAT VENT DESIGN
12"x24" RETURN AIR DUCT WITH REVERSIBLE FAN AT BASE
QUILTED ROLL INSULATION CURTAIN
24" AWNING VENT WINDOW
MANUALLY CONTROLLED SUN SHUTTERS
12" AIR VENTILATION SPACE W/4" SOFFIT VENTS
24" TJI OR OPEN STEEL TUBE GIRDER
12" FIBERGL. INSUL., R-38 FOIL-BACK (1 LAYER)
2x4 WALL W/3/4" RIGID FOAM & 3/4" SIDING
12" FIBERGL. INSUL., R-38 FOIL-BACK (1 LAYER)
8" THERMAL MASS WALL, BLOCK W/ALL VOIDS FILLED
4" CONC. FLOOR W/8x16 HEAT VENTS W/GRATE
.006 POLYETHYLENE FILM OVER ROCK BED
18" WASHED RIVER ROCK BED, 2"-5" STONES
2" RIGID FOAM INSULATION W/.006 POLYETHYLENE FILM

up in areas that can never be cleaned. When no more heat is needed from the radiant slab, the rock bed will reach ground temperatures within several days and will thus be available for passive cooling during the summer. If the cooling season is extensive, sufficient to exceed the cooling capacity of the slab, additional cool charging of the slab can be accomplished by the use of *cool tubes* feeding into the unit from deeper sources underground. Cool tubes are a problem in humid climates unless they are constructed of smooth pipe and have access for cleaning. Cooling inside the house is accomplished by the reversible fan which draws air from the thermal storage slab and pumps it up to the high portion of the house where it will cascade downward. Floor registers are the intakes. Warm air is forced through 2 feet of rocks to a labyrinth of perforated ducts or trunk lines which gather the cooled air and return it to the air mover.

Radiant Slab Construction Methods

This method is an economical way to construct a rock bed chamber since it is no more than a deep gravel support bed for the normal slab floor. The only difference with the normal gravel base under a slab is its depth (usually 12-18" instead of 4-6") and the size of the rocks. We want large rocks, 1-3" in size, to allow large enough air spaces between them to facilitate air movement. Another difference is the addition of air distribution pipes spread throughout the bed to improve the air flow around the rocks. Once again, rock beds should only be used in dry climates.

These trunk line ducts can be constructed in several ways. One popular do-it-yourself method is to lay a series of concrete blocks (hole to hole) with enough spacing in-between to allow air to enter the joints (without mortar) from the rock medium. The spaces are just smaller than the rock so that the rock does not enter the joints between blocks. Eight inch wide strips of 1/4 inch cement board sheets cover the trunk lines so that when the slab is poured on top, concrete will not enter the exposed spaces between the block. Black plastic sheeting covers the entire gravel bed as well so that the wet cement does not penetrate down among the rocks. The air handler opening and the individual register openings around the room are formed in the slab with square blocks of rigid foam and easily removed after construction is complete. Now, the system is ready to use after the slab is in place.

There are alternate methods of construction. Some designers have used a complete floor of concrete blocks arranged so that air is channeled through multiple pathways under the radiant slab. The air flow chambers that run at right angles to the air flow through the block are covered with corrugated metal with register holes cut in the metal at desired locations. Thus, when the concrete topping is poured over the floor area, all air passages are protected. One designer used corrugated sheeting laid directly on top of the foam lining to channel air under the slab. The ends of the corrugated areas ended at a sunken and insulated air trench, running at right angles to the corrugations. This allowed the air to change directions and return to the air handler ductwork.

Two similar systems, using different air-ducting materials, have also been used for a radiant floor. One is done by burying in the concrete a labyrinth of black plastic drain pipe (non-perforated). The other method is forcing air through the holes formed in precast concrete panels, the type used to build commercial buildings. To make the panels

lighter in weight, long tubes are formed in the core of the panel, which can be used for air circulation. One brand name is “Flexicore.” In underground homes, cored concrete panels are often used for the roof support system. These can then be utilized for passive solar heating of the thermal mass. The reason that I prefer the more primitive rock storage radiant slab is that more efficient heat transfer that takes place as the air flow is forced to bend and curve around each rock. In straight channel systems, the air flow tends to be slightly insulated from the heat exchange surface by the slow-moving friction layer of air in contact with the duct walls. The plastic pipe, even though corrugated, does not increase turbulence significantly and has the added disadvantage of being a better insulator than metal pipe. All underslab systems should be completely enclosed in watertight sealed plastic membranes to avoid moisture accumulation, and used only in dry climates.

Insulated Concrete Slab Without Air Storage

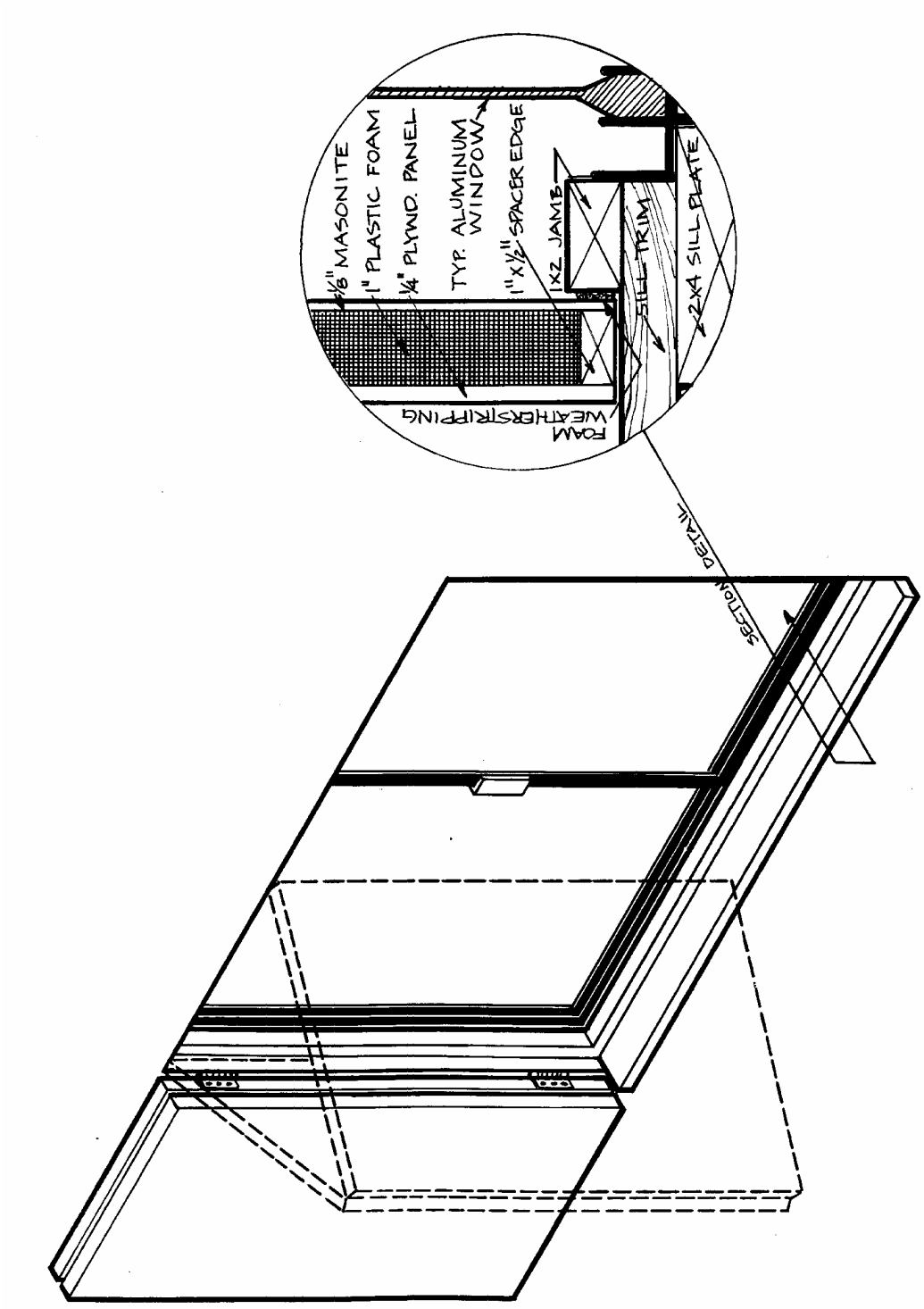
Many passive solar homes have used solid concrete slabs over 4 inches of rigid foam insulation to achieve similar results, without the added cost of the rock bed and air mover system. The success of such a system depends upon having enough direct sun coming through the windows that the floor can take up the heat directly. Unless you are going to do the labor of constructing a rock bed storage chamber yourself, I would opt for this last method as the most cost-effective, overall. If you live in a humid climate, this heat mass system is your only passive option. It is very important to also insulate the entire perimeter of the inside floor slab so that it is not in direct contact with the footing foundation where the heat would tend to be lost to the ground. Insulated draperies and/or outside sun shading are a very important part of a purely passive heated slab system. When it gets too hot you must be able to stop the sunlight from entering.

Wall Construction

The exterior walls of this maximum passive design are double-wall thermal mass concrete. The concrete mass is naturally on the interior and a separate stud wall provides a full 12 inches of insulation space on the exterior. Any conventional exterior surface can be used on the stud walls. There is no direct contact between outside and inside walls except at the top and bottom. The perimeter of the exterior stud wall is fully insulated with 2 inches of rigid foam. Where excessive heating of an exterior wall will occur, such as on a west wall, a layer of laminated-foil, pleated insulation is placed in the insulation chamber between the studs. One inch of rigid foam is then placed on the inside surface of the studs, toward the masonry wall. This provides a double cavity of two types of insulation: blown-in, loose-fill insulation between masonry and rigid foam, and multi-layer foil between wall studs. With appropriate top and bottom venting, this wall will effectively stop all heat penetration by venting it up and out.

Exterior Sun Control

The outside louvers on the sloping glass windows are essential to cut all direct sunlight when not needed. Simply using interior sun shades does not cut all heat gain. The heat is trapped between sun shade and glass and continues to convect heat into the room.



INDOOR FOAM INSULATER SHUTTERS

Certain highly reflective materials can bounce the infrared energy back out the window with only minimum heat gain, but in this case, a good deal of incidental light is blocked as well. Exterior louvers give you multiple options which make them worth the added expense, and they can provide rigid security for large passive glass areas as well. They need only periodic seasonal adjustment rather than daily movement, as in rolling shutters, and permit you to cut direct sunlight while still allowing indirect light to enter.

Most passive solar shading is designed into the size of the eave extension so that the eave projection starts to block sunlight about the beginning of spring, and completely blocks all direct sun by the time you want no more heat gain coming into the house (usually sometime in May). You can use sun angle charts to assist you. This type of shading is used on this module, as well, for windows on normal vertical walls. If the roof eave is too high to provide shading, a small architectural projection is built out directly above the window. This will usually house the rolling shutters necessary to offer security to non-louver covered windows. Finally, external roll down shading is also appropriate for sloping glass, but does not offer the same flexibility as louvers. These are mostly an all-or-nothing sun shade alternative.

The solar windows do have interior roll-down insulation which is an essential feature for any passive solar home operating near the full self-sufficiency level. Rigid foam backed shutters used on the interior are usually only practical where they are low enough to be reached for ease of closing. High windows, such as those illustrated, should use electric or pull cord operated rolling shutters. Do not forget to allow for opening awning windows on all high living areas for the direct venting of unwanted heat in a passive cooling mode.

Heat Venting Roof

This unique feature combines the best effects of heavy insulation with the necessary air venting between the insulation and the sheathing to prohibit heat gain passage through the insulating layer. This roof must have a minimum depth (joist space) of 12 inches, including 10 inches of fiberglass batt insulation with foil backing on the top and at least 2 inches of air space between the foil and the roof. The best designs use multilayered foil insulation in this 2" vent space – although this is not absolutely necessary. The added expense is not insignificant. This type of air ducting, reflective insulation has several layers of foil-backed paper or Mylar which, when unrolled and installed, produce several layers of alternating foil and air gaps to channel the heat up and out the top ridge vent. It alone, even without regular batt insulation, will stop almost all heat-gain from summer heat. But we still need the batt insulation below it to stop heat-loss in the winter.

Alternate Styles

The shape of the solar module section is part of a house that has various levels, each one stepping down a few feet so that the portion of the house behind it can have access to direct sunlight. All this forms a type of "sawtooth" roof shape. This allows a large home to have solar input into as many areas as desired, and eliminates the hot and cold spots of homes designed with only southern rooms having access to solar. Although this type of design allows maximum flexibility, it does appear modern in shape and is not completely suitable for more traditional homes. The louver covered roof portion can be

used on any number of sloping roof styles, but is fairly awkward looking on any roof slope with less than a 6 inch rise in 12 inches of run (6/12 pitch).

GENERAL GUIDELINES FOR SOLAR DESIGN

If you should desire to work your own calculations for passive design with the use of excellent graphs and charts, I recommend you get a copy of Edward Mazria's *Passive Solar Energy Book*, the expanded professional edition, at your library.

Most people I have found like to use general gauges for estimating, which will get them "in the ballpark." I have found the following figures to be effective and practical:

Needed Reference Figures

1. Glass transmitancy: Plate glass transmits about 85% of the solar energy striking it at a perpendicular angle (0 angle of incidence). Double glass transmits about 75% in optimal conditions.
2. If your windows are vertical, they are <u>not</u> perpendicular to the sun. The angle of the sun relative to the angle of vertical windows will determine how much of that 85% transmitancy gets through.

0 degrees angle of incidence (perpendicular) allows 100% of glass transmitance rating (85%)

10 degrees off perpendicular = 98% of that figure (98% of 85% = 83.3%) and so forth below

20 degrees off perpendicular = 94% of that figure (79.9%)

30 degrees off perpendicular = 87% of that figure (73.9%)

35 degrees off perpendicular = 82% of that figure (69.7%)

40 degrees off perpendicular = 77% of that figure (65.5%)

45 degrees off perpendicular = 71% of that figure (60.4%)

50 degrees off perpendicular = 65% of that figure (55.3%)

55 degrees off perpendicular = 57% of that figure (48.5%)

60 degrees off perpendicular = 50% of that figure (42.5%)

3. The heat storage capacity of these materials is useful:

WATER	=	62.4	BTU/cu. ft. (weight = 62.4 lbs/cu. ft.)
CONCRETE	=	22.0	BTU/cu. ft. (weight = 144 lbs/cu. ft.)
WOOD (dense)	=	16.8	BTU/cu. ft. (weight = 47 lbs/cu. ft.)
AIR	=	.018	BTU/cu. ft. (weight = .075 lbs/cu. ft.)
BRICK	=	25.0	BTU/cu. ft. (weight = 123 lbs/cu. ft.)

4. Sizing of storage heat mass (in cubic ft. of storage per square ft. of floor plan area):

Average Winter Temp	**Rock/Mason (cu.ft./sq.ft.)**	**Water (cu.ft./sq.ft.)**
5°F	1.5	1.0
15°F	1.0	.75
20°F	.75	.60
30°F	.65	.50
40°F	.45	.25
50°F	.30	.20

5. Sizing of summer cooling storage mass: Same as above for homes where the nights cool off to recharge thermal areas. For climates with hot nights, provide a minimum of 2 cu. ft. of masonry storage mass per sq. ft. of floor area. This material must be in direct contact with the subsoil depth of constant summer temperatures below 70° F. In some areas of Texas and the South, this requires cool storage below an 8 foot deep basement.

6. Sizing of Trombe walls of concrete or water storage tubes: A *Trombe wall* is a wall of storage mass immediately in back of a solar window. For *masonry walls*: Use wall thicknesses of 12 to 18 inches with double glass windows. Use nighttime insulation in cold climates. Wall thickness can be reduced 30%. With window insulation, I prefer the added temperature stabilization of the thicker walls. Air vents should have insulated doors on them to close off airflow when too hot or cold. Minimum vent size should be 6x12 spaced every 36 inches. For *water tube walls*: Use one cubic foot of water per sq. ft. of window area. Water is a more efficient collector during the day but unfortunately a better heat-loss conductor at night. Window insulation is more important with water storage walls than with concrete, since concrete has less thermal conductivity and tends to store heat better within its core.

7. Greenhouse sizing should depend more upon the allowance for wall coverage by the house rather than by a heating formula. With this in mind, it is essential to be able to

seal off greenhouse heat when needed. Greenhouse walls on open rooms can become excessively warm without either an intermediate closeable wall or external shading material. I prefer both if you can afford it. Use the same guidelines for thermal storage in greenhouses as the above guidelines on Trombe walls. Without window insulation, recommended sizes can be doubled for water walls without ill effects, but additional thickness in excess of 18 inches of concrete will not increase efficiency in accordance with excess cost. See illustration for typical greenhouse construction on page 265.

8. Reflectors: Reflectors for roof top glazing should be located above the skylight or collector and have a tilt angle of approximately 100 degrees. Vertical glass reflectors should open horizontally to the ground and be no more than 2 times the height of the window. Reflectors above vertical windows must be closely adjusted to the actual sun angle since angle of incidence to the glass is almost too high to be effective. Most reflectors are constructed out of metallized Mylar over a smooth, uniform base such as cement-board, plywood, or even rigid foam. When using rigid foam, you must provide a structural frame in order to withstand wind deflection forces.

GENERAL SOLAR DESIGN RULES TO FOLLOW

1. The long portions of the home should be oriented in an east-west direction, allowing for lots of solar windows on the south side for maximum efficiency.
2. Except in hot climates where no one sits outdoors in the sun, place outdoor living areas in open sunny areas, even if you design the front yard with privacy shading.
3. Use non-living areas such as the garage, shop, and utility room to act as a buffer for the home against the cold north side or a wind-swept side of the house.
4. When possible by terrain orientation, build into a south-facing slope. Otherwise, in cold climates, earth-berm the north side to a height just below the windows. Windows should be small.
5. Always provide sun-shielding for west-facing glass to avoid overheating as the sun gets low in the horizon. External louvers or rolling shutters are best. West walls should be heat-venting walls like the roof design in the design sample above. Placing a garage on the west side of the house helps provide a heat buffer against the sun.
6. Always use both internal insulating shutters and external protective shading in climates where the average winter temperature is 10° F or lower.
7. In superinsulated wall construction where the walls are over 12 inches thick, recess the windows from the exterior for wind shielding, except on the south side. If the south windows are recessed, bevel the wall projection above the window at an angle sufficient to not block the sun.
8. Sloping window glass must always have exterior sun-shading devices in all climates.

9. Do not cover masonry thermal storage floors with insulating material like carpeting. Use tile. If you use wood, bond it directly to the surface of the cement.

10. Vertical concrete structural walls (NOT referring to TROMBE walls) should not exceed 8" in thickness. There is no performance gain with the added thickness. The danger of having too much storage is increased when using walls over 8" thick.

11. Avoid designs where dark masonry floors are constantly heated by the sun unless you provide forced air storage of the excessively heated air. Otherwise, these dark surfaces will get too hot to stand on – like black sand on a summer beach.

12. Trombe and greenhouse walls of concrete should be between 12" and 18" thick. This is the optimum for all climates.

13. Water wall efficiency is optimized between 8" and 16" of tube diameter. The efficiency increases only slightly after 18" of thickness. Efficiency decreases rapidly with storage chambers less than 6" thick.

14. Insulate all masonry, on the exterior, down to the footing level for all climates with cold winters and moderately warm summers. Where hot summers occur with mild winters, do not use basement exterior insulation on the walls. Instead, extend it horizontally away from the building 12 inches below the surface to help retain coolness in the earth around the home. Watering the earth around the home helps to retain coolness at the subterranean levels. For buried insulation subject to moisture, use only ***extruded polystyrene***, the only type that is perfectly waterproof.

ACTIVE SYSTEMS

Active systems are more hardware oriented than design and strategy oriented, as with passive solar. To write a detailed analysis of all the major systems and specific designs of active solar systems would be beyond the scope of this book. In basic philosophy, I prefer passive solar with some active assists in forced air movements to and from storage, and in domestic hot water heating. Other extensive uses of active collection systems are preferred where large window areas are not desired or possible and where a hydronic heating system is preferred. The basic problem with active systems (which almost always use solar hot water collectors) is what to do with the heat in the collectors during the summer. The best solution is to heat a swimming pool during the summer. If you do not have a pool, the number of collectors used for space heating will definitely sit idle during the hot season. Of course, you will never want for domestic hot water!

Basic Types of Collection Systems

All collectors absorb infrared energy from the sun and convert it into heat energy. This heat is then available (depending upon its temperature and the medium for transfer) to heat the air within a building, the water supply, hydronic heating system, or to even generate electricity by steam. The three most common type of collectors are:

1. Flat plate collectors

2. Evacuated tube collectors
3. Concentration collectors

Flat Plate Collectors

Flat plate collectors are mostly constructed with a labyrinth of tubes that contain the heat transfer medium (usually water or anti-freeze solutions). A few are designed simply to heat air, using a variety of air turbulence methods to force the air into as much contact with the heating surfaces as possible. The air types have to compete with passive solar designs, and are hardly ever used today. Air is a relatively inefficient transfer medium and can't provide any of the hot water needs of the house. Flat plate collectors can be either covered by solar glazing, or uncovered, depending upon the climate and purpose. Many solar pool collectors are unglazed because they are only used in the summer time. Virtually all collectors used in cold climates require at least one layer of insulating glazing. Flat plate collectors are somewhat limited to the transfer of low temperature fluids. Too much is lost out the glazing if temperatures exceed 200° F. System-wise, air collectors are usually coupled directly to the house since unwanted heat can be controlled by simply shutting off the ductwork. Few use solar storage in combination with air type collectors since the quantity and cost of active air collectors increases substantially if one is trying to collect the excess quantities of heat necessary for storage as well as for household air.

Liquid solar heating systems are almost always tied to both insulated tank storage chambers and hydronic floor coils for in-floor heating. It is the preferred system in use today. With liquid systems, care must be taken to guard against freezing if water is used as the circulation medium. Freeze protection in the roof-mounted collectors is usually handled by automatic drain-down equipment. These types drain the water back into a small holding tank and then pump it back up to the collector upon start up. Both work well. Another difficult bug in water systems is the presence of hard water-soluble metals and oxides which eventually either erode the piping or cause clogging of the pipes as the material deposits minerals onto the walls. Special "getters" (mechanical or chemical units) are installed to remove the minerals in solution before deposits are formed.

Because of the unknowns in water quality, almost all liquid solar panels use an anti-freeze type of medium and connect to heat exchangers, to keep the heating medium and domestic water separate. In prior years, the common heat exchanger was merely a series of looped copper tubing inside a large solar water tank. The trouble with these system, besides only moderate efficiency, was that the heat was transferred to the cold water in the tank at the bottom and would mix slowly within the tank. Before the tank's water was usable, the entire tank would have to be heated – which usually took most of a day. All of this has changed with the newest technology. The very best systems today use external heat exchangers, and for good reason:

- They are more efficient.
- They don't have to be replaced if the solar pre-heat tank starts to leak.
- They are connected to the solar water pre-heat tank by a thermosiphon loop, which ensures that the hot water from the exchanger goes to the top of the

solar tank and is immediately available for use. No need to wait till the entire tank is heated up. This makes a very big difference in performance.

Evacuated Tube Collectors

For higher temperature applications in the 200 degree range, these collectors are ideal. The liquid absorption tube is set within a glass tube which has most of the air evacuated, thus allowing little heat to escape to the atmosphere. Reflective troughs are always placed below the glass tubes to reflect light onto the tube carrying the fluid. All lines leading from these vacuum tube collectors must be wrapped in high temperature insulation for preservation of efficiency.

Another type of vacuum tube collector is used to heat domestic hot water. Instead of a small pipe inside a glass vacuum tube, they place a 4 inch diameter by 8 foot long copper or stainless steel tank is placed inside a 6 inch glass tube. This is a variation on what we call a "tank" heater – the hot water is heated and stored right in the collector for the highest efficiencies. The vacuum design keeps the water tubes from cooling off at night. They are also highly immune to short-term freezing temperatures.

Concentrating Collectors

These types are for high temperature applications such as steam production and solar air-conditioning units. They all involve precision concentration of light on an absorber tube or spindle. Absorber tubes are used with parabolic reflector troughs and spindles with dish type reflectors. All require sun-tracking mechanisms to operate, and only work with direct sunlight. The best feature about these units is their ability to provide very high temperature applications to produce high power production such as electricity or air-conditioning, and still have enough residual heat left over for other storage purposes. They are only practical in the desert Southwest, generally.

Two Recommended Active Systems

HYDRONIC heating lends itself well to the addition of solar energy and is by far the most preferred system in active solar today. The fluids are usually self-contained and can use anti-corrosion additives and anti-freeze solutions with no risk to the user. Hydronic heating with coils of polyethylene plastic pipe embedded within a 1-1/2 or 2 inch layer of cement on the floor is one of the most pleasant ways to heat a home. Some passive cooling can be accomplished by reversing the process if the nights cool off sufficiently.

A popular hybrid system combines the use of solar collectors for preheating and then adds heat only as necessary with a boiler – either gas, oil or multi-fuel. To heat a home of 2500 sq. ft. plan on installing about 400 sq. ft of collector surface and using two insulated 500 gallon storage tanks so that you can collect enough heat during the day to circulate throughout the night. All sources of heat (solar, LPG, NG, wood, coal, oil, and electricity) can be used with water heating systems. The efficiency is high, the controls are perfected, and it can be easily installed. Hydronic systems are still more expensive than air-duct systems, but are more competitive in price than they used to be. Almost all active hot water heating systems have built-in domestic hot water heating which is an added plus. The multi-fuel backup boilers do as well.

DOMESTIC HOT WATER SYSTEMS

Unless you have one of the previously described hydronic solar heating systems with built-in domestic hot water heating, you should plan on a separate installation for heating your hot water. A solar domestic hot water heating system can pay for itself almost anywhere in the US – even if it is only used in the summer. Again there are many, many systems on the market. Most of them work well if installed correctly. Installation is one of the bigger complaints in the active solar market, so make sure you get good references on the installation as well as a good deal on the price.

Do not be taken in by the lure of solar energy tax credits. Credits are a subsidy for certain industries. They are sold to the public as a benefit for them, but the industry always gets the money since they immediately jack up their price to make up for the "discount" you receive when you buy their system under the solar credit. Don't blame them for doing it, as it is a natural reaction to supply and demand. Subsidies lessen buyer resistance, allowing the seller to raise his price. So don't think you are getting a good deal with solar tax credits – the base price of the equipment is now higher than before solar credits were available. Buy into solar because of your need for energy savings and self-reliance, not because of a cheap government gimmick to pacify the powerful environmentalist lobbies.

Types of Systems for Domestic Hot Water

Active

An active system means that some type of circulation pump is involved. There are a few variations of active systems:

1. A solar collector that, when heated by the sun to a set temperature, begins to circulate that heat directly into a pre-heat storage tank. The pre-heat tank is then connected to the primary water heater for final heating, if necessary. Some systems even run the pump by a small solar panel on the roof so that the system operates independent of utility power. This is a highly recommended feature. Collectors that use domestic water as the circulation medium are closed systems and must be protected from freezing or be used strictly in warm climates.
2. A solar collector that uses an anti-freeze solution to circulate to a pre-heat tank via a heat exchanger. These systems often have drain-down procedures to avoid overheating the anti-freeze solution in summer, when the collector may not be operating. These anti-freeze solution systems differ in what type of heat exchanger they use. The older systems used heat exchange loops of copper within the pre-heat tank. The newer ones use external heat exchangers, which are superior in all ways.

Passive and Thermosiphon

The best of the passive systems is the batch heater – where the collector and storage tank are one and the same (as long as the collector is insulated well enough to avoid heat losses at night). These are the most efficient – especially the type that are contained within vacuum glass tubes – which have no equal in terms of insulation value. By

heating the water in the collector, there are no pumps, heat exchangers, or other storage tank costs to detract from high efficiency. These batch heaters act as pre-heaters for a primary water heater, helping to warm the inlet water and thereby reduce the fuel usage within the primary water heater. No pump is needed. Water flows out of the batch heater and into the primary hot water heater anytime you turn on a hot water faucet. Batch heaters can also be connected to an external storage tank. This is especially advantageous in a hot climate where the heater can often heat more than its own storage volume of hot water. If the batch heater is placed lower in elevation than the indoor storage tank, the excess hot water will thermosiphon upward and circulate throughout the storage tank.

Thermosiphon systems operate by the tendency of hot water to rise and cool water to fall. Placing the storage tank above the collector allows this to happen. The natural convection flow tends to keep the collector plate operating at near peak efficiency. The hotter it gets, the faster the water circulates. The big liability of thermosiphon systems is freeze protection. You can't use a drain down system if the unit is under water pressure, and if you add a heat exchanger (anti-freeze closed loop) the efficiency drops. The best solution is to use one of the vacuum seal batch heaters and then heat tape the lines that lead into the house. I use the new type of heat tapes that have a built-in thermostat. The heat tape can be plugged in all year round and it only turns on when the temperature gets close to freezing. In a power outage during the winter, one would have to provide alternate energy to this heat tape. It is also a good idea to use flexible polybutylene plumbing pipe so that if they freeze, they will not burst.

Another type of passive collector has an insulated storage tank built just above the collector itself. The stored hot water keeps the whole collector/storage system nice and warm even on freezing nights. There are also tube type batch heaters built into heavily insulated collector boxes. They are not quite as freeze safe as the vacuum tube type, but they have the advantage of allowing you to replace the glazing on top if broken. The vacuum tubes are a factory-only repair, which is very expensive and labor intensive. One must dismantle and ship the whole collector back to the factory. By the way, using heat tape in the winter on the inlet and outlet pipes sets up a thermosiphon system inside the collector itself, keeping the whole system above freezing. With special flow valves, the tank can be mounted level with or even lower than the collector. There are various types of one-way temperature controlled valves on the market which take all the risks out of thermosiphon systems. They prevent reverse flow during the night as well. See the "Recommended Equipment and Sources" section.

All domestic hot water systems can overheat if not connected to another storage tank. 140° F is the maximum recommended temperature for hot water (to guard against scalding).

For collector mounting, the basic rule is to keep your collector tilted 10 degrees above numerical latitude position. In other words, if you are living on the 45th parallel of latitude, your collector angle above the horizontal should be about 55 degrees. Most globes and US maps will show lines of latitude.

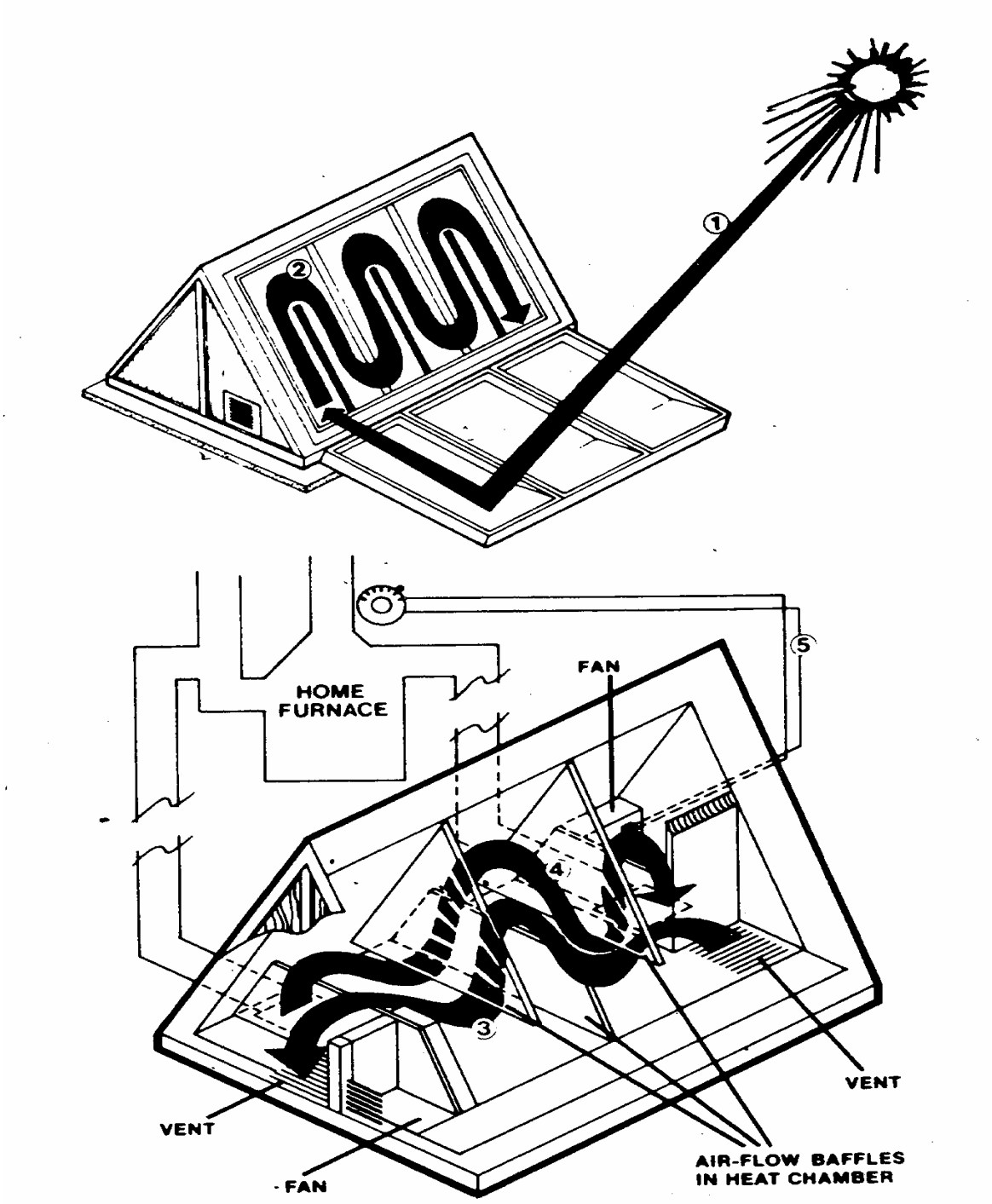
COMMON MYTHS ABOUT SOLAR PERFORMANCE

1. It always pays to buy the most efficient collectors. This is not always true. Overall efficiency of a system must include a figure representing the amount of performance you purchased per dollar. A 75% efficient collector costing half as much as a 90% efficient collector is a much better performance buy. System performance, overall will be determined to a greater extent by insulation techniques in the plumbing and storage, the proper sizing of the storage medium, and heat delivery equipment.
2. The higher the collector fluid temperature, the better. Hot is not necessarily more efficient. More heat is lost out the collector surface unless you use sophisticated vacuum tube collectors and high insulation on all plumbing.
3. Solar collectors operate well during cloudy weather due to the presence of ultra-violet radiation. Not so. Collectors only collect infrared radiation, some of which does pass through light cloud layers.

HOT AIR FURNACE

While hardly anyone uses a hot air solar collector today, there are two systems that qualify. The first is the greenhouse glassed-in area on a south wall which can collect large quantities of warm air for distribution throughout the house.

Another idea that has merit is the do-it-yourself solar furnace (see illustration). This is an A-frame greenhouse-type structure (that can be used as a greenhouse in the springtime). The prime difference is that the solar furnace needs massive dark-colored, heat-absorbing surfaces. It also utilizes underground insulated ducts that lead back into the house where an air handler draws heat from the solar furnace when its temperature gets about 20 degrees above the house temperature. It should only have one wall with solar glazing. All other interior surfaces should be insulated and painted a dark green or flat black. It works best when a shiny mylar-covered foamboard is laid out in front to reflect additional sunlight into the solar furnace. Dark masonry floors or even sealed water barrels can help the solar furnace provide heat well into the night. Use the solar reflective cover to close up the glazing at night for better heat retention.



HOT AIR SOLAR FURNACE

Chapter

12

Alternate Electrical Power

While it is possible to survive in a properly designed survival home without the use of electricity, it is not without considerable hardship–due to increased labor associated with household tasks, and decreased security through loss of communications and electronic detection devices. For these reasons and others, I will discuss in considerable detail the use of alternate electrical power generating facilities–generators, water power, wind power, and solar. Ultimately, I would encourage every preparedness residence to have some off-the-grid electrical capacity. Everyone can at least have access to an engine-driven generator and most can install solar photovoltaic panels coupled to a battery bank. These alternative power systems are mandatory for retreats. Naturally, all preparedness homes ought to connect to public utility power as well, if available at a reasonable cost.

Our discussion will center around design criteria and concepts. Recommended sources and associated costs are included in the "Recommended Equipment and Sources" section. We will not go into extensive detail on electrical relays, switching, and connections since if you plan on doing your own installation, you should get a book dedicated to installing solar systems. I will list some in the bibliography. Here, I will cover the following major types of power generation:

- Engine-driven generator sets
- Water power generation
- Wind power generation
- Photovoltaic solar panels
- Experimental generators

ENGINE-DRIVEN GENERATORS

Regardless of the power source you decide to use (public utility, wind, water, or all three), you should plan on having some minimal back-up power from an engine-driven generator. The primary advantage these machines have over other power sources is their ability to generate full sine wave, self-regulated power that most closely approximates utility power. Except for the fuel supply, they can operate completely self-contained

within the confines of your residence or retreat. This is important from a security point of view. All other types are exposed to view, being outside the home or on the roof. Most cannot be hidden. Because portable gas generators represent only a small, initial financial outlay, they should be purchased prior to other more sophisticated systems so as to provide you with immediate emergency power, even during the construction of a remote retreat.

Engine-driven generators have the following *limitations* or liabilities:

1. Fuel economy is difficult to achieve if the generators are run at less than 3/4 capacity. Fuel requirements for long-term use becomes the most expensive part of running a generator.
2. Fuel is limited in storage duration, hard to resupply, and volatile. It may also be subject to rationing or excessive EPA regulations.
3. Limited engine life. Engines must be overhauled anywhere from 1000 to 5000 hours, depending on the dependability of the engine.
4. Mechanical systems are extremely vulnerable to the specialized economy for supply and repair parts. Some require very specialized mechanics to work on.
5. Generators are noisy; thus they are hard to conceal without specialized mufflers and sound insulation.

In contrast, the *advantages* include:

1. A lot of power in a small package.
2. General portability.
3. Automatic operation with appropriate batteries and controls.
4. Excess *heat production* which can be used to heat the home.
5. Concealability.
6. Economic operation for high draw, short duration, standby conditions

Type Selection

The selection of an auxiliary power plant involves several considerations:

1. SIZE: Home and small business generators run from 1 kW to 20 kW.
2. ENGINE TYPE: They range from cheap, flat-head lawnmower type engines to sophisticated overhead cam automotive type engines. Some are air-cooled and others are water-cooled. One of the most important differences is the type of oil system: pressurized or non-pressurized, and filtered or non-filtered oil systems.
3. FUEL TYPE: You have your choice of gasoline, propane, natural gas, or diesel fuel.

4. VOLTAGE and PHASE: Small portables are usually 110 volts, single phase. Larger generators provide both 110 volts and 220 volts. You don't need 3-phase power unless you are running very large 3-phase industrial motors.

5. TYPES of STARTING: You can choose from electric start or manual pull start.

6. TYPE of ELECTRICAL TRANSFER SWITCH: Both manual and automatic transfer switches are available. A few companies make automatic switches with manual override, which is preferred.

7. PORTABLE, STANDBY, or FULL TIME: Each intended purpose requires a different size and engine type. The only type we will not discuss is full time generation. To run an engine generator full time is so costly that I do not consider this a viable alternative for a residence. It is much more cost effective to run a generator once a day in concert with a large battery bank and inverter. This will save thousands in fuel and maintenance costs, and will pay for the batteries several times over.

There are three major alternatives for both residential and business use:

1. The most expensive option is the large *fully automatic start-up, industrial quality, stand-by generator* with at least 2,000 gallons of fuel stored in an EPA certified underground fuel tank (see illustration pg. 406). This setup will cost you at least $15,000 to $20,000 to set up, and has the major disadvantage of high fuel consumption if you have to use it for long periods of time. Large automatic generator sets (gensets) capable of running your entire home or business will consume anywhere from 2 to 5 gallons an hour. At 2 gallons per hour, that's 48 gallons a day and 1,440 gallons a month. Not only is this going to cost you a small fortune to run and maintain, but you may run out of fuel due to lack of resupply in a crisis. The advantage, of course, is that you have full house power and all normal conveniences. It starts up automatically and maintains your electric power even if the power outage occurs while you are away. However, even in a large home, you won't use all the power the generator is putting out. Whenever you are using less than 75% or 80% of the generator's capacity, you are using the fuel inefficiently. As stated previously, the better alternative is to have a large battery bank and inverter which can handle smaller, normal loads. In such a system, the generator is only turned on to charge the batteries and to run high draw items like the refrigerators or freezers. To set up a system such as I am describing (called a *hybrid* system) you must make sure you have an automatic transfer switch that allows you to manually turn the generator off and on, or one that turns the generator on when the batteries discharge to a predetermined level. Most automatic transfer switches stay in the "transfer" position until the public power comes back on line. This is almost always unacceptable for our purposes. Only hospitals and other such users should use "all or none" transfer switches.

1 An *electric start, medium-sized, stand-by generator with a manual transfer switch.* This setup should be sized to run only essential loads once or twice a day. The manual transfer switch costs only a few hundred dollars, rather than a few thousand for the automatic types, and allows you the flexibility of being able to turn the genset off and on in order to save fuel. This is essential in a long-term power outage. This

allows you to ration your existing fuel supplies if resupply is a problem, and yet still run the set at least twice a day for an hour or two to charge up freezers and refrigerators, do the laundry, and run your furnace. The downside is that if the power goes off while you are away on vacation, it will not come on automatically. With a hybrid generator/battery/inverter system, you can have smaller loads set to automatically draw power from the inverter/battery bank, and run the generator once a day to recharge the batteries and run high current items simultaneously.

2 (Least Expensive.) *A small, portable gas generator (2-5kW) without any type of permanent tie-in with your electrical panel*. This avoids the costly electrician's fee and the manual or automatic transfer switches necessary to directly connect to your electric panel. These small, portable generators vary considerably in engine quality–from the cheap lawn mower quality engines to expensive, high tech, long-lasting engines and overhead valve engines with pressurized oil systems. Below, I will give you a more detailed rundown on this quality/cost issue. If you decide on a gas generator for infrequent emergencies, it's better to get one of the cheap ones. You can buy two or three for the price of one high quality unit. To connect these portables to your electric loads, you simply run heavy duty extension cords to the appliances you want to run. There is another option to energize house circuits indirectly which I will discuss shortly.

Manual Transfer Switches

The safest way to connect a generator to the house is through a MANUAL TRANSFER SWITCH, which is a 3-position switch that has a top, middle, and bottom position. With the handle in the top position, your house panel is connected to the public utilities. In the middle position, the panel is disconnected from all power (off position) and if you continue to lower the handle to the bottom position, the house panel is connected to the generator. Thus, this switch provides a fail-safe and positive way in which to make sure your house panel can only receive power from *either* the utilities *or* the generator–*not both*. This kind of switch is not costly and is a requirement for safety for any permanent installation of a standby generator. The transfer switch is spliced into the wiring between the house panel and the utility meter. The generator power leads are then connected to the bottom lugs (large connectors) within the switch. Only a qualified electrician should make these connections. It is not difficult if you know what you are doing, but care must be taken to make sure the main power is completely disconnected to the entire home before this installation can take place.

Backfeeding Power from a Generator

Alternatively, you can back-feed power into your house plugs if you need to make a temporary connection to a portable generator. This procedure does not have the positive fail-safe features of a manual transfer switch, so you must be very careful to manually turn off your main house power circuit breakers before you begin. If you are unsure about any part of the procedure I will explain here, do not attempt to tie into your home electrical circuits–just use extension cords.

First, a brief explanation on how your house electrical system works. From the utility electric meter on the outside of your home, you have 3 large wires leading inside to your main electrical panel (which is the panel inside your house with all the circuit breakers in them). There is a whole house circuit breaker either outside next to your meter or on the very top and middle of your indoor main electrical panel. Make sure you know where this main circuit breaker is. This is the breaker that must always be in the off position before connecting a portable generator to your home wiring.

The 3 heavy wires coming from the power pole to the meter and from the meter to the electrical panel are high voltage wires. Do not touch any of the connections or you will be electrocuted. Two of the wires carry 110 volts each, and the other is a neutral wire, used as a return connection to the power pole. All three are "hot" under some conditions so be careful. The two 110 volt wires are each "out of phase" with each other. This is a technical term relating to alternating current. You don't have to understand it–but the advantage to this setup is this: If you connect BOTH of these wires to a 220 volt appliance (along with the neutral wire–making a 3-wire connection), like on your range or dryer, the two 110 volt wires are *added* together to make 220 volts. If the two 110 volt wires were in the *same* phase with each other, the voltage of the wires would not be added together–you would still get 110 volts in a 3-wire connection.

This is very useful in hooking up your electrical panel. If you look at your panel, you will notice that there are circuit breakers on both sides of the panel, descending in two even rows. A few of the circuit breakers are wide double breakers and the others are thinner. The double-sized breakers are 220 volt breakers. The thinner ones are 110 volts. There are even some types of circuit breakers that fit two tiny switches on one normal sized 110 volt breaker. This is so that if you run out of open slots on your panel and have to add another electrical circuit, you can take out a normal 110 volt breaker and replaced it with one of these double, half-sized breakers and get more circuits.

Now, here is the key to understanding your panel. If you were to remove the front cover of the electrical panel (be careful not to touch anything inside or you will get shocked) you would see how the 3 big power wires that come into the panel are connected. You can tell which one is the neutral wire because it runs off to one side or the other and connects to a long shiny metal bar where all the white wires are connected. This is the neutral bar that returns all the electrical current from each appliance to the power company. The other two large wires coming into the top of the panel are the out-of-phase 110 volt lines I mentioned. Note carefully that these are connected to two shiny metal bars, called bus bars, that lead downward behind the circuit breakers. If your panel is not full of breakers you will be able to see that these two descending bus bars do not in fact connect all the circuit breakers on one side to the same bus bar (as you might suppose). In fact, these bus bars are built with alternating finger-like projections. As the bar descends, it feeds power to a circuit breaker on the left side of the panel and then feeds power to the next circuit breaker down on the right side of the panel, and then back to the left side, and so on, alternating its feed pattern. If you had only 110 volt breakers in your panel and they were numbered 1-10 on the left side, only the even-numbered breakers would be connected to the left-hand feedline even though the breakers themselves are on the left side of the panel. The odd-numbered breakers would connected to the right-hand feedline, even though all these breakers are on the left-hand side.

So why not use the left hand bus bar to feed all the circuit breakers on the left? Wouldn't that be simpler? Why alternate? By alternating each feed point, it allows the use of those double-sized 220 circuit breakers. These 220 breakers have TWO feed points, and they will only work as 220 if these breakers have access to a feed point from each of the two 110 volt out-of-phase bus bars. That is precisely what this alternating bus bar system provides. The big double breakers have one lug attached to the left bar and one to the right bar, regardless of which side of the panel the breaker is physically installed.

Here is why this explanation was necessary for you to understand. This splitting of the electrical panel into these two bus bars means that approximately 1/2 of your house is on the left-hand feedline (but only half of these circuits will be physically located on the left-hand side of the panel) and the rest of the house is connected to the right-hand feedline. Only the 220 breakers are connected to both feedlines in the electrical panel. So if you pick a 110 volt wall plug to backfeed power from your generator into the house panel, you are only going to feed power into half of the panel.

Let's suppose you want to energize the gas furnace with your generator. You would never try this with an electric furnace since the generator wouldn't be big enough to provide massive amounts of resistance heat. Keeping your gas or oil furnace running is important if you want to keep your water pipes from freezing in the winter. Suppose the gas furnace circuit breaker is the 4th circuit breaker down on the left side of your panel. So to backfeed power into this furnace circuit breaker, we need to find a wall plug near the generator that is connected to the same feed line that the furnace breaker is connected to. Remember, this does not mean that all plugs attached to circuit breakers on the left-hand side of the panel are going to connect to the furnace breaker, which is also on the left. Remember that the circuit breakers alternate attachment to one feedline or another as they are mounted. To find the other circuits on the same feedline as the furnace, we must go up or down from that 4th breaker and alternate sides as we go. So the other circuits linked with the furnace breaker would be the even-numbered breakers on the left side and the odd-numbered breakers on the right side. Visually, if you touch the furnace breaker on the left, the next breaker linked to it would be on the right side, either one breaker up or down from there. You should go through your whole house and put a small label on every wall plug so that you know which feedline of the panel they are connected to. You can use A or B labels rather than left and right to avoid confusion with the fact that sides alternate on the panel from one breaker to another. Hopefully, you will find a wall plug near the garage that is also linked to the furnace circuit breaker. Now connect a double-ended extension cord from the generator output plug to the garage plug and you will have power to the furnace.

You can't buy double male end plugs on an extension cord. You have to buy a new male plug, cut off the female end, and splice on the new male-ended plug in its place. Now you have an extension cord with male plugs on both ends and no receptacle end. Plug one end into the generator output receptacle and the other into the wall receptacle.

Interestingly enough, we can avoid all the hassle of determining which side of the feedline each wall plug is on if we connect the 220 plug on the generator to a 220 volt receptacle in the house (like a dryer plug). We won't be using the 220 dryer on a generator anyway. In this way, our generator will backfeed into both sides of the house

panel and energize all plugs. Now, this is not dangerous, but it will certainly overload a small generator if you don't shut off most of the circuit breakers *before* you make this connection. Note that to do this you will have to buy two male-ended 220 plugs of different sizes–one that fits the generator 220 receptacle and the other that fits the dryer plug. Splice these onto a *big heavy duty* contractor's extension cord of suitable capacity to handle the full load of the generator output. There should be at least 10 gauge stranded wire in the extension cord. Check the tag to make sure the wires are this size. Most cheap extension cords are 14 gauge, and better ones are 12 gauge. The smaller the gauge number, the bigger the wire, so 12 gauge is bigger wire than 14 gauge.

Here is what you must do to safely make this all work. **FIRST manually shut off your MAIN whole house CIRCUIT BREAKER**. You must never connect a generator directly into your house circuits via the wall plugs without making sure that no electricity can be back-fed into the public power lines. Not only is it illegal, but it is also dangerous to any utility linemen who may be working on the power lines. If *you do not understand what you just read, then do not use this procedure*.

Go to your house panel and turn *all* your 220 volt breakers (the big fat wide ones) to the OFF position. You will not use any of them with a small generator, with the possible exception of a well pump. Now turn OFF any 110 volt breakers that have automatic appliances on them (things like refrigerators and freezers and well pumps). Now, when you activate your house panel with the generator, you won't be activating any major loads. We will have to use our human computer to manage how much load we put on the generator. A 5000 watt generator is only equivalent to three normal house circuits. Your electrical panel has 20 or 30 house circuits, so you can see that we can only run a few things at a time. Go around and turn off lights and other things you don't want ON. If the generator gets overloaded, it has a circuit breaker on it (red button) that will pop out. To get back in operation simply unplug the extension cord so there is no load on the generator. Turn off some items in the house that were overloading the generator, and then reset the red button and restart the generator. After the generator is back up and running, reestablish the extension cord connection. Always wait till the generator comes up to speed before putting a load on it.

Other Insights and Strategies for Generator Use

Fuel consumption of these medium-sized portables is around 3/4 to 1.5 gallons per hour. Since these are portable generators, most people stockpile gasoline in portable gas cans or barrels, with a small barrel pump to facilitate use. Be sure to add stabilizing additives to the fuel stored so that it will retain its octane rating longer. Products like "Stabil" are sold at auto parts stores nationwide. I list a higher quality product in the "Recommended Equipment and Sources" section, but "Stabil" works fine for most situations. Storing large quantities of gasoline in a garage is not legal in most cities, so you should place these barrels in a small storage shed outside. If you do keep any fuel in a garage, be sure to place it on the wall farthest away from the home and near the garage door so it can be removed quickly in case of fire or emergency.

I don't recommend any generator smaller than 4,000 watts (4kW) capacity for general home use since it takes almost that much wattage to start up a large refrigerator and

freezer together. You should also plan on running these small generators on a once or twice per day schedule as previously mentioned. They don't have a long life span if run continuously.

What do we do for electricity when the generator is not running? One excellent system is to use a bank of golf cart batteries to store 12 volt electricity. Combined with 12 volt lights or an inverter, to convert the battery voltage to 110 volt alternating current, we can have house power for light loads when the genset isn't running. A generator combined with a battery/inverter system is what is called a *hybrid system*–hybrid because it is a combination of two or more different generating systems. You can keep this battery bank constantly charged with either a few solar panels or with an inverter that has a built-in battery maintainer. Inverters with built-in battery charges will keep your batteries charged with 110 volt power while it is available and then switch automatically to inverting mode when the power fails.

Here is the strategy. Use your generator for only the heavy-draw electrical items: Refrigerators, washing machines, and to charge the battery. Then shut the generator down and use the batteries and inverter for lighting tasks, radios, stereos, and computer use. These are low-draw items, so there is no need to keep your generator running to power these items.

By the way, never try to operate 220 volt resistance heaters (electric water heaters, electric ranges, electric dryers, etc.) with batteries or a generator–they use too much power and it is not an efficient use of generator fuel. Better to bring in a propane camp stove to heat hot water than to burn gasoline in a generator. For clothes drying, hang your clothes out to dry on a line. For those with electric water heaters, have a second water heater installed that uses propane or natural gas. These will operate without electricity.

If you use computers in your home or business, you can get both an Uninterrupted Power Supply (UPS) and a backup battery system all in one. When a high quality sine-wave inverter (like Trace brand) is installed, it will automatically sense the loss of utility power and switch over to your battery bank before your computer shuts down. So instead of investing in those expensive computer UPS units, invest in a sine-wave inverter and battery bank instead and you will have both a UPS and a backup power supply for lights and TV/radio–very essential for finding out what is going on in the world during a crisis.

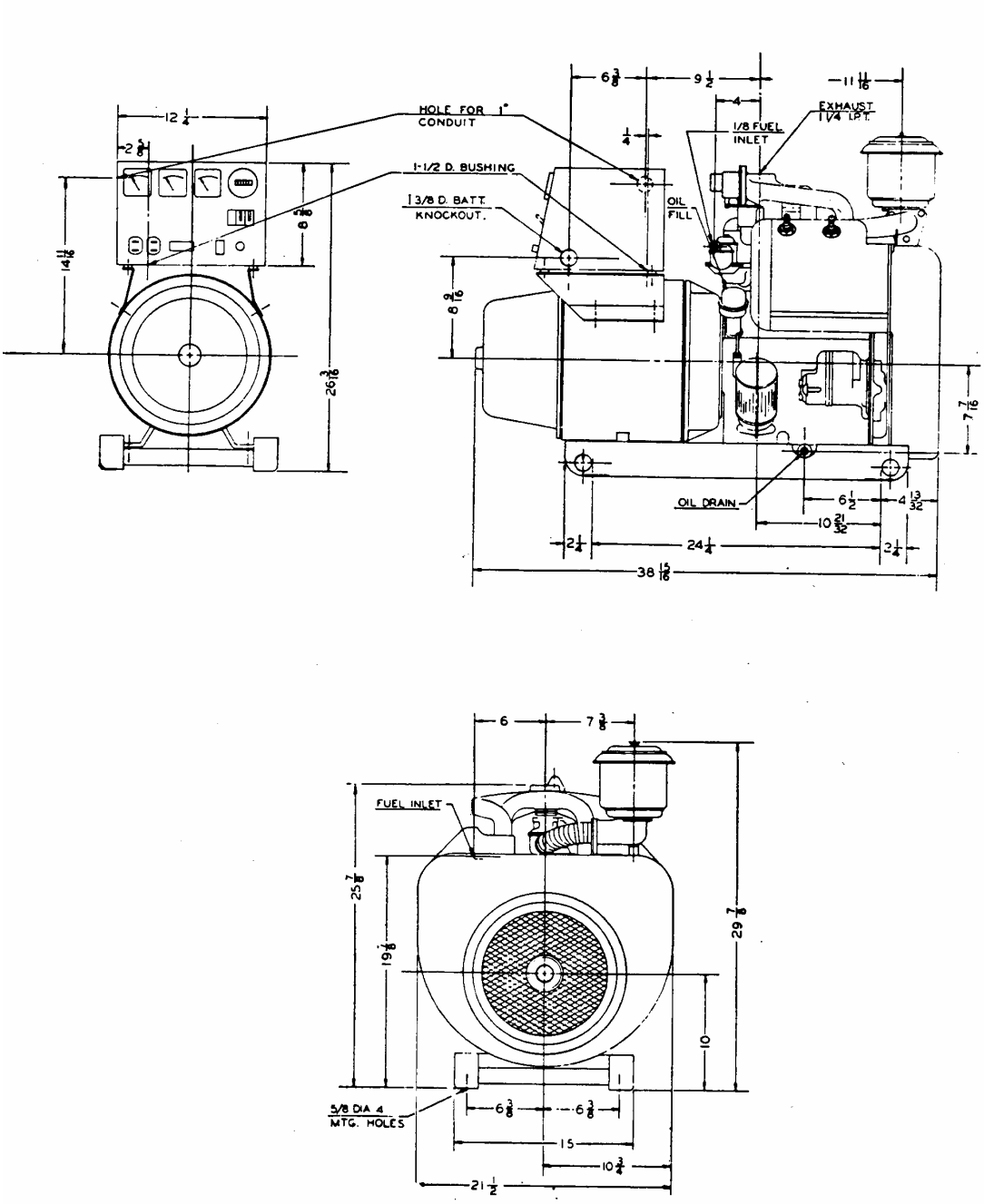
Equally important is the way in which the battery bank is charged and maintained. Do not use trickle chargers. Even though they are low powered, they never quit charging, and eventually the batteries will boil away the liquid and be damaged. Use one of the new charger/maintainers that have special electronics to *float charge* the battery. A float charger maintains a battery at somewhere near 13.36 volts, which is the ideal steady state charge to keep a battery fresh for a long period of time. The Trace inverter has a built-in charger that will keep batteries at a perfect 13.36 volts–the ideal voltage to make sure your battery never deteriorates. If properly maintained you will only have to add water once or twice a year.

Portable Generators: Judging the Quality/Cost Relationship

There are several ways to classify generators and it is important to separate them into these classes so that you can correctly compare costs. The first class is *engine speed.* Almost all of your large, heavy duty *stand-by generators* (non-portable, fixed backup units) run at the low speed of 1,800 rpms. This increases generator life span as compared to the cheaper portables that run at 3,600 rpms. On the other hand, the slower turning generators build up more internal pressure on the engine parts, so they must be built to higher, heavier standards–which naturally costs more. So if we intend to buy a generator for "off the grid" regular usage, we should spend more money and buy one with an 1800 rpm engine. They use less fuel, and will give long years of service. There are a few 3,600 rpm generators in the expensive, heavy duty class–so just because it runs at 3,600 rpms doesn't mean it is cheap. However, these engines will always have a *pressurized oil system*–which leads us to our next category.

This next class of generators has to do with the fuel and lubrication systems. There are several varieties of engine designs, some cheap and some more expensive, but the main difference in quality is the oil lubrication system. Cheap engines almost always have *splash type* bearing and cylinder wall lubrication. The rotating crankshaft splashes oil from the pan and flings it on the walls of the cylinder and other moving parts. This is satisfactory for short-lived engines, but heavy duty engine loads require a *pressurized oil system* with pump and oil filter. Therefore, all of the heavy duty, long-life engines will have an oil filter mounted on the engine somewhere. The cheap, lawn mower quality engines will not.

The *cheapest* engine designs will also have other characteristics you can watch for. Most will be side valve engines–a valve opening and closing routine that is very close to the crankshaft so that a pressurized oil system does not have to be used. Up a notch in quality are overhead valve engines (OHV). The next step up, as in cars, are overhead cams (OHC) as well as overhead valves. But this latter type cannot work without a pressurized oil system–oil can't be flung up to the top chamber of any engine effectively. Side valves are noisy, while overhead valves and cams are the quietest–but the most expensive to build.



TYPICAL SMALL GENSET LAYOUT

The fuel of choice for portables is almost always gasoline. Some portables are diesel powered–especially in the higher output sizes, since many people use these portables in the stand-by mode. But diesel is harder to start in the cold, so most portables are gasoline driven.

How do we use this information? It's not as simple as "always choose the most expensive or best." For example, the cheapest generators (splash oils systems, 3,600 rpm, side valves, noisy) may be less than half the price of one of the longer lasting generators. But rarely will one of the medium quality generators outlast two of the cheaper generators. Since we can buy two of the cheaper for less money than one medium quality unit, it is a better deal to buy two of the cheaper ones, and have a spare waiting for use or to rent out to others who haven't planned ahead. This pragmatic choice is especially right if you are not going to use the portable generator except on rare occasions. On the other hand, if you are a contractor and are building a home without public power, you should get the heavier duty, more reliable units to ensure less downtime.

I will mention brand names and sources in the "Recommended Equipment and Sources" section. With some brands, like Kohler, you can usually depend upon them being "top of the line" in quality and cost. With a few other brands, you can always count on their being at the low end in cost and quality. There is an appropriate place in the market for each. The difficulty arises with certain generator manufactures (like Honda) that start out building top of the line, costly units and then start adding lower-end cheaper units to their line, still touting their "quality" reputation. It is my opinion that people end up paying too much for less quality at the lower end of these lines. In the lower quality range, it is better to switch to the lower cost manufactures who make no pretenses toward higher quality. Here's how you can tell: The consistently "top of the line" manufacturers have different classes of generators, but none of them are competitive in price with the cheaper manufactures. A company who claims to be "top of the line" but who also markets lower-end generators to be competitive with the "cheapies" is suspect. Price doesn't lie on the low end of the price scale. If it is cheap, it is not high quality. But remember, you don't necessarily need "top of the line" quality. Only pay for the best when you intend to put the unit to heavy duty use. None of the cheap lines made in America or Japan put out a bad product–they will all perform well within the price you are paying for them, and sometimes the cheaper ones will give you the most value for the money.

Stand-By Generators

Stand-by generators are fixed units, hard wired into your electrical system, with separate, long-term fuel supplies. Most often the fuel of choice is either LP (Liquid Petroleum) gas or natural gas. The second choice is diesel. LP or natural gas is the preferred choice for city installations due to a reliable source of resupply, safety in fuel storage, and ease of starting even in the coldest weather. Diesel or LP is the preferred fuel in rural areas, with diesel predominating with farmers (who have to have a steady supply of diesel fuel for their farm equipment anyway). The only liability of LP or natural gas is that some engine power is lost with these fuels, as compared to gasoline and diesel. With LP gas, you will have an 8-10% loss of horsepower, and with natural gas, nearly 14-15% less power.

Diesel engines run at their fully-rated power. All stand-by diesel generators should come equipped with engine block heaters and glow plug starting if you live in a cold climate. Some engines use a compression release mechanism to enhance starting. A lever is moved and the valves do not fully close, allowing the starter to spin the generator at a high speed. When the lever is released, the valves close and the engine starts more easily.

Also related to choosing a fuel for a generator is the fuel type used by your survival vehicle. Under certain circumstances it may be difficult to get fuel for vehicles. If you have storage fuel (such as diesel) that can serve your generator, tractor, and vehicle, then you are further ahead during shortages of supply. Things are more complex now that the EPA has required different fuels to be color-coded. High sulfur fuels (which are best for engines) are prohibited for highway use, so if you want to use your stored fuel in your vehicle you must store the low sulfur fuels that are not dyed red in color. Unfortunately, you end up paying road fuel tax on the fuel you burn for your generator. If you use a lot of fuel, it would pay to have two different tanks.

There is much less difference in quality among larger stand-by generators. All the major brands build reliable engines, but some have slightly less reliable electronic controls. Most stand-by generators have heavy duty, slower 1,800 rpm engines and all have pressurized oil systems with filters. For this reason, you get your best quality per dollar in the moderate price ranges. You will pay too much of a premium at the "top of the line" just because of the name. The best buys are in the lower middle of the pack. However, if you intend to run a generator nearly constantly in an off-the-grid home, then it's best to go with the "top of the line." They will outperform the others in the long-haul.

Calculating Your Power Needs

First, for comparison purposes, let's determine your *average house electrical load* in kilowatts. Take your monthly electric bill as an accurate guide of past usage. The number of kilowatts used will nearly always be indicated. Average your usage over a year's period to get a monthly average, then divide this by thirty days to get a daily average in kW. This is normally between 20 and 30 kW per day. You will not want to use nearly this much power in an alternative energy system, but at least you will know what your present lifestyle is costing you in total energy.

Second, we need to calculate the *maximum load demand*. This does not mean you pick a generator to handle the load of every electrical device in the home as if they were all turned on at once. Most houses have 200 amp service but rarely are using more than 50 to 100 amps at any one time. It is extremely wasteful to size a generator to the maximum possible load. It will end up being run at low fuel efficiency almost all the time. We really need to decide what is the *maximum essential load* we will encounter if we have all our basic equipment on at one time. This might include:

- Washing machine at 280 watts
- Refrigerator at 1,420 watts
- Twelve lights at 75 watts each = 900 watts

- Furnace fan at 1,200 watts
- Computer or TV at 300 watts
- misc. at 800 watts

for a total of 4,900 watts

Let's assume that the average person wants a 110/220 volt, 60 cycle single phase generator for stand-by use, and he calculates a maximum normal load of 4900 watts. But his electric bill shows that he uses an average of 30kW per day. How do we resolve the difference? The average usage during the day varies between .5kW and 10kW per hour during the hours the family is awake. If the family has electric heat, electric water heating, clothes drying, or air conditioning this figure will be much higher. Note that one of the differences between alternate energy use and normal utility use is that, off the grid, we will not be heating food or water or drying clothes with electricity, which drops our usage dramatically. We will switch to propane fuel for these high-draw items. If we buy a 10 kW gasoline generator, at a cost of $7,000, and run it for a thirty day emergency period at an additional $900 in fuel costs (based on 1.6 gal./hour over an 18 hour day), our total first yearly cost will be approximately $17,800 if no maintenance is required, and if we installed the equipment ourselves. This is the overkill method which is generally employed in generator sizing. During many periods of the day the house usage will be one-tenth of the total capacity of the generator. Running the generator for these tiny loads is a waste of fuel. Even the normal maximum essential load we calculated is less than half of what the generator will put out. Conversely, if we use this generator in a hybrid system, adding a large battery bank and inverter, we will add another 2,000 to 5,000 watt load to the generator which will more appropriately harness the capacity of the genset.

Phantom Loads

One of the most difficult things to calculate are hidden electrical losses from appliances that are using power even when they appear “off.” In small alternate energy homes these phantom loads can represent as much as 10%-20% of your daily loads. For example, few people realize that your TV, VCR, door bell, and refrigerator all draw power even when not running. They have small sensing circuits that are continually monitoring certain functions. In a remote-controlled TV, an infrared sensing circuit has to be on at all times so that you can use the remote to turn on the TV. The same is true with a VCR. The thermostat and transformer on your furnace are a sources of phantom loads. Even some cheap brands of GFI wall plugs can waste small amounts of electricity (although the Levitron brand is extremely high quality and will not produce any phantom loads). If you have a gas oven, some of the newer types will burn a glow plug during oven operation just to ensure the flame is relit if it goes out. This can waste 200-600 watts every time you bake something. AC smoke detectors also waste a small amount of electricity constantly. Individually, these may seem like small losses, but added all together, they can be significant, especially when trying to conserve. Most of these small phantom loads play havoc with the automatic switch in modern inverters. Inverters need to be put to “sleep” between usage so they don’t continue to waste battery voltage in the “on” position. But often, these small phantom loads will make the “sleep” mode difficult to adjust.

Let's consider another method of sizing, based on average loads rather than maximum loads. In order to do this, some essential, alternate forms of heating are required for heat-consuming electrical appliances. As discussed earlier, it is very wasteful to burn fuel in a generator to produce electricity to turn back into heat. The fuel is much more efficiently used to heat directly. Alternate fuel burning appliances should be available for the following tasks:

- COOKING (gas, white gasoline, alcohol, kerosene, or even wood)
- WATER HEATING (solar, gas, kerosene, wood, or coal)
- CLOTHES DRYING (air dry inside or out, or hang near a wood-burning stove)
- DISHWASHING (wash by hand, let air dry)

The maximum essential load can now be decreased to under 5 kW/hr, as previously outlined. Now we can get by on a 4 or 5 kW generator which will cost about $500 for a cheap one and $1,500 for a heavy duty set. It will burn about a gallon an hour at full power. Total monthly fuel cost in an emergency, running the generator twice a day, will be around $180. The few thousand dollars saved in this way will buy a lot of alternate forms of energy and equipment. If we add a large battery charger to operate a hybrid system, we will have to increase the size of the generator beyond this 5kW minimum.

Hybrid Systems

The most efficient use of a generator of any type is to match it with a battery storage system outputting 110 volts through an inverter (creating the hybrid system). This accomplishes several things:

- It forces the generator to run at near full capacity, for better efficiency
- It runs fewer hours and less often (as needed to charge batteries)
- Modern inverters handle the battery load regulation
- Emergency power is still available for a limited time if fuel runs out
- The system is adaptable to solar power for additional fuel savings

Using battery power requires the reconversion of direct battery current to alternating current in order to be usable for certain appliances–but not for all. Most portable hand tools have universal AC/DC motors which can run off AC or DC power of the correct voltage. Even 110 volt lights will run on DC and last longer, too–but one would have to put ten 12 volt batteries in series to get 110 volts DC, which is not very practical. Most resistive type heating elements will also run on DC, though they will not get very hot unless you apply 110 volt DC. In any case, I do not recommend heating with standby electrical power. Dumping excess solar generated DC into heat is acceptable, however. As long as large, power-consuming appliances are kept off (ranges, dryers, etc.), you can get by with a few solid state electronic inverters for conversion to AC from DC. These are advantageous in that they have a low no-load consumption so that battery energy is conserved. The old technology inverters used mechanical rotary motor-generators (essentially a DC motor, turning an AC winding) and have a high no-load consumption that will run down batteries very fast. These big inverters are still used on navy ships for

high conversion loads. They have the advantage of putting out pure sine wave alternating current at much higher amperage than solid state inverters are capable of.

In sizing a hybrid generator-battery storage system, keep in mind that we need to store at least a full day's electrical use in the battery bank. This requires generator usage only once a day. Houses that run completely off-the-grid should size the battery bank to last 3 days between generator uses. The cost is worth it because generator life will be extended dramatically and fuel consumption per day will be cut by two thirds. When using dwindling supplies of stored fuel, consumption becomes a major alternate energy system selection factor.

The critical factor in storage capacity is not cost only, but matching the charge/discharge rate to the generator capacity and the expected draw. Maximum battery life will be achieved when the prolonged charging or discharging of the battery does not exceed 20% of the total amp/hour rating. Thus, with a 30 kW hour battery bank, we can safely discharge and charge at around 50-55 amps through the generator or inverter battery charger. Another estimating factor to use when computing storage battery size is to multiply the amp/hour capacity of the generator by seven. A 5 kW generator puts out about 45 amps. Multiplying by 7 gives us 318 amps, times 110 volts, gives us about 35 kW hours of battery bank.

Generator Installation

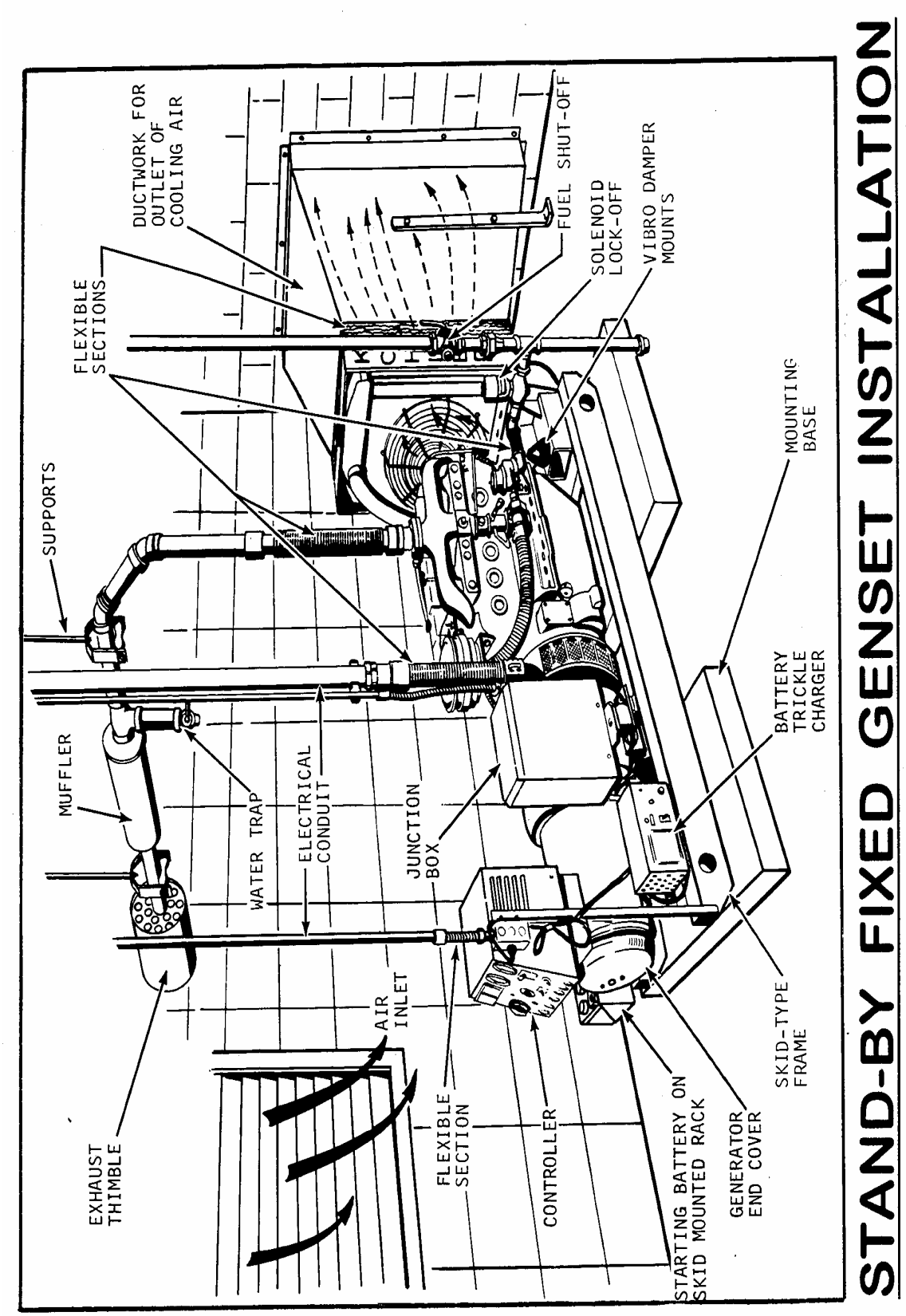
(See illustration.) We will discuss two aspects: location as pertaining to the environmental necessities of engine generators, and privacy of installation.

Environmental Needs

- The supporting structure, especially the foundation, must be of concrete to support the weight of the system and related accessories.
- The area must lend itself to vibration and noise dissipation.
- The area must be dust-free generally, and free from flooding.
- Adequate space must be available for servicing and possible entrance of fork lift, or access hole for crane if the genset weight is extremely high.
- Ventilation must be available.
- Exhaust must be expelled safely and quietly.
- Fuel must be available not too far away.

Privacy Needs

As discussed briefly in the chapter on remodeling, I recommend (where possible) that the generator be installed in a concrete block room or building for noise suppression and security. The most privacy is gained by an underground basement installation. The earth is an excellent sound insulator, so I generally design the generator room outside the walls of a high security shelter and with a lower ceiling so that additional earth can be placed



STAND-BY FIXED GENSET INSTALLATION

over the concrete ceiling. A generator room under a garage slab will not give total sound insulation. The rigid structural nature of concrete still allows significant noise to come through the floor.

The biggest problem in making a private installation is the cooling air. You will note that in the cooling and ventilation section, large louvered doors or openings are called for. It is virtually impossible to soundproof these. Even if you have long distant ductwork to take the airflow away, the amplifying effects of long ducts makes the sounds even louder. The only effective solution is to keep the cooling system completely confined within the house by using the heat or by ducting the heat up a chimney so that the noise goes vertically above the house where it cannot be detected. Great care must also be taken in silencing the exhaust. Whenever feasible we will always connect a generator's exhaust to special silencing mufflers and then run the exhaust up through a masonry chimney.

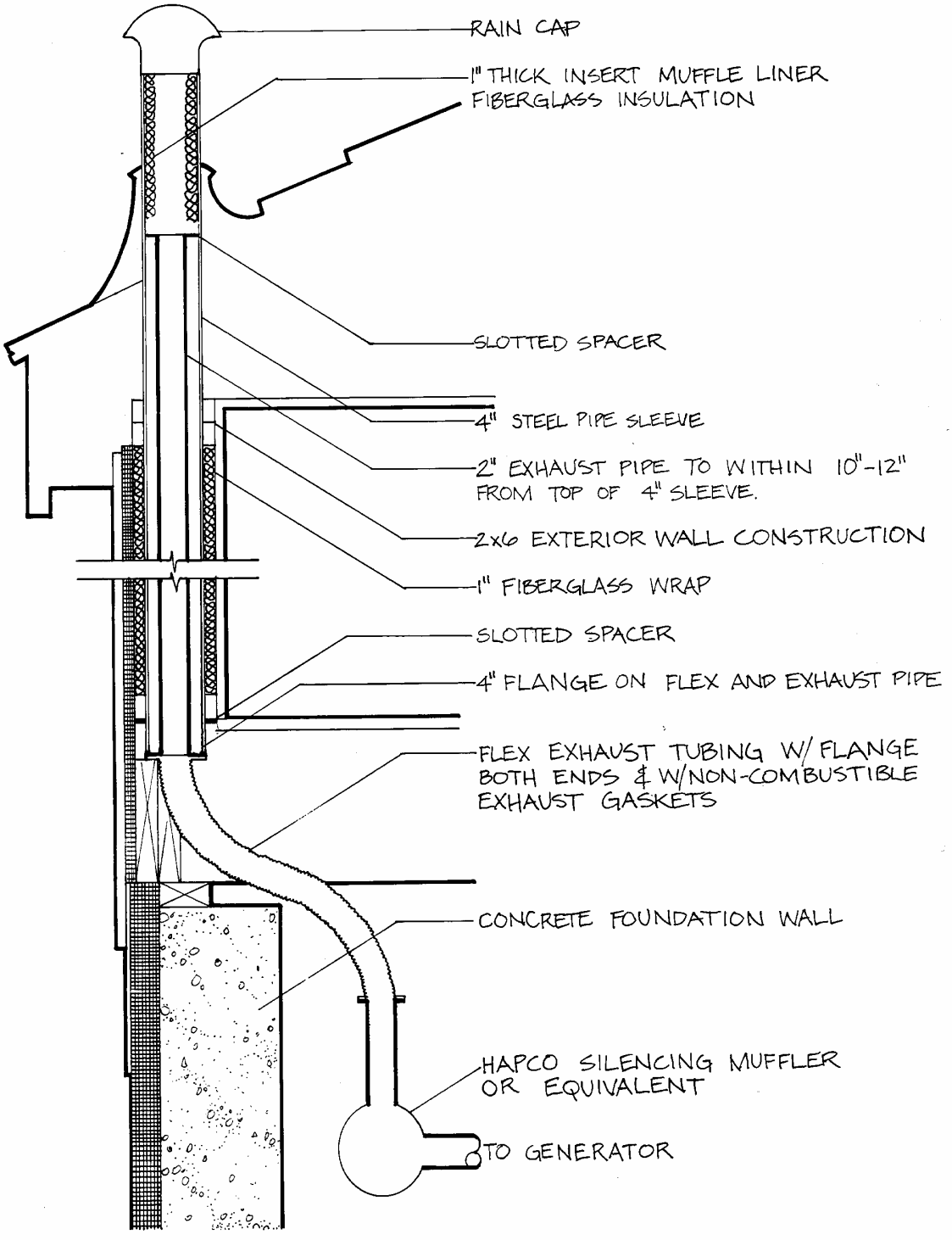
Silencing Mufflers

Normally, an extra silencing muffler in series in the exhaust stack is necessary to achieve sufficient noise attenuation for concealment. See the "Recommended Equipment and Sources" section for recommendations. Additional silencing may be achieved by connecting the exhaust pipe to a masonry chimney. This prevents metal-amplified vibrations from going directly into the air. It is also important to make sure the generator chimney flue has some 90° offsets instead of going straight up. This helps reduce harmonic amplification. The first illustration to follow shows a drawing of an all metal, double-wall exhaust pipe going out through the roof of a house. For maximum silencing, the special silencing muffler should follow just after the regular generator muffler. The vertical chimney pipe it connects to should be at least twice the diameter of the exhaust pipe so that the velocity of the exhaust is allowed to slow and the resistance is reduced. Always use a rain cap on the top. It further reduces the noise and keeps the pipes from taking on a lot of water during rainy weather. On the second illustration of exhaust plumbing details, note the use of a flexible exhaust section on top of the generator. This accordion-like pipe keeps the engine vibrations from inducing stress cracks in the rigid exhaust piping. It is also important to have at least two 90° bends in the exhaust pipe before it connects to the chimney to allow for expansion under heat. If connected directly without the bends, the connections will be put under heavy strain over time. Lastly, as illustrated, make sure you use special thimbles to shield the wood members of the house against the exhaust heat where you penetrate floors and roofs. Thimbles are special double and triple metal pipes nested inside one another that keep the heat from reaching the wood framing.

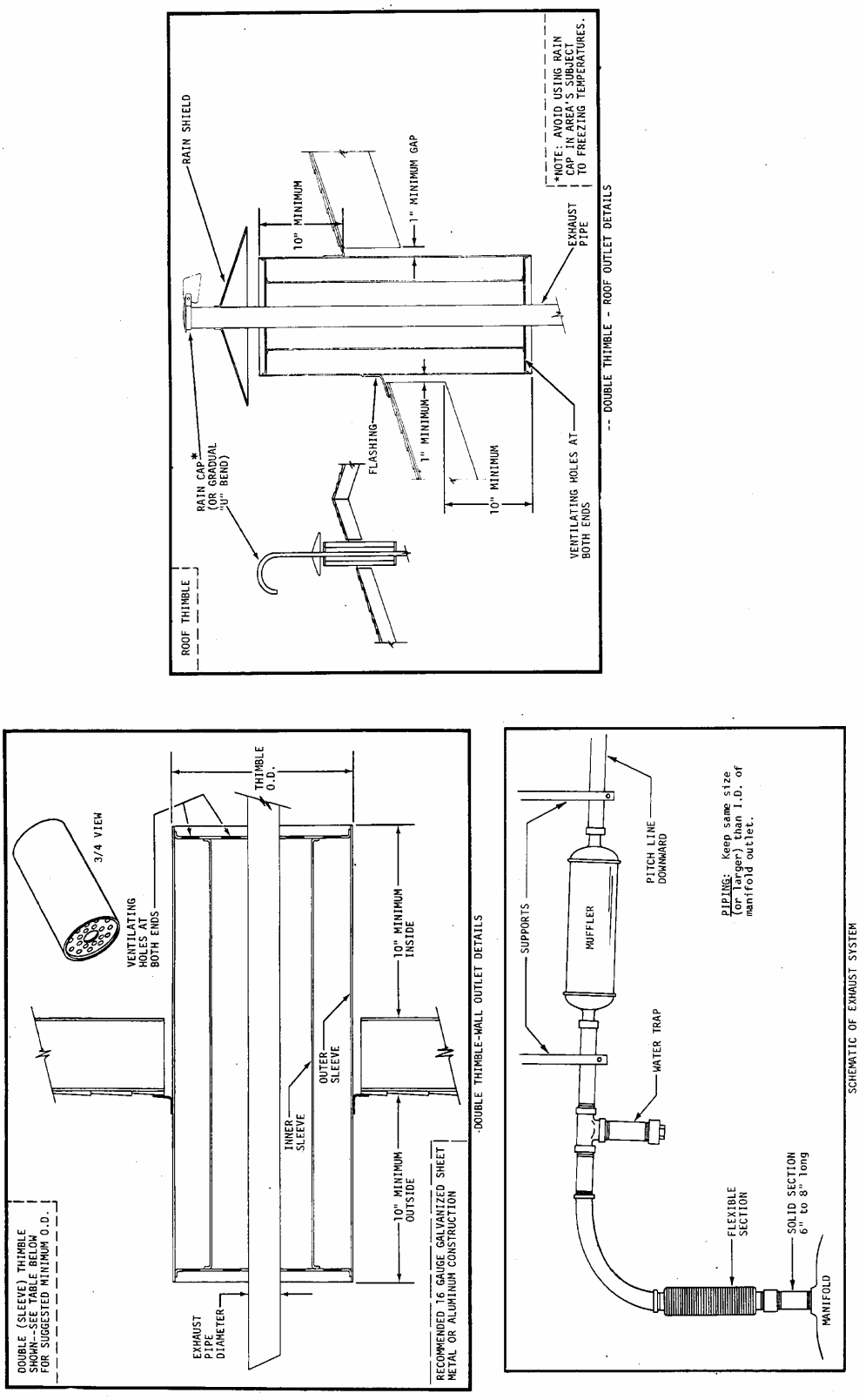
Vibration Damping

Vibration is a significant problem to be contended with in engine generators. All generators should be mounted on rubber vibration dampers. This is especially effective in reducing noise vibration throughout the house as well. For high privacy installation, I order a heavy duty oil-resistant rubber mat for the generator to be installed on. Sometimes it takes two in order to stop the vibration from being felt throughout the basement floor. The porous mats are the best vibration dampers, but they can be ruined

CONCEALED GENERATOR EXHAUST SYSTEM



GENERATOR EXHAUST PLUMBING DETAILS



by leaking fuel or oil from the generator. Also, the skid-type frames that almost all generators come with are not conducive to sitting on rubber foam mats. They tend to crush them at the concentrated points of contact. The solution is to mount the generator on a 3/4 inch plywood board that has been coated on top with enamel, and place the anti-vibration foam under the plywood. In this manner, the vibration and weight is more widely distributed.

All fuel lines, coolant hoses, and electrical connections must have flexible portions to inhibit the deteriorating effects of vibration. Fuel lines are especially vulnerable and should include a section of flexible fuel hose in any piping system.

Air Requirements

Air in considerable quantities is needed, both for combustion and for cooling of large gensets. Approximately sixty percent of the fuel's heat value given off in combustion will be absorbed by the engine and cooling mechanism; 40% goes out the exhaust. Sizing of air inlets for air-cooled generators is done in the following manner: one square foot of inlet opening for generator sets 2kW and smaller; and an additional 1/2 square foot for each 1,000 watts of size above 2,000 watts. These sizes should be increased if louvers or screens are utilized as follows:

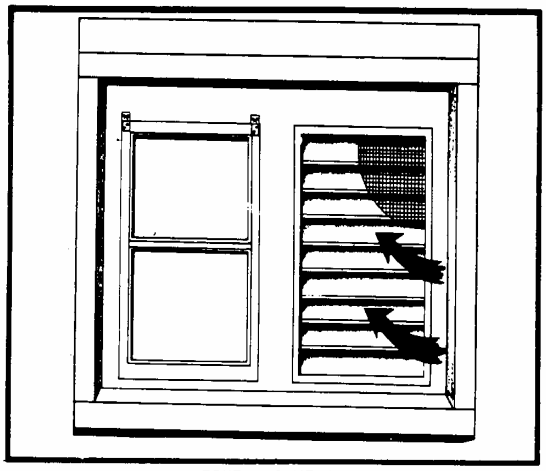
- Louvers: Increase size by 25%
- Screens: Increase size by 40%
- Furnace Filters: Increase size by 60%

These figures only apply for constant operation, however. If you are only using your generator on a short schedule, once or twice a day, you may well be able to use no outside cooling system or 1/2 the above figures at most. Another rule of thumb for cooling air flow in CFM (cubic feet/min) is approximately 10 times the kW rating. (Example: 10 kW generator needs 100 CFM of cooling air).

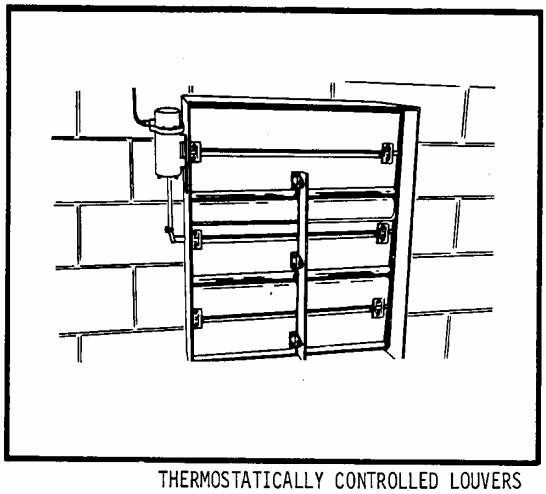
Even if you do not provide for outside cooling, all generators must breathe. Combustion air in CFM is generally determined at three times the kW rating. (Example: 2 kW generator needs 6 CFM). Again, these figures apply when operating at full capacity.

Cooling System Types

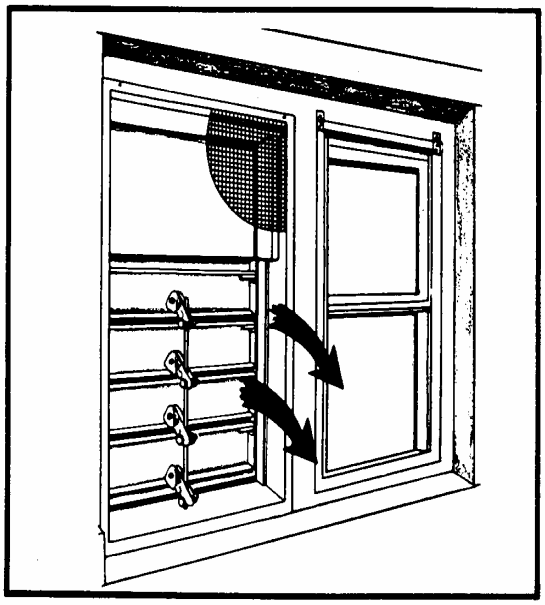
- FORCED AIR SYSTEM: This is the most common for portable generators. A fan simply forces air around finned areas of the cylinder block and head.
- AIR VACUUM SYSTEM: (See illustration.) This is more effective in a confined space. It reverses airflow by sucking air out through the shroud jacket rather than pushing.
- AIR VENT SYSTEM: (See illustration.) A modified forced air system which ducts the hot air away in a duct rather than into the room. Diesel models all vent to the side, and LP gas or gasoline models vent to the top or side.



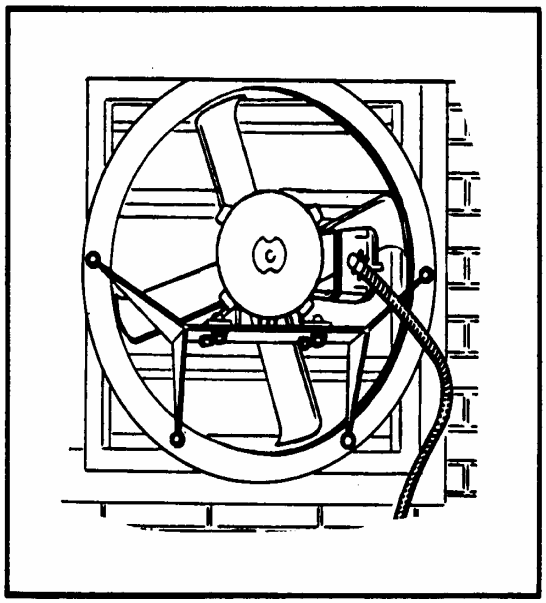
FIXED LOUVERS FOR AIR INLET



THERMOSTATICALLY CONTROLLED LOUVERS

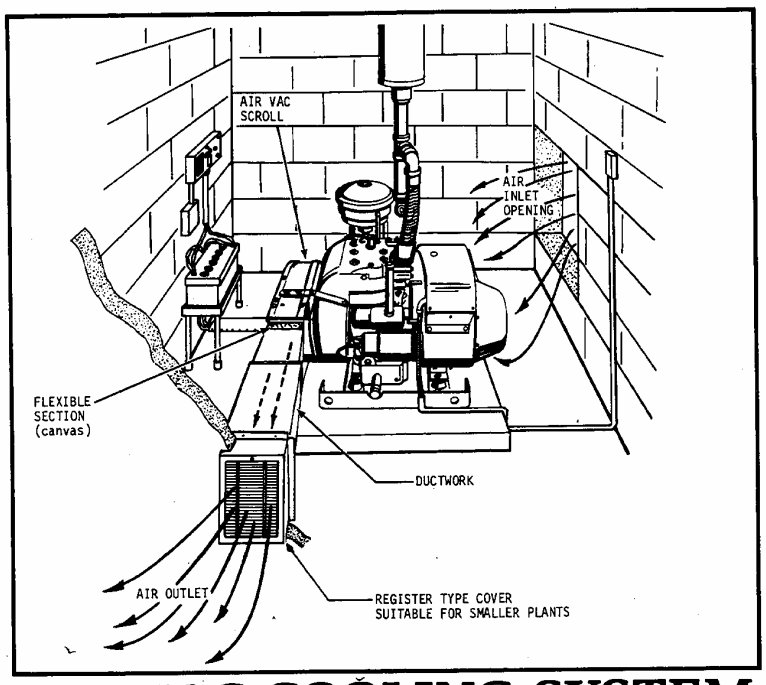


EXHAUST FAN OPERATED LOUVERS

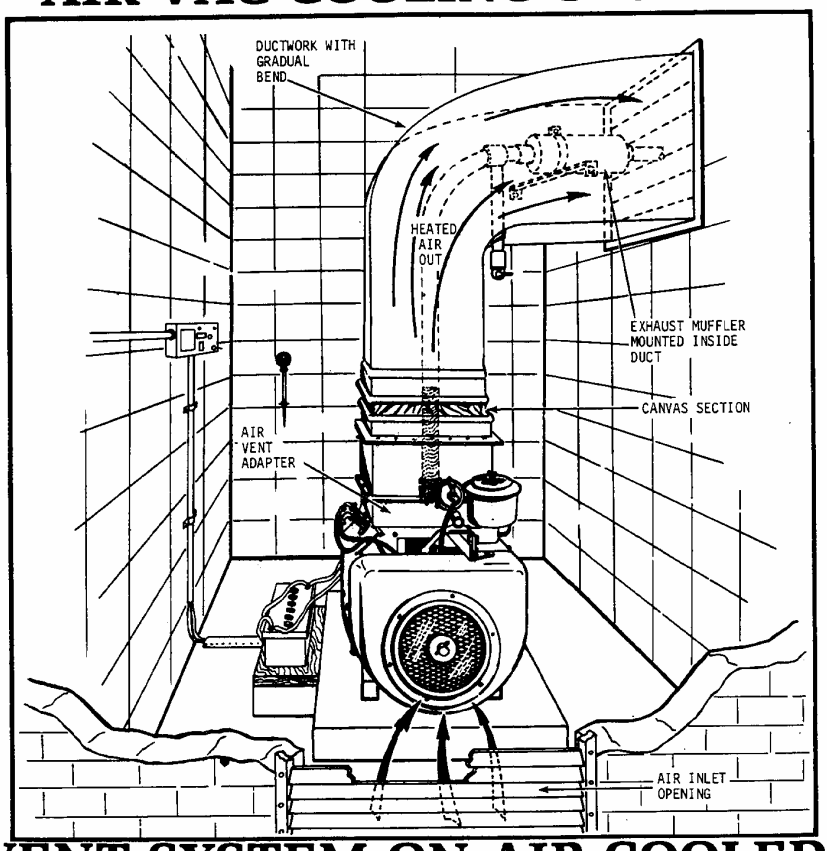


FANS REQUIRED ON SOME INSTALLATIONS

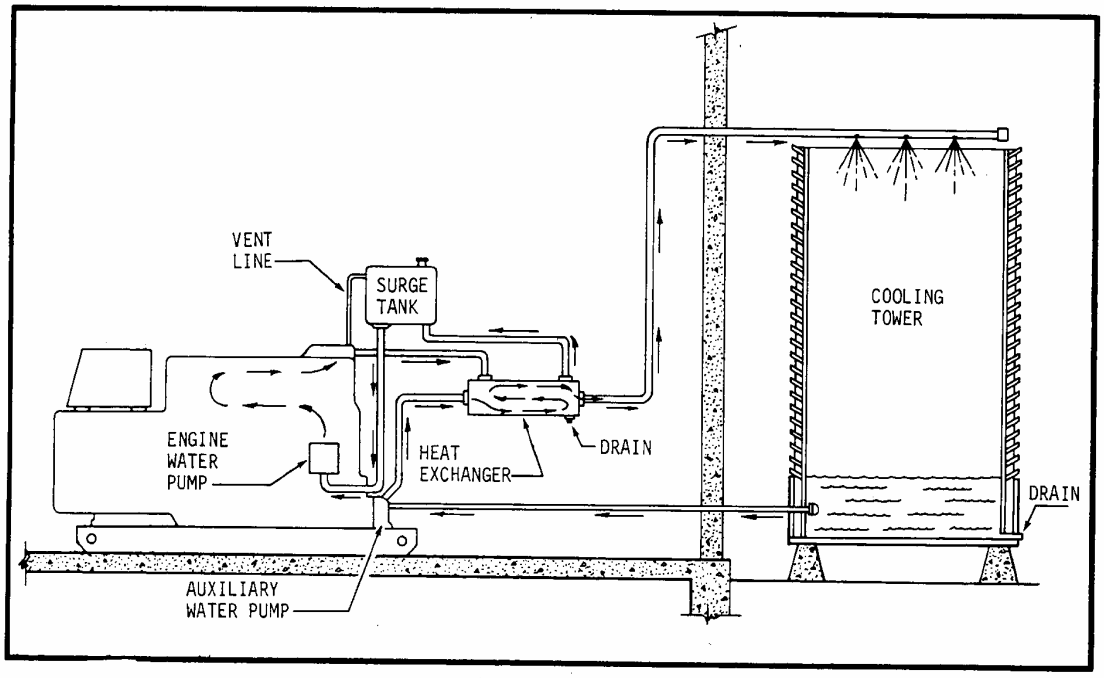
EXHAUST FAN LOUVERS



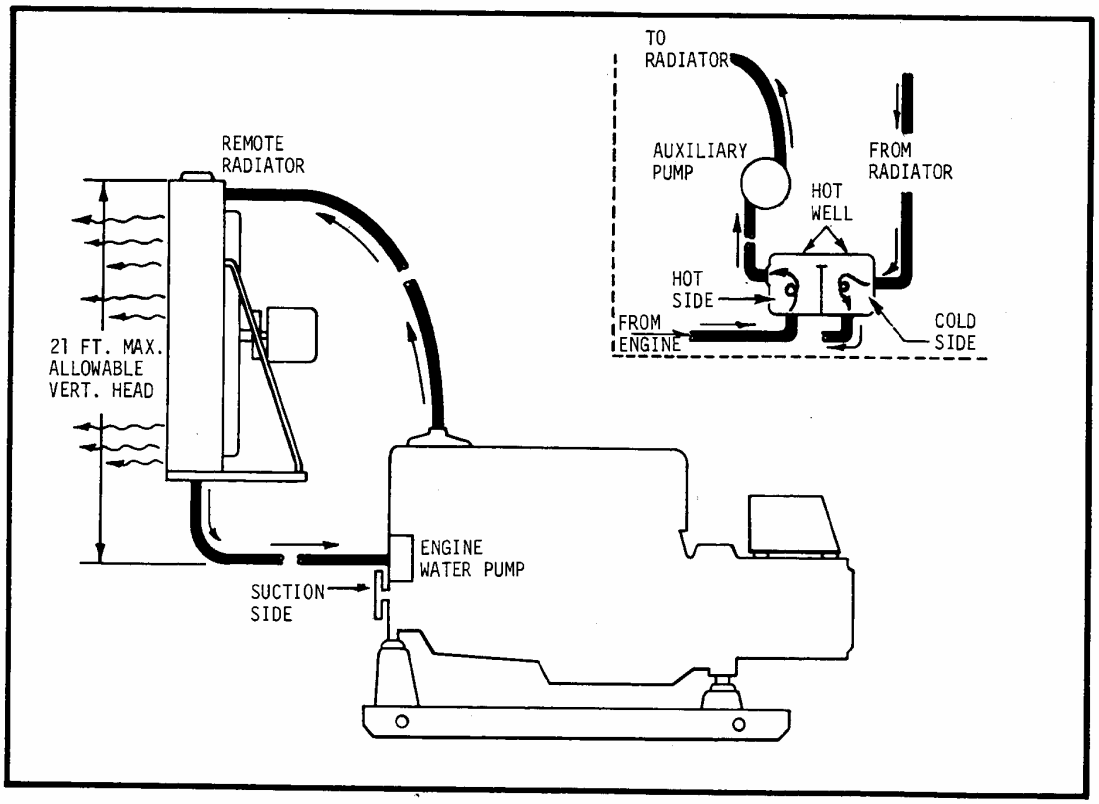
AIR VAC COOLING SYSTEM



AIR VENT SYSTEM ON AIR-COOLED SET



COOLING TOWER SYSTEM



REMOTE RADIATOR SYSTEM

There are three types of general cooling systems on liquid cooled gensets:

1. RADIATOR COOLED: The radiator is either integral to the engine or sometimes remotely placed to better dissipate heat (see earlier illustration on the large Stand-by Genset). Almost all the large home generators will use radiators. The following illustration shows a remote radiator installation. This is the system most recommended for private generator installations, where one does not want to have any louvers penetrating the generator room which will be hard, if not impossible, to sound insulate. Simply plumb in a remote radiator up in the garage and you can have auxiliary heat when you need it. Some have even provided two remote radiators with appropriate valves. One goes in the furnace system to provide heat for the house, and the other in a garage for dumping when too warm to use. Changing the valves on the hoses routes the hot water to whichever use is desired. But perhaps the most efficient use is to tie the generator cooling system to an external liquid heat exchanger and connect it to your preheat water tank. Now, any time the generator is running, you will be heating hot water for domestic use.
2. EXTERNAL WATER COOLING: This type of system should not be used unless you have access to a lake, a river, or sea water where you have access to a large body of water that will not be appreciably warmed by the addition of generator heat. If you have a retreat on a lake or river, you can simply let the generator water pump bring in lake water and pump it back out to the lake. This is wasteful of the heat and should not be used when the heat could be used to heat domestic hot water, as mentioned previously.
3. COOLING TOWER: This system is a dual loop system–the first is the heat exchanger loop which circulates through the engine (note that an expansion/surge tank is necessary), and the second is the cooling tower loop. Some water is lost in the second loop through evaporation and must be made up through periodic additions. This is only used in large industrial equipment.

Fuel Requirements

Gasoline

Gasoline has some advantages over other fuels in its universal availability, ease of starting, and relative ease of handling. It also has some disadvantages of being highly volatile, being expensive, and having limited storage time without special additives. Gasoline tends to separate or stratify in storage. Stabilizers inhibit this. Make sure there are no copper fittings in your gasoline storage system. Copper reacts with the fuel additives and degrades the fuel rapidly. PVC plastic pipe is suitable for fuel use, and is very inexpensive.

The normal fuel system for most small generators is the small gravity-fed fuel tanks mounted above the carburetor–called a day tank. Since gasoline tanks larger than 25 gallons are normally prohibited inside structures, only the smallest-sized sets use this system. On larger sets, the system is limited by the distance horizontally or vertically that the engine-mounted fuel pump can carry the gasoline from the tank. This is usually limited to 5-8 ft. vertically and 12-14 ft. horizontally. If the tank must be located outside

these bounds, it is necessary to install an electric boost pump in the tank or line to push gas toward the engine pump.

Another system uses a priming tank to ensure sufficient automatic starting fuel when the generator has been sitting unused for long periods (see illustration). The priming tank, above the carburetor, always retains a certain amount of fuel. While the set is operating, the fuel from the priming tank, used in starting, is replenished by the fuel pump since it is in series with the carburetor. A separate return line to the main tank must be used to avoid pressurizing the carburetor. The return line must be as large as the feed line.

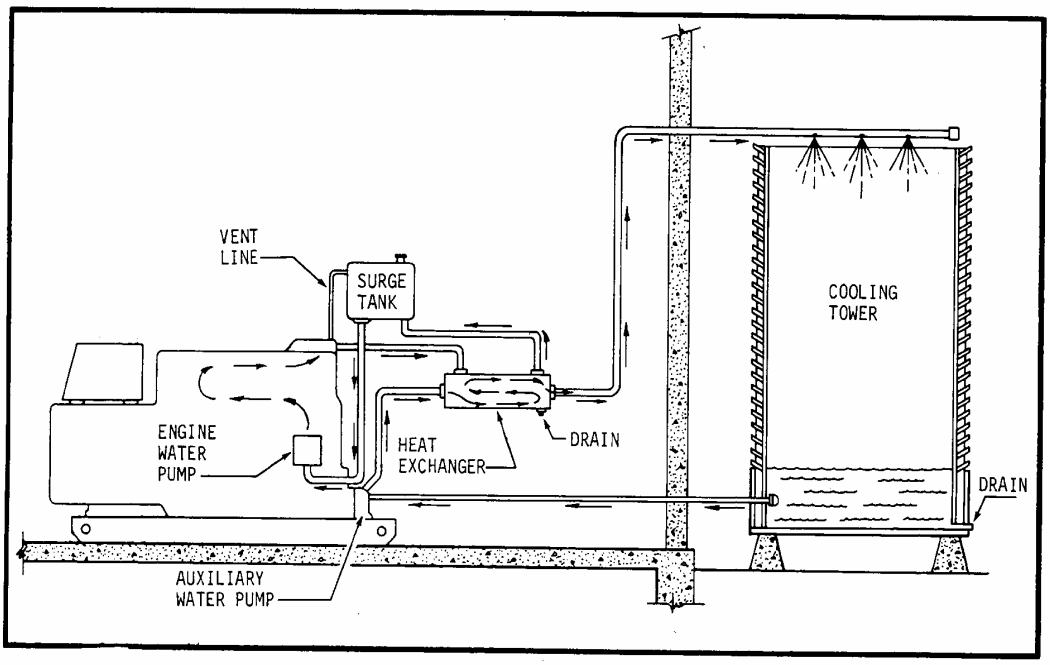
Normally, fuel tanks should not be located higher than the float level of the carburetor. If the gravity pressure is sufficient to unseat the float needle valve, the generator will accelerate uncontrollably. For tanks located above the carburetor, it is necessary to provide a valve (spring loaded to the shut-off position) which is electrically opened at the time of startup. This is a standard item in many cars to prevent "dieseling" or "after running" after the car has stopped. An additional precaution is the antisiphon hole inside the tank on the feeder line (see illustration). This prevents the emptying of the tank by inadvertent or purposeful siphoning of the feedline.

With all this said, it should be noted that because of the danger of gasoline systems and the complexity of the above fuel systems, very few stand-by generators use gasoline. Gasoline is almost exclusively used now in small portables with their own self-contained fuel tanks mounted on top of or on the side of the engine.

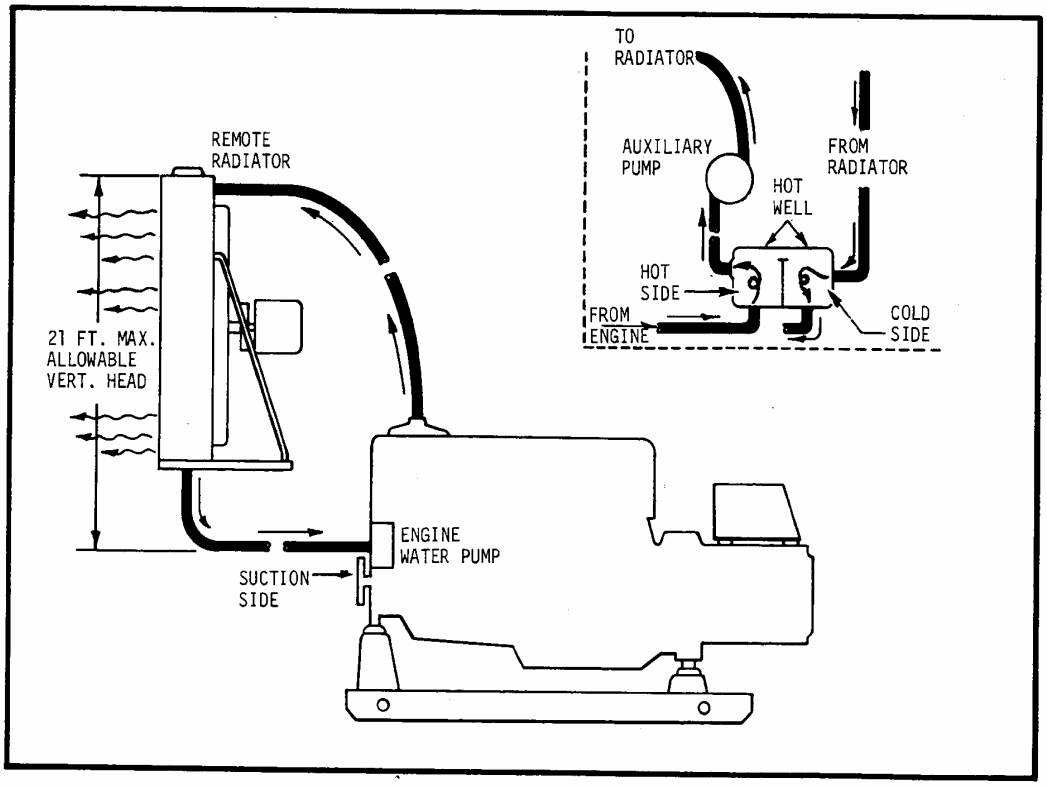
Diesel Fuel Systems

Since diesel fuel is less volatile than gasoline, it is allowed inside structures in much larger quantities. Due to the high pressures involved in fuel injection systems on diesel engines, extreme care must be taken to keep air and foreign particles out of diesel lines and fittings. Galvanized iron and metal surfaces should never be used with diesel systems because the oil reacts with the zinc in the pipes and causes flaking that clogs the system. Black iron pipe or copper is the best, though plastic pipe is often used now as well. The best location for the main fuel tank is on the same basic level as the fuel pump, but lower than the injectors. When situations dictate otherwise (such as with the use of underground tanks), additional pumping provisions may be necessary. When the main tank is located close to the set and when the vertical lift is five feet or less, the pump may be able to handle the load. Generally speaking, when the static head of pressure exceeds six inches hg (column of mercury), an auxiliary pump and priming tank are necessary.

Priming tanks or *day tanks* are small tanks attached about one or two feet above the fuel pump of the diesel engine. These are used to provide gravity-fed starting fuel. This tank is filled by an electric boost pump from the main underground fuel tank so that the engine pumping distance is only required from the day tank to the engine. These day tanks have an internal float which shuts off fuel when a certain level is reached within the tank. A day tank is a good way to avoid the problems associated with any larger fuel supply either overhead or underground. The pressure head is reduced from the overhead tank since the pump takes fuel only from the smaller day tank. However, an electric solenoid valve



COOLING TOWER SYSTEM



REMOTE RADIATOR SYSTEM

must be used here to assure that leakage will not occur. *Transfer tanks* are essentially very large day tanks which allow an engine to continue to operate after the main fuel is depleted.

Many tanks are replenished by a nonpositive displacement pump with a release valve so that excessive pressure does not force fuel out the vent system. All main tanks should be vented so that excess pressure can escape. The vent must be designed so as to prevent the entrance of dust, dirt, and moisture. Return lines from transfer tanks must not enter the main tank near the feedline because the air bubbles formed by returning oil are fed into the fuel pumps, lessening effective pressure.

Fuel Recommendations for Diesels

#2 Diesel Fuel: This is minimum 40 cetane-rated fuel meeting ASIM fuel standard classification I-975-60T. Number two domestic furnace oil used to be a lower grade of fuel which was unsatisfactory as an engine fuel, but this is no longer the case. It is all one grade now, with the exception of sulfur content.

#l Diesel Fuel: Kerosene is included in the fuel (forty cetane) to improve operating conditions above 5,000 feet and cold weather. It is more volatile and less viscous (flows easier). It is necessary to add one quart of lubricating oil to every 100 gallons to make up for the lack of engine lubrication normally available in #2 diesel fuel.

Fuel additives: There are a number of fuel additives for diesel to improve running and eliminate smoke. They also eliminate water in the fuel and help keep algae from growing when water is present. Mileage is definitely increased with the better additives. These are highly recommend–see the “Recommended Equipment and Sources” section.

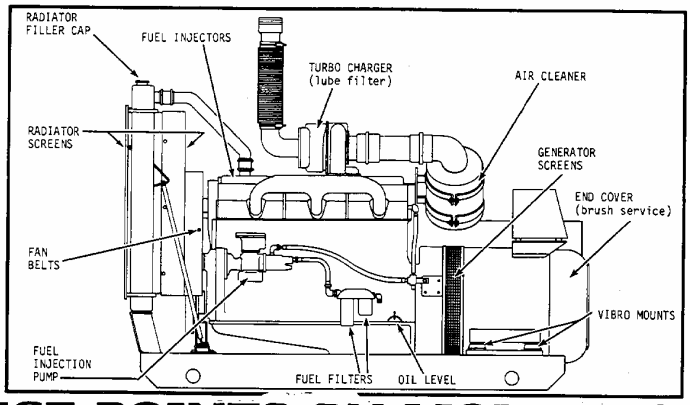
Gas Fuel Systems

There are four major types of gas/combination systems:

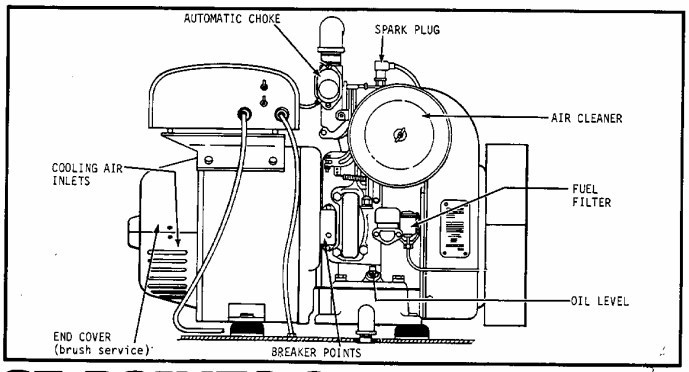
1. Liquefied petroleum gas (LP)
2. Natural gas, including manufactured sewage gases, methane
3. Dual fuel systems (natural and LP)
4. Combination types that use either gas or gasoline

Gaseous or compressed gaseous fuels are rated according to their heat value per cubic foot or per gallon (propane conversion factor is 36.39 cu. ft. gas per gallon liquid, and butane is 31.26). Some deception sometimes occurs when suppliers rate their supplies according to the “high heat” value, which doesn't take into consideration the primary factor which makes one fuel better than the other–the hydrogen proportion. The higher the hydrogen proportion, the higher the production of water vapor in the combustion process and hence the lower the true heat value. Always ask for the “low heat” value which takes this into consideration. It makes a difference of anywhere from 10%-15%. Liquid petroleum gas is usually propane or butane or a combination of the two. It is the ideal storage gas for indefinite periods because it does not deteriorate with time. Propane

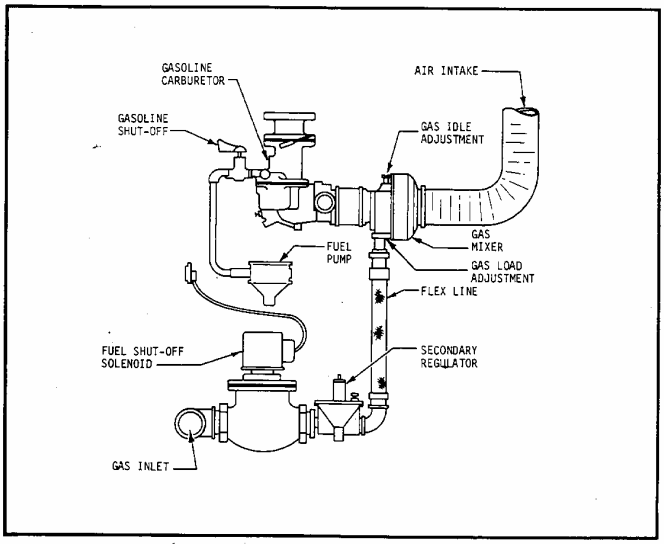
DIESEL



SERVICE POINTS ON LIQUID COOLED SET



SERVICE POINTS ON AIR COOLED SET



COMBINATION GAS-GASOLINE SYSTEM WITH MIXER

is preferred where gas is subject to below freezing temperatures as butane loses most of its pressure below 32° F. The user should specify the exact type or mixture of the two types he desires in areas where it is customary to mix the two types of gas. In very cold climates, butane is rarely used. You can rely on all well-established propane companies to provide you with fuels of the proper pressure.

Gas Piping

Gas pipes must never be used for electrical grounding and must be mounted rigidly and protected against vibrations. A flexible connector is a must where the primary connection joins the engine or the tank (see illustration). All pipes should be black iron or the new plastic lines which are legal outside the home. Joints must be securely fastened and sealed airtight.

General LP Components

The primary regulator is used to control the gas pressure as it comes off the transmission line or from the storage tank. Pressure is reduced to allowable inlet pressures for the secondary regulator. The secondary regulator is a low pressure type which admits the proper amount of gas to the carburetor as demanded by the float valve of the carburetor.

The fuel shut-off automatically shuts off the fuel supply when the engine is stopped. Most valves are electronic solenoids, spring-loaded to the closed position. Some have safety features which close even if the engine stalls with the ignition on. Earthquake shut-off valves protect against leaks. There are two types of carburetors: straight gas and combination gas-gasoline, which allows the engine to run on either fuel. The vaporizers are a device used to heat the liquid LP gas to increase its pressure for regulation and combustion. The following illustration shows a gas-gasoline combination setup, as well as generator service points for maintenance

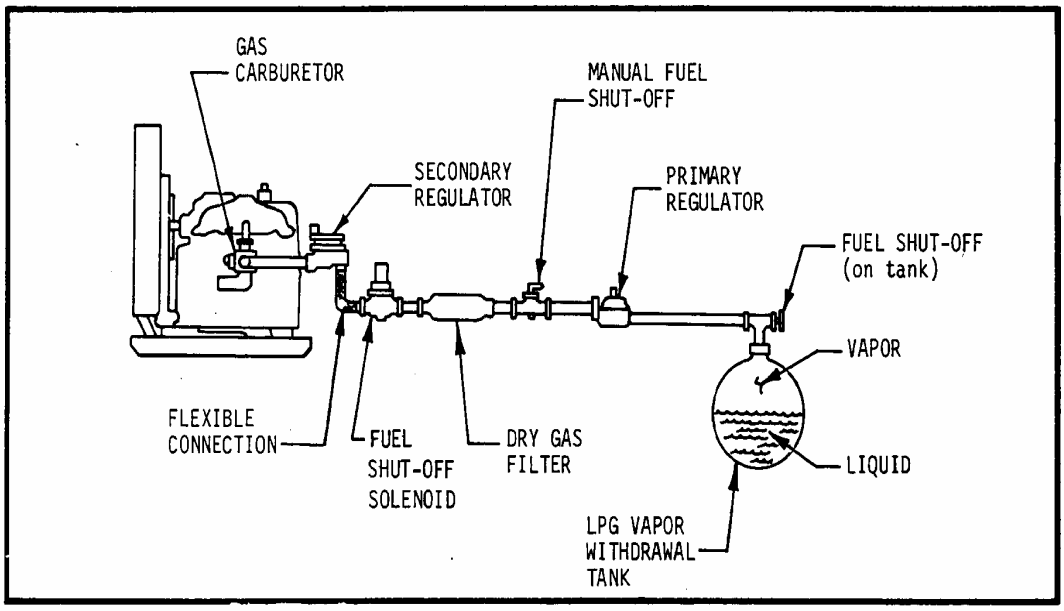
Gas Supply Systems

Vapor Withdrawal System

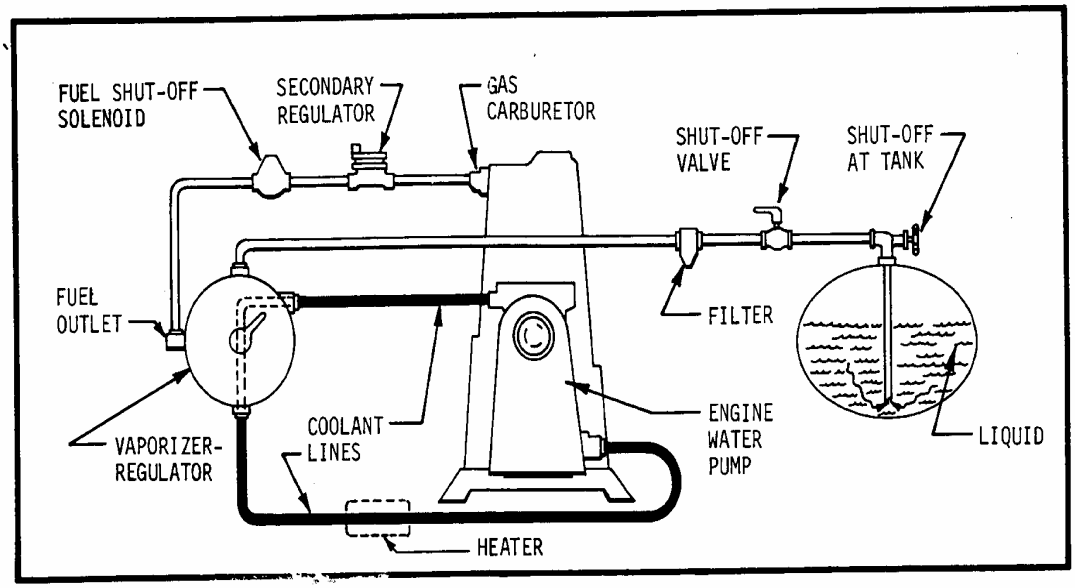
(See previous illustration) This system is used when the tank has sufficient pressure to expel its contents in gaseous form. For such a system to operate, the liquid content of the tank cannot exceed 90% and air temperatures must be high enough to promote vaporization below 40°, butane has little effective pressure below this temperature; thus, it is relatively useless with this type of system. Note that propane tanks are usually only filled to 80% of their capacity to allow for vapor pressure. If you have a 1,000 gallon tank, you really only have 800 gallons of liquid gas.

Liquid Withdrawal System

This system is used when vapor pressure is not sufficient for withdrawal. LP gas is forced out of the bottom liquid side of the tank by external pressure into a vaporizer which preheats it to increase vaporization pressure. Vaporizers receive their heat from the



LPG VAPOR WITHDRAWAL SYSTEM



LPG LIQUID WITHDRAWAL SYSTEM

engine, either directly or through the coolant. Electric heaters are used for the initial start-up and where temperatures are extreme.

Dual Fuel Systems

Dual fuel systems offer automatic changeover from one fuel to another, between natural gas (NG) and LP gas. This is done by the use of two separate regulators–a line pressure regulator for NG and a vaporizer regulator for LP gas. Cutting off the NG creates a partial vacuum in the line which automatically opens the LP regulator. Of special interest to the self-sufficient family are the combination gas and gasoline systems. Fuel changeover is not automatic, but requires very few steps. These systems normally use gaseous fuel as the major source and gasoline as the back-up, but both types of setups can be installed: either a gas-gasoline carburetor or a gasoline carburetor with an LP gas adapter.

Maintenance

Regular servicing of generators is extremely important to prolong their life. On the previous page, 419, is a sample idea of types of services required, not including major overhauls. In addition, I highly recommend using Militec-1 oil treatment to prolong engine life. This is one of the few oil treatments that has a proven track record and numerous scientific studies to back-up their claims. It is not expensive and, added to an engine every 3rd oil change, will double the life of the engine. Not a bad investment for a $25 treatment once a year or so. This treatment works for all vehicles and transmissions as well. Oil change intervals. on gas and gasoline engines are extended since the oil gets less dirty. However, oil change schedules should not be extended on diesel engines. Even though the Militec-1 guards the engine metal parts, the carbon content that drips down into diesel oil systems must be removed periodically. There is a sophisticated oil filtering systems by Amsoil that will help on diesels–so use both if you can. Generator life is essential to preserve. In a major crisis, you may not be able to make repairs or have access to parts.

Special Accessories

GenMate Auto Start Switch (Not A Transfer Switch)

When putting together a hybrid system that includes a generator, you may want to add a special controller that automatically starts your generator whenever the batteries get down to a certain level, or when a high draw item like a 220 volt water pump starts up. The GenMate automatic generator controller starts the genset on demand to recharge batteries or start a water pump. An internal micro-computer continually monitors battery condition, external controls, or water pressure switches. The unit can set generator start and stop voltage, low battery alarm set point, and number of generator start attempts. For water pumping, connect to a float or pressure switch.

Auto-Generator Start Controller & Transfer Switch

Program your generator to start automatically when your batteries are low and turn off when charged. You can usually install such a system for about $150-$400 but it depends

on the situation and type of generator. Options include a manual bypass, overcrank protection, visual and auditory alarm for start failure, visual genset running indicator, and remote control reactivation of the start cycle.

WATER POWER GENERATION

Water power is the most sought-after source of independent power, not only because it is consistent and strong, but because water is also the "life blood" of physical existence for a preparedness home or retreat. Every effort should be made to secure an independent source of water. It used to be that use permits for power generation were not as hard to obtain as irrigation rights, but now there is a lot of hassle involved with government red tape and environmental impact. In some states the independent power producers are having to obtain permission from as many as 6 or 8 agencies, and some of their requirements are contradictory with each other.

How to Determine What Type of Power Plant to Install

There are a lot of variables involved in working with water power. The type of power plant we install depends on several important factors related to water sources–quantity, flow, height of fall, condition of the stream bed, abrasiveness of the particles in the water, variations in seasonal flow, and potential for flooding and debris. Except for a couple of new and innovative technologies, we generally have to put the water in a pipe to contain it and concentrate its force upon whatever type of turbine we are using. There are two key terms we must understand first:

- HEAD: The vertical fall or distance between inlet pipe and turbine at the bottom. The speed of water and its pressure is determined mostly by the height of fall.
- FLOW: The volume of water flowing through the pipe.

Determining Head and Flow

The head is measured using standard surveying techniques. The larger the height difference you can attain, the more power there is available. Normally, we are looking for lots of head since the higher the head the cheaper the type of equipment necessary to harness the power.

The flow on a small stream is best measured by running it over a small waterfall or through a large pipe and measuring the time it takes to fill a bucket of known cubic dimensions.

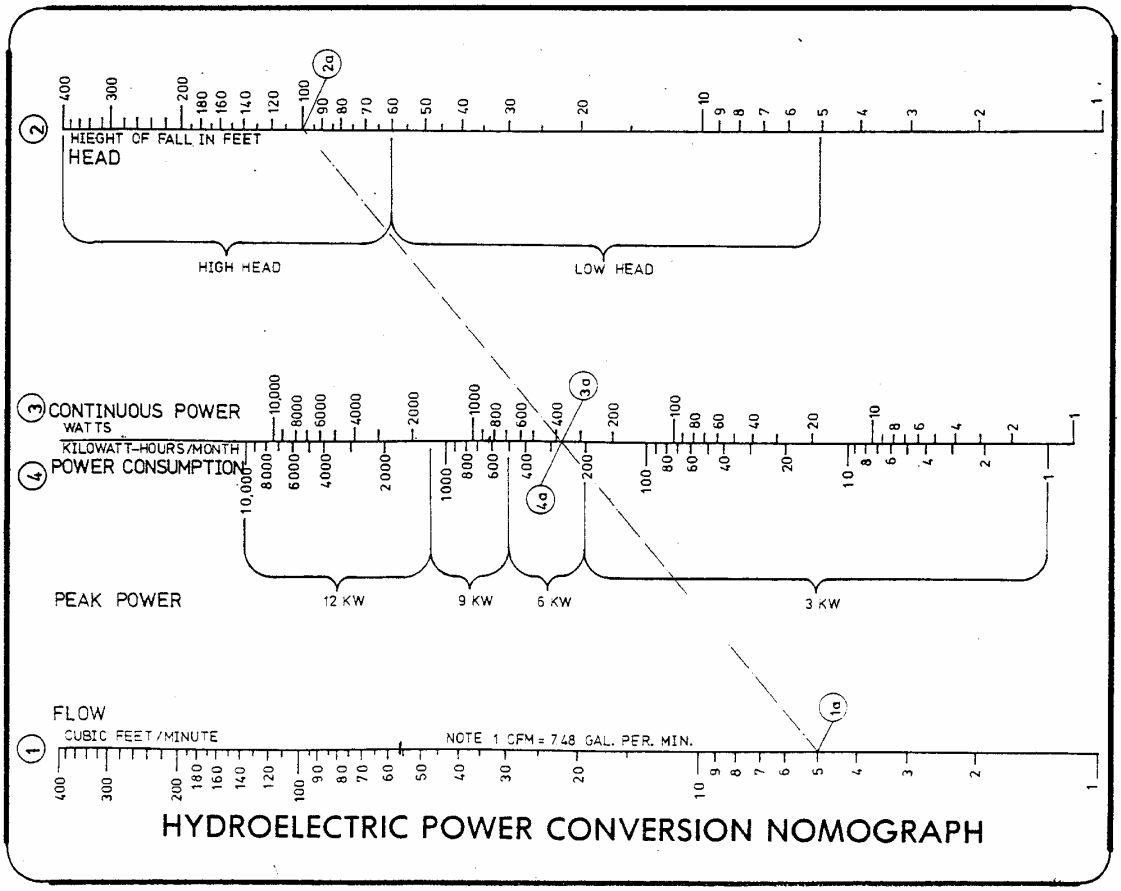
A slow moving stream is usually measured by constructing a *weir* (a special measuring dam) which requires a few hours to build, even on a small stream. Measuring anything

HYDROELECTRIC POWER

Once the head and flow have been determined for your site, you are ready to determine the amount of power you can expect. We have prepared a nomograph for this purpose. The nomograph is simply a chart which enables you to determine your power output from any combination of head and flow values which are within the range of I.P.D.'s hydroelectric systems.

HOW TO USE THE NOMOGRAPH

1. Locate your flow value on scale (1).
2. Locate your head value on scale (2).
3. Using a straight edge (ruler), draw a straight line through these two values. (See the example on the nomograph using 5 C.F.M. flow (1a), and 100 ft. of head (2a).)
4. Your continuous power output appears where the line intersects scale 3. (For the example, the value is about 360 watts (3a).)
5. Scale 4 gives the equivalent total power consumption per month in KW hr./mo. you may expect. (For the example 360 watts (3a) of continuous output will produce 260 KW hr./mo. (4a) of usuable electricity).
6. The peak power output of the system is shown by the brackets. (For example the value is 6 KW.)



HYDROELECTRIC POWER CONVERSION NOMOGRAPH

larger than a stream would be a major task. You can accept a less precise method, simply because the water level never remains constant anyway. The important thing is to get a fair estimate of stream capacity–not an exact measurement.

Here is how to proceed. First, pound a couple of wide, short boards on both sides of the stream where it is extremely shallow–this will simplify your measurements. Measure between the boards to find the width of the stream. Next, measure the depth at suitable small intervals. Add all of the total depth measurements together and divide by the number of measurements that you took. This will give you the average depth. Now multiply the width of the stream times the average depth in feet to obtain the cross sectional area of the stream in square feet (see illustration on page 425).

Second, measure off a ten foot long section of free-running stream and time how long it takes a floating object to traverse this distance. Divide the distance by the time and then multiply that time by .08 to give you the average velocity of the stream in feet per second.

Finally, multiply the cross sectional area times the flow in feet per second, and you will have the total in CFS (cubic feet/second).

The power obtainable from water is proportional to the rate at which the water flows and the vertical distance which the water drops (head). The basic formula to calculate this power (in kwh/month) is:

$$\text{POWER(kW)} = \frac{\text{cross sectional area (ft) x FLOW (cfs) x HEAD (ft)}}{11.8}$$

An easier way to determine how much power can be derived from your site is to use a simple nomograph. The following one by Independent Power Developers of Noxon, Montana is self explanatory (see the following illustration).

This is the amount of raw power available. If your generating system is about 80% efficient (which is high), then you will have 80% of the above figure available to you for power generation. With a small stream of water, this may only amount to about 500 watts an hour. But it must be remembered that this is available 24 hours a day which would equate to 360 kW a month. The average American home uses between 1,500 and 2,000 kW a month, so to use limited alternate sources of power, a fair amount of conservation would be in order. This can be done best by eliminating electricity as any heating source (water, cooking, space heating) and replacing them with renewable fuels and solar energy. Even then, our example of 500 kWh would certainly not handle peak loads if several motors or appliances are turned on at once. This can be overcome by storing energy in batteries or in a water reservoir behind the dam (if you have a big enough generator to take advantage of the stored-up flow). As energy is demanded, a gate opens allowing more water to flow. Flow controllers are expensive, however, so I would recommend using batteries.

Dam Construction

(See illustration on pg. 425) The dam is an essential facility to achieve the maximum head possible and to provide some control of water supply. There are three essential design features of a dam which must never be taken lightly:

1. An immovable footing system to hold the dam firmly in place
2. A waterproof face or membrane to prevent water erosion of the dam face and foundation
3. An erosion-proof overflow or spillway surface to keep the back side from eroding

All of these essential design features can be built into the two basic dam structures illustrated. The earthen dam is by far the easiest to build using local materials, but its criteria for construction are more rigid than the masonry dam. A high grade of clay must be available for sealing the dam against leakage. Water seepage through an earthen dam would cause the base materials to become suspended in solution, making them less capable of holding back the pressure. Rocks embedded in the earth on the spillway side can effectively control erosion if tightly packed, at least two deep.

The masonry dam, either of stone and mortar, or concrete, or both, is the stronger but more costly alternative. It is an essential type if you wish to build the generating facility integrally with the dam, which is possible on small stream sites. Larger stream sites may require a combination earth-filled dam on the sides, and a masonry structure in the center where the spillway is located. Either a straight drop spillway or a sloping spillway is suitable as long as the river bed is protected from the pounding and speed of rushing water.

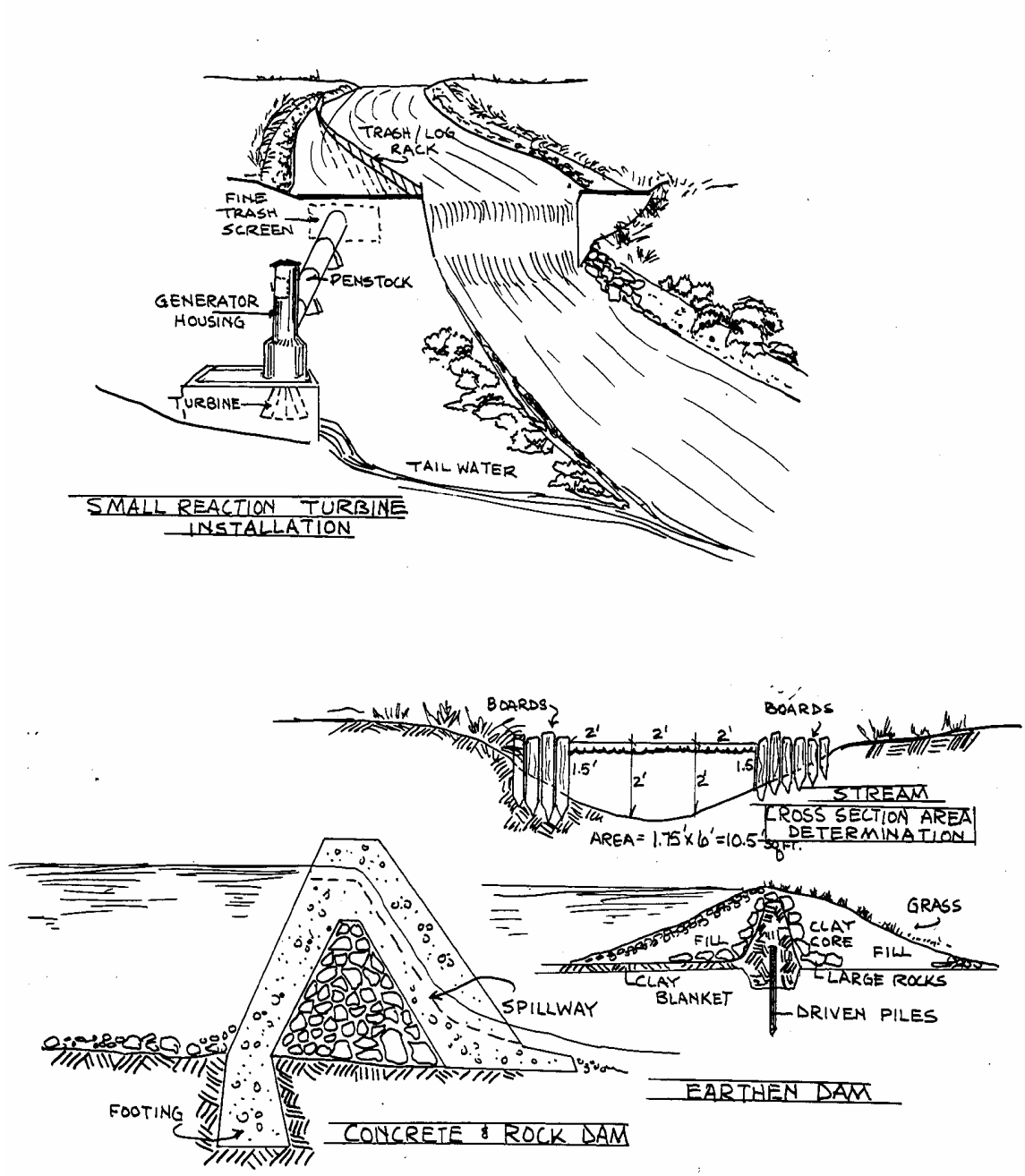
Sometimes I do recommend wood dams, built of large, treated timbers on very small water sites as they are very strong and economical to build. They especially come in handy for the diversion dam you will need to channel the water around your dam construction site. On larger streams where this is impractical, you must build the dam on one-half of the stream at a time, using appropriate dikes, or divert the entire stream temporarily by digging a second channel.

Types of Turbines

The foregoing power equation does not help us to make an initial decision on what type of water turbine we will use. There are some types of turbines which are more suitable for extracting power from high heads and low flow volumes, and others which are more suitable for moderate volumes of slow-moving water (low head).

Impulse Turbines

If your property is on a very steep, mountainous slope with a very small stream with a head of over 50 feet, you will be able to use the inexpensive impulse turbine. Commonly called a *Pelton turbine*, the impulse turbine takes greater advantage of the speed of the stream than the weight of water and is better suited for high heads and low volume



TYPICAL DAM CONSTRUCTION

(see illustration). You will need at least 60 to 100 feet of head to get good performance out of a Pelton. The minimum head is 20 feet. Fortunately, all you need for flow is a full 2 to 4-inch diameter pipe of water. The complete system is composed of a long pipe or hose which channels the water from a high dam down into one or more compression nozzles. These force powerful jets of water against the spinning turbine wheel nearly tangent to its circle of rotation. The resulting speed of shaft rotation (under load) will be about half the speed of the water velocity at the nozzle. The shaft is usually coupled directly to a DC generator which charges a bank of batteries. Nozzle sizes run up to 1/2 inch in diameter. Efficiencies run about 80%.

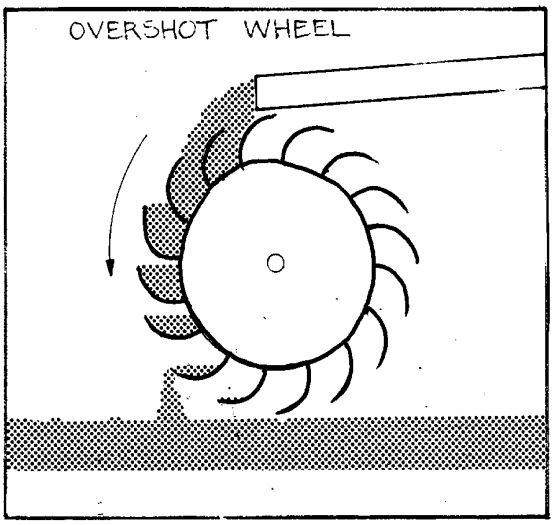
There is a modified high-speed turbine on the market called the *Turgo* wheel. Unlike a Pelton wheel where the jet or jets of water hit the paddles of the wheel straight on, the Turgo wheel has the water impinge on the side, allowing it to take advantage of the wing-like shape of the blades to accelerate the speed of the turbine. This design also allows for a larger flow–up to 1" nozzles instead of 1/2" for the Pelton. While both types drive brushless alternators, the Turgo manufacturers have devised an electronic system that allows for changing the voltage right on the motor. You can select from 12, 24 or 48 volts with a change of wires. It costs about 20% more, but for locations which have a little more flow, this is the overall best choice. Another advantage of this turbine is its ability to use lower heads. You can put a Turgo on as little as 5 feet of head if you have high flow. This won't produce a lot of power, but it's better than the 20 foot minimum head required for Pelton wheels.

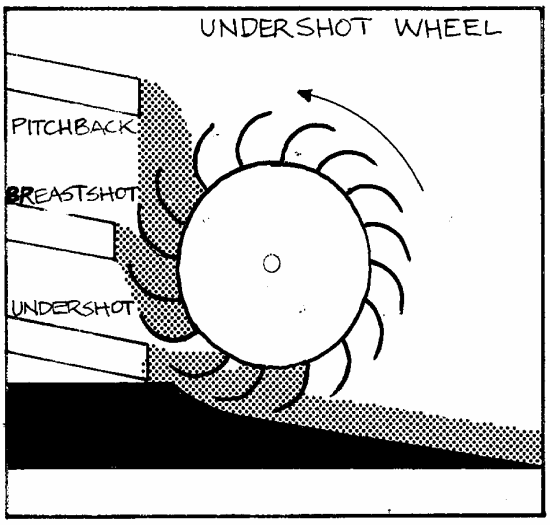
Reaction Turbines

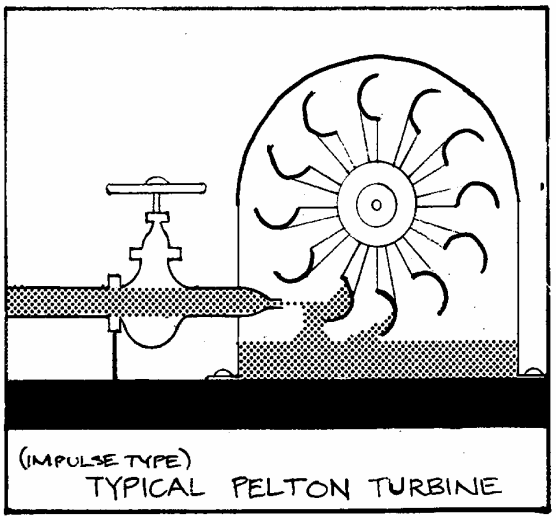
The large intermediate area of water power with medium heads and medium flows is best suited to the more common reaction turbines such as the Francis, Hoppes, or Nagler turbine. Horizontally placed, as illustrated, resembling fan blades, reaction designs utilize the force of water to cause a force on the turbine blade at near right angles to the direction of flow. This angular force causes the turbine shaft to rotate at speeds nearly equal to the speed of the water striking it. This still does not eliminate the need for gearing up to generator speed, but it does allow for increased efficiency in the process. Both impulse and reaction turbines are susceptible to balance problems and are hard to manufacture without precision tools and casting methods. Reaction turbines are suitable for AC generators and the regulation equipment that goes with them. However, most small systems still run a DC generator and charge a bank of batteries. Efficiencies run about 70% to 85% depending on the head.

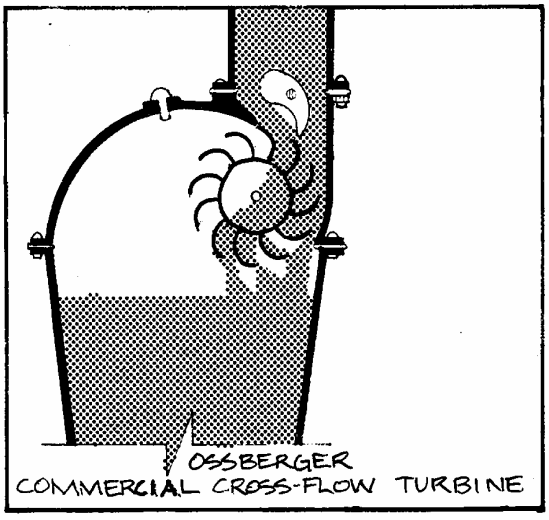
Crossflow Turbines

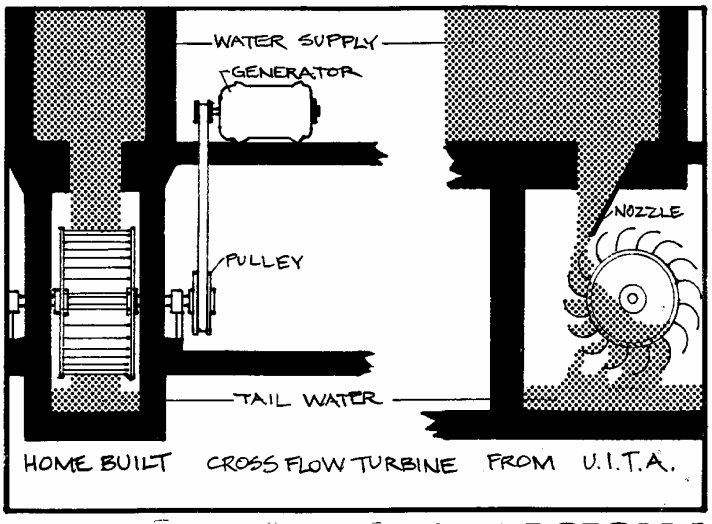
One other type of turbine is the crossflow (or Mitchell/Banki) high-speed type of turbine, which lends itself to home manufacture. The crossflow turbine looks like a simple water wheel, but its hollow design in combination with high-speed nozzle inlet makes the water shoot through the unit and strike the blades twice before exiting. Efficiencies of about 65% have been achieved on home-built units, which is fairly good. Crossflow turbines have good torque and can be geared up to use a higher RPM generator. This type of turbine is really the only one suitable for home manufacture, and can be done with basic

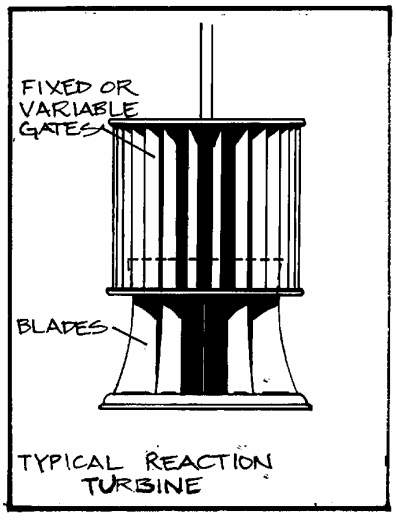












WATER PROPULSION METHODS

welding technology. Crossflow turbines can be used for heads as low as 1 meter and up to heads as high as 200 meters.

Submerged Propeller

Where there is a fast flowing stream but virtually no harnessable head, a submerged propeller-driven turbine may be used. The only American model is a small 100 watt unit costing around $1,000. It is the Aquair unit and looks like a small submarine about a foot long with a large propeller on the front. If you put it inside a pipe, it is more effective and can put out a nice stream of power 24 hours a day. Even at the measly 100 watt output, that's 2,400 watts per day. There is another larger floating unit I describe in the equipment listing but it is only manufactured in Australia. Because of its size, it would be uneconomical to import.

Waterwheels

The most difficult type of water source to deal with is the wide, high volume, slow-flowing river. Finances and time do not permit the heavy excavation and costs (not to mention regulatory requirements) associated with building a large, wide dam. Thus, other than the floating type of propeller units just mentioned, this type of water is only suitable for the large waterwheel, using an "undershot" design, as illustrated. Any site allowing a breast shot or overshot design will be better suited for one of the reaction turbines described. If you have enough head to make a spillway high enough to route water over its eight foot height, then you have more than enough to use a reaction turbine. The only reason for not doing so might be purely financial where you plan to hand-build the waterwheel and gearing mechanisms for the generator. Waterwheels themselves are fairly efficient. But the shaft speed requires so much gearing to come up to the required 1800 rpm that a great deal of friction losses occur in the process. A more efficient way of converting waterwheel energy to motor or generator shaft speed/power is to drive a hydraulic pump with the water wheel. The flexible hydraulic lines can then be routed around the shop to a portable hydraulic motor which, in turn, can drive machinery or a generator. Variable gearing attachments are available to compensate for different hydraulic pressures incurred by the wheel.

Large Residential Hydro Power Systems

If you want to generate large amounts of power (from 10 to 50 kW), you will need to deal with a major manufacture of custom designed systems. The longest- running American company in the field is the JAMES LEFFEL COMPANY, which uses a Francis type turbine to extract power from high volume, low head rivers. There are 3 or 4 other American companies now that have similar operations. HYDRO-WEST in Washington State is a comparable supplier on the west coast. With large systems, you cannot buy a simple off-the-shelf unit. Each unit must be custom-designed for the actual site. The pipeline system, water inlet, trash racks, generator house, controls, and transformers all have to be matched to site conditions. Naturally, this is very expensive. But these systems will produce large amounts of power and will allow you to sell power back to the utility companies at a substantial long-term profit. So if you have a moderately large source of year-round water, and have a community of homes that needs power, this is the

way to go. See the “Recommended Equipment and Sources” section for addresses and URLs.

If you desire a completely underground, concealed power system, there is one source of submersible generators. Not only are there privacy advantages to the submersible units, but it avoids the costly process of making a turbine house, as is necessary to enclose other generator types.

Medium-Sized Residential Power Systems

Most residential applications are under 10kW simply because of the high cost of harnessing larger flows of water with big equipment. Unfortunately, in the past few years almost all the companies that used to manufacture systems in this medium range have gone out of business. The ones that have survived have done so by specializing in bigger, more expensive systems. So, even though they will still handle small to medium requests, they are used to bigger fees, and small customers end up paying a premium.

Microset turbines, for example, marketed by Jade Mountain, operate with water heads as low as three feet, and flow rates of as little as 1.3 gallons per second. Water heads as high as 40 feet and flow rates up to 380 gallons per second are possible. Microset turbines use a propeller driven by flowing water to generate power. Their most unique feature is that the generator also serves as a pump, enabling you to lift water and start a siphon flow through the turbine. That eliminates the need for elaborate water handling weirs and ducts. With the right combination of head and flow, the smaller of these units can supply all the electrical needs of 4 average houses.

This means that you can hardly do any economical sort of medium sized hydro system without paying at least $50,000. While this cost is almost 4 times more than comparable power in an engine driven generator system, your fuel costs are zero, and your maintenance costs are about half of the engine driven type. Of course, maintenance does happen–especially on anything but a Pelton wheel. Periodic cleaning of the intake screens can be a hassle if you are in an area where the water receives a lot of fallen leaves and branches during the spring and fall–not to mention periodic floods, which can do significant damage to your inlet if not properly designed. Water power is exciting, but it’s no free lunch. That is why you either pay big dollars and produce a lot of power for multiple homes, or you go with the small micro-hydro systems

The Pipeline

Except for the submersible or floating propeller type units, if we want to harness water power we must have a pipeline to contain the water from inlet to generator. Unless we put the water in a pipe, the water head doesn’t do us any good. Large and medium-sized, low head hydro systems require large pipe sizes and a fairly sophisticated pipeline inlet and trash rack screen. Twelve-inch pipe is common and comes in various “schedules” representing different strengths, sizes, and materials. You can figure on paying $5-$l0 a foot for this size of pipe, and that's not all. If you make any bends or turns, each angled fitting will cost you about $100 in the larger pipe sizes.

Fortunately in the pipe sizes of 2" or less which you use in micro hydro systems, the pipe and fittings are fairly cheap. With all pipelines, we must have a series of trash racks and screens on the pipeline inlet to keep debris and small fish from being sucked down into the turbine. If you have a non-submersible generator, like most Pelton wheels and reaction turbines, you need a small power house which is set over a concrete base and an outlet for the water that will not erode. This outlet trough is usually formed out of concrete as well. All hydroturbines produce some steady vibrations so the concrete base and weight of the total housing must be sufficient to keep it from shifting on its foundations.

Types of Hydrogenerators

After you have made the initial decisions as to the type of turbine and the design and placement of the dam, inlet, and turbine house, you will need to make some further technical decisions as to the type of generator (AC or DC) and its appropriate regulating mechanisms.

AC (alternating current) generators are preferred in terms of convenience and suitability for present day appliances. But they are more costly than the DC (direct current) devices because of the necessity of providing sophisticated flow regulation mechanisms. The alternating current, in order to be useful, has to maintain a constant rate of cycling back and forth, usually at 60 cycles per second. This is wholly dependent upon the speed of rotation of the generator (1,800 RPM). There are two ways of obtaining this constant RPM despite differing water flows which determine the speed of the turbine wheel. Either the flow of water to the turbine can be increased or decreased by use of variable gates, or the gearing from the turbine to the generator can be varied with adjustable pulleys. The most common solution, though not necessarily the best, is the adjustable gate method. These mechanisms are quite sophisticated and therefore expensive, but they have the tremendous advantage of saving water when not needed and backing it up into your reservoir. This, in fact, is the only storage medium for alternating current that is suitable financially, and it depends upon your terrain and location.

While it is possible to rectify AC into DC and store it in a battery, you must provide expensive inverters to convert it back to AC again, at some loss in efficiency. Now if you go to all that expense, it is better to use a DC generator in the first place since it requires no regulation of flow other than a maximum overspeed protection. Direct current is limited in terms of transmission distance due to high line losses: however, AC overcomes this by stepped-up voltages for transmission through a transformer, which has only small losses.

So, with all things considered, here's how the AC/DC decision stacks up. Most small hydro units run a DC alternator and store the power in batteries. The small hydro sites do not have to be near the river since we use a long pipeline to bring the water down the mountain. Therefore, we can locate the micro-hydro anywhere close to the house, as long as we have some place for the water to go. Medium and large scale hydro systems almost always generate in AC and are tied into the utility power grid so that any power not used is sold back to the utility. AC also is preferred because the distance from the

river to the home is sometimes several hundred yards. AC lends itself to using step up transformers more than DC.

WIND POWER GENERATION

Wind power has always been an exciting potential resource. Unfortunately, when the realities of production settle upon us, it becomes impractical in some cases. It is hard to avoid the temptation to run out and buy a wind generator in the spring when most areas of North America experience two or three windy days at a stretch. For some reason, people are easily fooled into forgetting about those long periods of little or no winds which abound in most areas of the United States in the summer, fall, and winter. I have a little better sensory criterion to help you determine your area's wind potential.

Make Sure You Have Enough Wind

The best way to recognize an area of good wind potential is through your sense of *discomfort*. You should be *frequently complaining about the wind* if you live in an area with high production potential. Good wind areas also mean higher levels of air infiltration into your house, higher heat loss in the winter, and problems with blowing dust, sand, or debris. For serious wind power generation, the winds in the proposed site should average 10-15 mph. If you want to be totally self-sufficient through wind power, a fairly large and expensive wind machine will be required. It should be coupled to a battery bank for energy storage and use during periods of low wind output.

But let's suppose only half of the year produces good wind potential. You may want to consider a hybrid system that combines another alternate means of power generation with your wind machine. Most areas in the east have good winds in the winter, and poor solar potential during this same period. Yet, in the periods of good weather, they have lots of sun but no wind. These are excellent conditions for a combination system–a wind generator for the winter months and a solar PV system for the summer. It isn't as cost-effective since you have to buy two different systems, but you also have the benefit of redundancy and the complimentary nature of the two–when one is not producing, the other usually is.

Still want to live in a good wind area? If so, the first thing to do is redesign your house so that it is protected and sealed up against wind effects. This could include earth-berming the first three or four feet of the house and providing fences and wind-breaking trees wherever necessary. In very high wind areas, we might even consider using sloping shapes for the house on the windward side in order to lessen wind noise and wind resistance. It is also possible to find a site in a wind-shielded area where the wind machine is still within 100 yards of your home. Windbreaks composed of densely planted trees can also help to reduce the wind effects on the home.

Investing in a major wind system is a lot more than just buying the wind generator. Large systems require a significant investment into a large tower system, including cables to guy the tower for stability in those high winds. There is also the cost of heavy

feedlines to bring the power into the house. Even if the tower is close by, if it is 50 feet high, you will need at least 75 or 100 feet of cable.

If you are really serious about pouring $10,000 or more into a wind system, do take the time to invest in a recording wind odometer, and spend several months tracking the winds and averaging your velocity. Some of you may be lucky enough to know of a residential wind plant in the area from which you can derive some hard figures on performance. Others may live in areas covered by standard weather and wind data that will apply to your homestead. Be careful of local terrain masking of general winds. Sometimes you can live in a high wind area and be located in a spot that experiences a lot of wind "skip."

Get Above the Turbulence

At 50 feet, winds are between one-third and two times the velocity of the wind at ground level due to the absence of ground turbulence. So, you should consider 50 feet the minimum tower height for most installations. The actual location of the tower should be clear of obstructions and trees for 100 yards, or be twice the height of upwind obstructions. Do not be tempted to integrate the windmill with the design of the house (as is proposed now and then to take advantage of the higher roof-top winds). Vibration and noise are a significant problem with wind machines, especially the larger ones. The house acts somewhat like a musical instrument–amplifying the vibrations and drumming them through the house, day and night. A special concrete-reinforced design would be necessary to withstand the pressures of a roof-mounted wind system. This advice does not apply to some of the small, mini-wind turbines like the aerodynamic AIR 403. These small, 3-bladed balanced units can even go on the roof of an RV or motor home. But all two bladed props will give you a "chopping" sound that will be bothersome.

Some Pointers About the Nature of Wind and Power

It is usually more important to design a system to use the higher winds all of the time, than to use the lower winds most of the time because of the following relationship: The power capable of being extracted from the wind increases with the CUBE of the wind speed. That means that a 20 mph wind has eight times more power than a 10 mph wind. The 10 mph wind would have to blow eight times as long as the 20 mph wind just to match its potential. This is only valid if the higher winds blow at least a third of the time. I am not suggesting you design a machine to take advantage of a hurricane once a year. Many people decide to go with a huge prop to extract the power from slow winds. But the increase in diameter of the prop only increases the power derived by the square of the increase. This increase is hard to justify in comparison with the extremely high cost of the larger propellers. They are most susceptible to damage in high winds as well. The ironic conclusion is that winds (much like water sources) with the *least power* require the *most expensive* machines to harness that power. The economic payoff is harder to achieve in these situations. On the other hand, the higher winds can use even crude, but strong, homemade machines with efficiency.

Matching the Machine to the Winds

If you are in a marginal wind generating area (average 10-12 mph) then you will need to pick a 3-bladed propeller with a cut in speed of 8-10 mph and a rated wind speed of less than 20 mph. Unfortunately, there are almost no wind plants that give full rated power under 20 mph. More on that shortly. The 3-bladed prop delivers more initial torque at the lower speeds. They also make less noise than two-bladed props.

The lower cut-in speeds allows you to utilize the lower winds even though the amount of power produced will be small. In fact, unless the wind is higher than 8 mph, the amount of power is negligible and not worth trying to capture. As long as the cut-in speed is at least 7 mph this is acceptable. If your area averages 15 mph winds, you can choose from the greater number of standard machines which are usually rated for maximum power at 25 mph wind speeds, and that have a cut in speed of 6-8 mph. It is important to match the cut-in and rated output speeds of the generator to your actual conditions–not to your hopes and desires. Cut-in speed is not very important due to the low power outputs at low speeds, but cut-out speed is important. A machine that cuts-out at 18 or 20 mph is going to dump the best winds. Generally look for a cut-out or governed speed in excess of 25 mph.

Rated power output per rated wind speed is one of the key factors to look for in a wind generator's specifications. Most units are designed for full rated output between 25-30 mph. However, some machines don't reach their rated power output until over 40 mph. Obviously, those types of machines are not a good choice for most areas. Very few areas have 40 mph winds to take advantage of that design. But even the 25-30 mph rated wind speed machines are a problem. Most of the time wind machines are going to be turning in the 12-15 mph range. So, don't expect to be making the full rated output of the machine unless the winds are very high. We want a machine that will put out the most power possible at the wind speeds we experience most in our area–which will be 20 mph or lower most of the time. Since this isn't possible with most machines on the market, we need to select a compromise point between two factors: *rated speed* vs. *price per rated watt of power*. What this boils down to is that we are looking for a machine that has the lowest price/watt ratio with the lowest rated output speed. This will give us the most output per dollar.

All the best machines have a price/watt ratio of less than $2.50. A good many machines are under $2/watt. Never buy a machine that costs more than $2.50/watt (1999 prices). This automatically eliminates every machine under 400 watts. The tiny machines of 50-300 watts range in price from $18/watt at the high end to $2.50/watt at best–and most are in the $4-5 dollar/watt range. This is not a good buy. Serious wind power homes will require machines of at least 1,000-2,000 watts, depending on your budget. The June/July 1998 issue of Home Power magazine has a comparison of all the available machines. I will also give my recommendations in the "Recommended Equipment and Sources" section.

Always Plan on a Battery Backup

Wind systems almost always require a storage battery system for windless periods. For this reason, most manufacturers produce DC output. Actually, almost all windplants have AC, 3-phase alternators for efficiency and low maintenance, but they rectify this power to DC for storage in batteries. Even the systems that tie into the utilities convert to DC and then invert back to 60 Hz AC. This is because the AC generators put out what is called "wild AC"–AC power whose frequency is constantly changing. This type of AC power is not usable until changed to a steady frequency of 60 cycles/sec. So they rectify the power to DC and then invert back to the proper 60 cycle AC.

Battery storage size is an important consideration. If the battery bank is undersized it will be subject to costly and periodic replacements due to too frequent charging and rapid discharging. Plan on sizing the amp-hour storage capacity to at least 7 times the maximum current capacity of the generator. This will avoid excess charging capacity that may shorten battery life.

Windplant Type Recommendations

Permanent Magnet Alternator Type

DC generators and AC alternators operate by moving multiple coils of copper wire through a magnetic field. In this type of alternator the magnetism is created by permanent magnets, which allow these units to operate without any external power source. The downside is that this magnetic force is constantly resisting the rotation of the generator even at low speeds, and thus is not as efficient at low speeds as is the induction generator.

Induction Alternators

These types of wind generators produce the most power with the most cost-effective equipment. They are very efficient and produce a lot of power for their size. The magnetic field in an induction alternator is created by an electromagnet, rather than a permanent magnet. It has the advantage of having the magnetic flux vary according to the output of the generator. Thus at low speeds, it produces small amounts of magnetism which allow the blades to turn at higher speeds relative to a permanent magnet alternator. As the speed increases, more magnetism is produced allowing the power curve to parallel the speed curve. However, induction alternators rely on input voltage from an external power source (usually the utility or some small amount of permanent magnetism in the armature) in order to have any output.

DC Generators

DC generators produce straight DC power. They do so by using contact brushes on a rotating armature within the unit. These brushes and armatures do experience wear. The brushes must be replaced every 3-5 years. While this is not often enough to be a problem, brushes should be stockpiled in advance so as not to be caught with a supply problem. There are also brushless generators on the market, but they are more complex and a little more costly. DC generators represent a small minority on the current market. Most models are induction alternators.

Summary Recommendations:

See the "Recommended Equipment and Sources" section for recommendations, but with wind power you really want strength and reliability. These machine have to endure a lot of punishment. Of the modern machines, Whisper and Bergey brands have a reputation for near bulletproof reliability.

BATTERY STORAGE

Battery storage is essential to any system that provides either intermittent power to your system or power that is too low in output to handle peak loads. Batteries store extra energy when you have a surplus, and give you back that energy when your electrical production facilities are not otherwise producing enough power. This battery section will apply to almost all the forms of power production we have discussed–whether engine generators, water power, or wind.

Battery Size

Most batteries are sized by AMP-HOUR capacity even though alternate energy systems are sized in kilowatt-hour capacity. It is important to know how to reconcile these two, because most appliance power usage is given in watts, and most generator output is given in watts. Watts are a unit of power equal to the multiplication of the amps times the voltage. Keep in mind that for a given amount of power in watts, the higher the voltage, the fewer amps will have to be pulled through the wire. So at 120 volts, a 1,200 watt load would have to pull 10 amps of current through the wire. But at 12 volts, this same load would have to pull 100 amps of current. Why is this important? Pulling higher currents without increasing the wire size causes heat; sometimes enough to melt the wire. Thus, the higher the amperage or current the wire is carrying, the bigger the wire must be to avoid overheating. Stranded wire is used in high current situations since the electrons flow around the edges of the wire. Stranded wire has many more paths for current travel. But even so, it takes a wire with 10 times more capacity to carry 100 amps than to carry 10 amps. Bigger wires cost lots more money, and the higher the amperage, the higher the potential of melting a wire if you have sized it too small.

Now, back to our sizing problem. A 100 amp-hour battery would run 1 amp for 100 hours or 10 amps for 10 hours. To convert to kilowatt-hours, the units we use for our generators and inverters, we have to know what voltage we are using. To convert battery amp-hours to watts, just take the amp-hour rating times the voltage. Thus, if we have a 12 volt 100 amp/hour battery, this would equal a 1,200 watt-hour storage capacity or a 1.2 kilowatt-hour system. Kilo means thousands. If we connected a bank of 10 of these batteries together, we would have 12kWh of storage capacity or 1000 amp-hours. Now let's suppose we take these same ten 12 volt batteries and hook them up in pairs of 5 battery sets at 24 volts each. Even though we have doubled the voltage, the number of amp-hours in the battery bank remains the same. That's because we effectively cut the number of batteries in half as we combined all the 12 volt batteries into 24 volt pairs.

Now let us further suppose we want to have enough battery power to last for 3 days without recharging and our total average daily use is 20,000 watts (20 kW). If we have 100 amp-hour deep cycle batteries, which should not be discharged below 80%, how many will we need to last 3 days? We derive our answer as follows: 3 days @ 20kWh = 60kWh of power we need to store. With a 12 volt battery system, 60 kwh divided by 12 will equal 5,000 amp-hours. Divide this by our 100 amp-hour batteries and that yields 50 100 amp-hour batteries total. But that doesn't take into consideration that we can't use all the capacity in those batteries without damaging them. Since we can only use 80%, we will treat our 100 amp-hour batteries as if they were only 80 amp-hour batteries. So, now the 5,000 amp-hours required divided by 80 amp-hour batteries gives about 62 batteries. That's a lot of batteries. At $50 each for the cheapest type that would be $3,100 just for batteries, not to mention all the battery cables and connections to hook them all together. For better industrial batteries in larger pre-manufactured banks (that last a lot longer), it would cost about $10,000.

For most people this is too much money to put into the battery bank. I point this out because the basic problem is the amount of electrical usage we started out with in this example. Twenty kW each day is typical for a normal utility-powered house. We should cut our usage down to no more than 10 kW each day on an alternative energy system. So a reduced 3-day reserve battery bank would be 30,000 watt hours or 2,500 amp-hours of capacity.

There are large industrial cells on the market, and they can be ordered prepackaged in 12v, 24v or 48v giant batteries, but they are so heavy that they require a forklift to move around. The convenience of using one of these battery banks is only useful if you place them on a ground level floor of your house where they would be easily handled without excess equipment expense. If you have to get 2,000 lbs. of battery bank down some stairs, it's better to stay with the smaller, individual batteries. The industrial batteries will last much longer than the smaller deep-cycle batteries, but they cost so much more that you should only go with the industrial option if you are going to run off-the-grid full-time. If you are going to simply have a stand-by battery bank, go with the smaller cheaper batteries, put a battery maintainer on them plus a pulse type desulfator, and the batteries will keep almost indefinitely in this storage mode.

As a storage option, you can also order certain brands of lead-acid batteries in a dry charged condition. They come with acid in separate containers. They will keep indefinitely in their dry charged state–simply activate the batteries by pouring in the acid when needed. Take great care in handling acid. Wear eye and skin protection. Use heavy rubber gloves and old clothes. Have ample water supplies nearby to wash off immediately any acid that you may come into contact with.

Battery Technology Choices

There are several types of rechargeable battery technology, but only two that are commonly suitable for home use: lead-acid batteries and alkaline types. Lead acid batteries are still the workhorse of the world. They are cheap and readily available in many sizes and types.

Lead Acid Technology

There are 3 basic technologies involved in lead acid batteries: flooded wet cells, gel cells, and AGM (absorbed gas mat) cells.

Flooded Cells

Of the flooded wet cell batteries, there are automobile type batteries for starting cars and deep discharge batteries for recreational use and storage of energy. Auto batteries are designed for shallow discharge and for short bursts of high amperage. For this purpose, the battery needs lots of *thin rigid plates* to give maximum current in as small a volume as possible. But thin plates do not allow many cycles and they are easily damaged. Deep discharging an automobile battery leaves a damaged plate structure behind that will not recharge to a unified chemical content. Thus, every time you let an auto battery run down completely you have lost from 1/5 to 1/3 of its capacity–permanently.

For lots of cycles we need *thick pasty plates*, but with thick plates, we cannot get a high current output as compared to an automobile battery. Deep-cycle batteries typically feature thick plates with a high-density active material. The thick battery plates allow for reserve energy to be stored deep within the battery plate and released during slow discharge rates. The high-density active material remains within the batteries' plate/grid structure longer, resisting the normal degradation caused by cycling conditions. This type is what we want for an alternate energy system. Even though deep discharge batteries will take numerous cycles (typically 200-400 cycles), flooded batteries of the deep cycle type will not handle high amperage currents. Use of high current (400-600 amps) will shorten their cycle life dramatically.

Another problem with lead acid is deterioration of the chemical makeup of the battery plates with use. These batteries have plates made of lead oxide mixed with other elements and the plates are submerged in a bath of sulfuric acid. As the free electrons are transferred from the negative to the positive terminals, sulfur comes out of the acid solution and joins the plates. The lead oxide turns into lead sulfate on the positive plates. If the plates are discharged too deeply and left in this condition, the positive plate will not return to full capacity when recharged. The plate portion that has become hardened with a sulfate crust becomes unusable. This is called *sulfation* of the battery and is the number one cause of battery failure. To prevent sulfation, make sure batteries get recharged immediately after use and abide by the recommended discharge limits. An automobile battery is best never discharged below its 80% level of total capacity. Deep cycle batteries can be discharged as low as the 20% level of their capacity but they will last even longer if not taken below the 50% level very often. Make sure that only distilled water is added to batteries. City water or well water with high mineral and chemical content will react with the acid and dilute its effectiveness.

When filling a battery that is low on water, make sure it is fully charged first. When charging a battery that is very low, make sure you use a charging current of at least 10 amps. If you trickle charge a low battery, the electrolyte does get circulated within the battery and stagnation occurs. The strong acid at the bottom can actually eat away at the bottom of the plates. Sulfation can be eliminated with the new “pulsed technology” or

"frequency desulfators" as will be described shortly. Everyone should have at least one of these units to make sure (when batteries may no longer be available) that you can maintain what you have for as long as possible.

Gel Cells

Gel cell batteries are lead acid technology and except for the acid gel have basically the same chemistry as a flooded cell battery. The batteries' electrolyte is in a gelatin form which is absorbed into the plates and the battery is sealed with epoxies. As a semi-solid, voids develop between the gel matrix and the plate to allow passage of gases which may render that area of the cell inert. This reduces its capacity permanently. Therefore, gel cells are very sensitive to how they are charged. Gel cells cannot be charged to as high a voltage as flooded cells, otherwise voids will be created. So, never use a conventional battery charger on a gel cell. Automotive battery chargers are designed to charge to the 14-14.5 volt level, which is too high for gels. Use only a gel cell charger or one of the new battery maintainers that only go as high as 13.36 volts. These batteries are designed for use where safety against leaking acid is required. They may be used in any position and the batteries are exceptionally leak resistant. Gel batteries are used for UPS (uninterrupted power systems) to run computers, emergency lights, and camcorders. Gel cells are deep discharge batteries, but will not tolerate high discharge or charge rates. They are perfect for steady, moderate current draw use, such as in a fishing boat or in a wheel chair. However, they cost almost double the price of wet cell flooded batteries.

Absorbed Gas Mat (AGM)

This is the newest technology in lead acid batteries. Unlike gel cell batteries, AGM cells have a fiber floss mat between the plates with wicking characteristics for retention of electrolyte. The electrolyte is absorbed and held in place by the capillary action of this glass mat. The cells are sealed and develop internal pressure when used. If this pressure rises to a set point, a relief valve opens to vent a small amount of the pressure during charging. By design, the mat is only 90% saturated with electrolyte allowing a portion of the mat to be filled with gas. These gas spaces provide the channels by which the freshly generated gases, which are in their atomic state and very reactive, are allowed to recombine rapidly and safely. Due to this engineered reaction, and coupled with the purity of the plate and grid material, AGM batteries have much lower internal resistance and thus can provide higher rates of discharge and quicker rates of recharge. Additionally, this gas mat provides a higher degree of support against shock and vibration than other types of batteries. AGM batteries are comparable to nickel cadmium in performance, but do not have the memory effect of NiCads. Unlike other sealed batteries, the AGM battery technology allows for more positive plate material in its cell construction. Therefore, there is an increase in amp-hours, reserve capacity, and depth of cycle; and a reduction of internal self discharge over other sealed batteries. Most lead acid batteries lose 1% of their charge per day, and will discharge completely within 3 months if left to sit without a battery maintainer attached.

AGMs do not have a gel electrolyte but do everything a gel cell does: they are leakproof, have good deep cycle capacity, and are shock proof. Even more, they have the highest

current discharge and charge rate of all deep discharge batteries. Their big downside is price–they are the highest in price of all lead acid batteries.

Here's how I see the difference in lead acid choices:

- If you want the most capacity for the money and you don't need a sealed battery, and you don't use high discharge rates, then choose flooded cells. Under *moderate* use, flooded cell, deep discharge batteries will give you more cycles than gel or AGM and cost less too. If you use flooded cell batteries in an EV (electric vehicle), make sure your motor's current limiter won't let you exceed 200 amps current draw.
- If you need a sealed cell to guard against acid spillage (boat, wheelchair, or electric bike) but you don't need high discharge rates, buy a gel cell. They are the most reasonable of the true sealed technology. Some flooded batteries are advertised as sealed, but they are not truly sealed–the caps are hidden under the lid.
- If you have any equipment that draws *very high amperage*, in excess of 300 amps at a time (high performance EV or running lots of high amp equipment), then choose AGM technology. Under high draw and high charge conditions, these batteries will maintain their rated number of cycles. Flooded or gel cells will drop in longevity by 1/2 or 3/4. For these reasons, AGM is the only deep cycle suitable for automotive use as well. They will tolerate jarring shocks, high currents for starting and deep discharge too. If you have an RV or camper vehicle that uses the same battery system for starting as for RV use, choose the AGM.

Alkaline Technology

We aren't talking about the ordinary alkaline flashlight batteries sold in stores, but either nickel cadmium or nickel iron batteries. In these batteries the plates are composed of a nickel alloy submerged in potassium hydroxide. They are very reliable but have some liabilities. They are typically much more expensive than lead-acid technology, and nickel-cadmium cells have a memory effect problem. If discharged to the same level, or if they sit for long periods without use, they develop a new set point and will not fully discharge. Nickel-iron batteries have a problem of requiring a higher peak voltage to charge them, which some solar panels cannot provide. Generators, however, have no problem charging nickel-iron batteries.

Your Battery Choices

Let's discuss some of the alternatives in lead acid, starting at the low cost side and moving up to the industrial alternatives. Some batteries come in 12 volts, and others come in 6 volts or even 2 volts, such as the large industrial cells. Keep in mind as you select and price batteries that they are very heavy. Trying to buy batteries from across the country could cost you a lot in shipping. Try to find local suppliers whenever possible. In the listings below, take a close look at the cost-per-amp/hour that I cite. While this doesn't tell the whole story, it does give you an idea of the relative cost of each type of battery. While the cost per amp/hour goes up with the heavier duty,

industrial type batteries, so does the durability and longevity. However, longer lasting does not always equate with the best buy. If your system will only be used in a stand-by mode, not in a daily use, it is rarely necessary to go with the expensive battery systems.

Golf Cart Batteries (6 volt)

For small to medium installations, golf cart batteries are probably one of your best alternatives. These are flooded cell, deep discharge batteries that come in 6 volts. If you want to make a 12 volt system, you have to hook together multiple pairs of 6 volt batteries. Once the pairs are hooked together in a series connection, the pairs are linked in parallel so that their capacity is added together (still at 12 volts). Briefly, a series connection involves hooking the positive (+) terminal of one battery to the negative (-) terminal of the other battery. The remaining terminals (one positive and one negative on each battery) will have 12 volts between them. These remaining two terminals are available to make the parallel connections with the other pairs, similarly linked. In making the parallel connections, all the positive terminals are hooked together, and all the negatives on the other sides are connected–leaving one powerful positive and one powerful negative terminal. Golf cart batteries are only about $50 each, so they are a good buy. They can be purchased at most recreational battery outlets. All major battery manufacturers make them. Cost per amp/hour is about $0.25.

RV Batteries (12 volt)

These are 12 volt batteries made for RV vehicles and house trailers. They have better deeper discharge capabilities than an auto battery but not as much as a golf cart or lift truck battery. They are larger than almost any automobile battery on the market, and have convenient screw-on lug terminals besides the regular automotive terminals. Cost per amp-hour is about $0.40 but they do not last as long as two golf cart batteries, nor do they discharge as deeply. Don't go below 50% capacity on an RV or marine type battery. These and other flooded deep discharge batteries are made with thick pasted plates and have very rugged separators between the plates to make the battery more immune to physical shock and vibration, and to reduce the chance of failure due to dendritic growth (chemical fibers and crystals) during recharging. Manufactures say they are designed to be discharged down to the 20% level of capacity each day, and recharged overnight, but they will last longer if not taken down below the 50% capacity. For longer life under regular 80% discharge conditions, you have to go up to the next level–lift truck batteries.

Lift Truck Batteries

Electric fork lifts use deep discharge batteries that are larger and more powerful than golf cart or RV batteries. They come in either 12 volt or 6 volt units, and are also a good buy. The 350 amp-hour L-16 battery is the standard in the marketplace. Cost per amp-hour is about $1.13, and they will outlast a golf-cart battery at least twice. These are true 80% discharge batteries. Lift truck batteries also come in much larger units than the L-16, but the L-16 is a good buy. There is even a heavy duty L-16 with an "HC" designation. This has almost 400 amp-hours of capacity for only $10-15 more money per battery. It also has dual terminal lugs which makes multiple battery cable connections much easier.

Sealed Solar AGM Batteries

Some companies make medium-sized, sealed lead-acid batteries of the AGM type for solar systems. The electrolyte in these units cannot stratify, so they are better suited to the low charging voltages of a limited solar system. Because of the improved electrolyte and discharge/charge rates, they do not need to have an equalizing charge like other regular deep cycle batteries. Expect to pay twice as much for these batteries as lift truck batteries–over $2.00 per amp-hour. They are not the most cost effective, but are very useful in certain solar applications where high rates of discharge wear out traditional batteries too fast.

2 Volt Industrial Cells

These are batteries with large surface areas on the plates to improve chemical contact. The plates are thick like smaller deep discharge batteries. These are not paste type plates, but hard mesh designs. They are the longest lasting lead acid type available, and the most expensive. These can be purchased individually and hooked together to make 12 or 24 volt battery banks, or you can buy them prepackaged and ready to go. The prepackaged battery banks are very heavy and require the use of a crane or forklift. These will cost about $2.30-$2.50 per amp-hour in the individual cells, and about 20 cents less in the prepackaged battery banks. This price does not include truck freight, which is costly.

Probably the ultimate in industrial 2 volt batteries are submarine batteries. Submarines use batteries when rigged for silent running. They are built for a lifetime of use. A typical 2 volt 7,000 amp-hour battery will cost about $3,000. That comes to $18,000 for one 12 volt 84kWh battery bank. That's a lot of money, but you probably would never have to replace it. These can also be ordered in a dry charged state, with 2 gallons of acid for each cell in separate containers. You add the acid when you want to activate the batteries. As usual, see the "Recommended Equipment and Sources" section for sources.

Charging and Maintaining Batteries

Sulfation is the formation or deposit of lead sulfate on the surface and in the pores of the lead-oxide battery plates. When sulfation becomes excessive and forms large crystals on the plates, the battery will not operate efficiently and may not work at all. Common causes of battery sulfation are standing a long time in a discharged condition, operating at excessive temperatures, and prolonged under or overcharging. High charging rates are often used to vibrate and shock the plates into dumping these sulfate deposits. That may clear the plates, but the sulfate doesn't go back into solution. It just piles up at the bottom of the battery.

There are two new technologies which actually treat the problem at the source. First is the *desulfator*–a high frequency charge that causes the sulfates to de-crystallize and go back into the acid solution. This is the only technology that truly recycles the sulfates. Second is the *pulse charge technology*, where a small electronic unit hooked to the battery terminals absorbs a small amount of battery power to charge a capacitor. It then discharges the capacity to give a small shock charge to the battery. This technology does not remove sulfation but keeps it from accumulating. It is something that should be used

with all new batteries. Use a desulfator for batteries that have been in service and need rejuvenation. Deep discharge batteries are more capable of being restored after sulfation than automotive batteries. The hard thin plates of automotive batteries, once damaged, are hard to restore. The tests I have done show that a desulfator will restore an automotive battery's ability to take and hold a charge, but the battery will still not have any depth of reserve for prolonged starts.

When charging a battery, it is important to charge it vigorously enough to stir up the acid which tends to stratify. Long-term stratification can even eat away at the bottom of the plates, since the acid is stronger there. For long-term storage of a battery, use one of the new ***battery maintainers***. These chargers bring the battery up to the optimum maintenance voltage and hold it there, without overcharging. They float charge at a perfect 13.6 volts so the battery can last for many years without use. The optimum voltage for steady state charge is 13.6 on a 12 volt system, and 27.2 for 24 volt systems.

When a flooded lead acid battery bank is being used regularly, the batteries should be given an extra heavy equalizing charge every month to make sure all batteries are brought up to the same level. Weak batteries tend to rob all the power out of good ones and will eventually cause the entire bank to be charged improperly. There are newer battery technologies on the market (gel and AGM) which should not be equalized or overcharged since immediate and permanent damage will occur.

Battery watering has been solved by the invention of special caps that condense the water vapor as it comes off the battery. They are expensive, and thus are only used on large lift truck or industrial cells that have fewer individual cells.

Cable Recommendations

In terms of the battery bank location, it is important to have it as close to the load as possible to reduce line losses through voltage drops. Battery cables need to be very heavy duty and always have fuses in series with the positive lead to guard against shorts or excessive current draw. The best cable for battery connections is insulated *stranded* copper–the type used on large automobile grounding connections. It should be at least size 00 (pronounced "double ought" and written as 2/0) for terminal connections at the end of each battery bank, and #2 stranded copper between individual batteries in a bank. Large battery banks over 1,000 amp-hour capacities should have 3/0 or 4/0 cables. Even better, though more costly, is *welding cable*, which has many more strands of copper wire than automotive grounding cable. The number of strands in a cable is important because electricity travels on the *outside surface* of each strand. Thus a single #12 awg copper wire will handle less current than a #12 awg stranded cable.

Since batteries are also subject to temperature (cold reduces power dramatically), it is well to keep them in a heated area away from severe cold. However, since the charging of the batteries produces hydrogen gassing, which (in high concentrations) is explosive when mixed with oxygen, adequate venting of the area should be provided–but not so much that the room is allowed to freeze in winter.

Recharging Batteries with a Generator

Many of the newer portable generators have built-in DC 12 volt charging circuits for battery charging, but the current output is small. These will charge one or two RV batteries, but not a large battery bank. To do any serious charging of batteries you will have to power a separate battery charger through the AC output of the generator. Make sure the charger is one of high quality so that it is capable of charging your batteries rapidly at first and then automatically tapering off to a float charge. Here are some charger options.

Welder/Generator Charger

A portable, engine-driven arc welder is actually a generator built to supply arc welding power–either AC, DC, or both. A welder puts out approximately 30 volts at a current of 200 amps or more. This is just the right amount of voltage for charging a large 24 volt battery bank. You can even charge a 12 volt bank on a low setting. Most modern, portable welders will deliver both AC and DC power at the same time, so you can run AC tools and charge DC batteries as long as you don't exceed the unit's rated output.

Battery Chargers

Any automotive charger can charge a very large battery bank; but such chargers only sense the voltage, not the battery's amp-hour capacity. If the battery is very large, it will take longer to recharge. More than one battery charger may be connected at once, including other charging sources such as solar panels or windmills. However, each different source should have its own regulator to taper the current to the battery as it comes up to a full charge. Automatic (regulated) battery chargers tend to regulate too early for the fast charging that is desirable with a generator. When they taper down to a low charge current too soon, you end up running the generator much longer than is needful. There is nothing worse that running an expensive generator an extra 2 hours just to taper charge a battery at very low amperage. Let the generator do the bulk charge fast, and then taper charge or top off the batteries with solar. If you get a charger with a manual switch, you can override the automatic function and get faster charging to the full rated capacity at will. If charging from utility power, use an automatic charger.

Battery chargers are expensive due to the cost of the transformer, which rarely fails. Commercial chargers can sometimes be found at scrap yards and easily repaired. For 24 volt systems, you must buy a truck or industrial charger of that voltage. Two 12 volt chargers of equal capacity can also be attached to each 12 volt half of the bank–no need to disconnect the cables.

Inverters with "Standby" Battery Charging Option

All modern inverters have an optional battery charging function, which works extremely well. This option costs far less than a separate battery charger of equivalent capacity, and these chargers are the most sophisticated on the market. They will truly keep a battery at the perfect float voltage that will preserve battery life almost indefinitely. Trace inverters have a "programmable" regulating response, which is adjustable to each battery's optimal float point. Some high capacity chargers are capable of putting out such high current shocks as to vibrate the plates and knock off inactive sulfate crystals. This tends to

restore some capacity in older batteries, but does not extend life unless coupled with a battery desulfator that dissolves crystals that have settled to the bottom of the battery.

Beware of fast but incomplete charging of batteries. This is especially important if the battery is very low in voltage. Be sure the battery is kept on the charger at least 8 hours. A hydrometer reading is the best way to assure that they are "topped off" correctly. Failure to top off or "finish-charge" batteries at least every two weeks will reduce their life greatly. Beware of excessive gassing when fast charging. It is hard on the batteries and creates a hazard of explosion. It is, however, not a good use of a generator to finish-charge a battery. Better to use your solar panels to do the finish-charging after the generator has finished its high current bulk charge (after the first hour or so). If your generator system is used only seasonally (such as in a cabin), a small solar module should be used to maintain your battery bank at full charge during the months you are gone and the generator is off. A typical deep cycle battery will lose about 1% of its charge each day just sitting. Allowing a battery to remain in a low state of charge, is *very damaging*.

Guarding Against Battery Corrosion:

As lead acid batteries are charged, acid vapors escape and condense on battery tops, terminals and cables. Soon, small electrical currents flow between terminals and corrosion sets in. Copper and aluminum turn green or white with oxide powders. Before you put your system together, smooth on a thin coat of petroleum jelly (like Vaseline brand) over terminals, cable ends, and all nuts and bolts. You must disassemble all the little parts of the connectors to make sure everything is covered. For stranded wire ends, heat them with a propane torch and then dip them slightly into petroleum jelly and the jelly will melt and wick into the wire strands. This is the only way to keep corrosion from getting in between the wires–which is impossible to get out later. Now connect everything together, and you're done. Installing Hydrocaps on your batteries helps a lot by condensing the water back down into the battery before it escapes into the air.

Another suggestion is to hose down your batteries once a year in order to remove acid splatter or dust which can cause electrical leakage between terminals.

TRANSFORMERS

Transformers play an important role in getting the generated power over long distance wires without an excessive voltage drop. There are many on the market, and they come in every conceivable range and size. But nested-coil transformers only work on AC power. DC is transformed in a different manner and usually has to be built into the generator output regulator. The higher the voltage, the longer the distance the electricity will travel without voltage losses. So, if we need to send power over a distance in excess of 100 yards, we would have to employ some form of transformer. Thus, if you envision such a possibility, it is best to pick an AC alternator as the source of power. If you pick DC, you'll have to make sure it produces the higher voltage. It cannot be efficiently transformed after it leaves the generator.

When you use an AC transformer to increase the voltage for transmission, you must have another transformer at the other end of the line to bring the voltage back down to what

the house can use. Let's assume we have a transmission distance in excess of 100 yards. If we don't use a transformer, we must increase the size of the transmission wires substantially to avoid the voltage drop. The more amperage we draw from the source and try to send down the wires (at lower voltage), the more heat will be generated in small diameter wires. Increasing the size of the wire helps up to the point where the extra cost of the heavy gauge wire approaches the cost of a transformer. You also compare the losses in efficiency with or without the transformer. Transformers have losses in the 10-20% range and so does wire, depending on the length, number of strands and total cross sectional area.

Alternate energy equipment installers will have charts or graphs that will help you determine what size wire you need for the amount of amperage you send down a certain length of wire at 12 volts. To calculate for a 24 volt system, just remember that the amperage is half of the 12 volt values. Essentially, every time you double the voltage you use, you cut the amperage going down the wires by half–hence less resistance in the wires and less voltage drop. This is why 24 volt systems are becoming more popular than 12 volt systems. The only advantage of 12 volts is the incredible supply of products available in that voltage due to automotive and RV use. There is also a lot available in 24 volts since boating systems use that voltage. For those of you with Internet access, there is a nifty Online calculator of voltage drop and wire size that you can access for free: http://www.mikeholt.com/free/voltagedrop.htm

INVERTERS

Inverters are electrical equipment that convert direct current to alternating current. In addition, they raise the voltage from 12, 24, or 48 volts to 110 volts AC. There are two ways to accomplish this conversion of power. The first and oldest way is by building a DC motor onto the same shaft as an AC generator winding. The 12 or 24 volt DC current is applied to run the DC motor, and the AC windings simultaneously produce perfect sine wave power. AC/DC rotary motor-type inverters are very reliable and last for many years. However, they have the big disadvantage of having a high "no-load" rate of power consumption. It wastes a lot of battery power just to keep the inverter turning–even under no-load conditions. If you are using a battery storage system, this can be very unacceptable. The newest types, such as the WINCO motor inverter, have an automatic "on demand" start-up feature to eliminate no-load power losses. There is only the extra current necessary to bring the unit up to speed. This type of system would work well if it were only used for major loads. Bringing a motor-inverter up to speed just to run a light bulb would not be a good use of energy.

The second type of inverter dominates the market today. These are all-electronic marvels that have very low no-load drain on the battery bank. Efficiencies run as high as 95%, but that is only for high demand loads and using straight resistant loads, like light bulbs. If you are drawing very little power, the inverter efficiency drops down below 80%. It also goes down with most normal loads that you really need to use on an inverter: motors, electronic appliances, or fluorescent lights. For this reason, as stated before, I always prefer to put everything I can on direct battery power, and only run the essential

110 volt motors and electronics through the inverter. As efficient as they are, nothing is more efficient than DC appliances running off DC battery current.

Inverters have overcome all of the old reliability problems and are reasonable in price, especially considering all the magical switching and control functions that are now built in: transfer switching, battery monitoring, auto shut-down, sleep modes, and automatic generator and utility interfaces. I will discuss the use of these special inverter control options in the master electrical plan. On the downside, the biggest inverters still can't handle more than 30 amps output at 110 volts, whereas motor inverters have no limit. So, if you want 220 volt power, you have to combine two inverters, which costs double, plus the cost of the interface. If you are on a really tight budget and can't afford the big inverters (from $1,000 to $3,000 each) you might consider getting one of the small capacity, portable inverters capable of running a computer or TV, which are all well under $1,000. Most of the larger of the small units have enough surge capacity to start a circular saw and then keep it running under load. This makes a great portable source of power, when connected to a car's battery.

UTILITY INTERTIE: The newest and biggest of the electronic inverters can also be set up to feed power back to the public utility. Laws in some areas now require utilities to pay you the same rate for power that you sell back as you pay to buy from them. When the power from your alternate energy source exceeds your needs, you can sell back the extra to the utility. When you need more power than what you produce, you can draw extra as needed from your utility line–all automatically. The electric meter simply runs forward for net usage of public power and backwards when you are producing more than you use.

There are also some new solar panels on the market that have a built-in inverter on each panel. Each inverter converts either two 12 volt panels into either 110 volts or one 24 volt panel. You can even buy these little inverters for your existing solar panels. However, keep in mind that these micro-sine wave inverters only operate with a source of 110 volt electricity. They will not feed 110 volt sine wave power directly to your house when the power is down. However, if you have a battery bank with another larger sine wave inverter, you could use that to fool the smaller inverter into thinking it was still attached to public power.

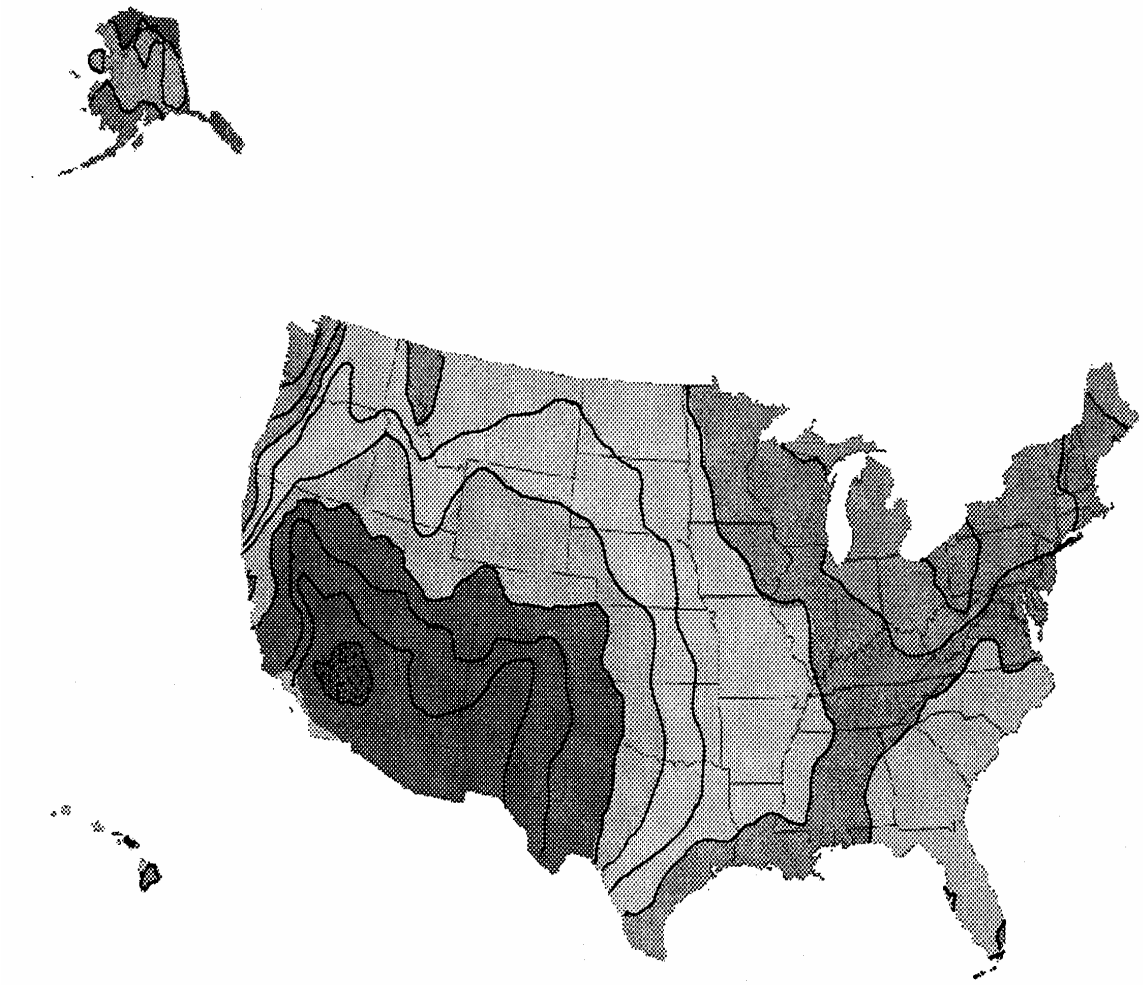
The bad news is that public utilities are getting increasingly difficult to work with. They keep hiding behind the safety issue. However, the safety issue was solved years ago. All of the big inverters and the micro-sine inverters have reliable built-in controls that immediately ***shut down any output*** if they sense a loss in public power–no one can get electrocuted upline from your house. Even when utilities reluctantly allow intertie connections they make you pay dearly in bureaucratic red tape and countless inspections and hassles. So more and more nowadays, the solar pioneers are turning to "guerrilla solar." In short, this means they are connecting to the utilities without telling anyone. As long as this is done inside your home with a completely National Electric Code-approved system (without inspections) there is absolutely no harm done to anyone–in fact the world benefits in numerous ways from clean solar power.

SOLAR POWER GENERATION

Compared to these other forms of power generation, solar is the master of simplicity and longevity. It comes the closest to a no-maintenance, no-hassle system. Its great disadvantage is high price per watt of electricity produced and relatively low output. This means, to get the kind of power you get from a generator, we must spend many more thousands for the initial equipment. However, it pays and pays you back for years due to savings in fuel and maintenance. Thus, in a true off-the-grid home, solar really makes sense almost everywhere, except in areas that have heavy cloud cover most of the year.

Let's look at the power figures for a comparison with the previous power sources. The typical photovoltaic solar panel puts out 55 to 75 watts at 12 volts in bright sun. In reality, over the course of even a sunny day, you might only average 50 watts per hour for 8 hours. That's a total of 400 watts per day per panel. But even this is not all usable. We will have percentage losses in charging the batteries as well in the use of an inverter to take power out the other end. If we use 12 volt appliances that don't go through an inverter, we might get up to 90% efficiency. If we go through an inverter, we'll be lucky to get 80% overall efficiency. This cuts the power per panel down to 320 watts per day per panel. Now we have enough power to operate one 75 watt light bulb for a little more than 4 hours (with one panel). This is not a lot of power, and may explain why so many people with RV's complain about their solar systems not living up to expectations. The fact is, you need a lot more than one or two solar panels if you are going to produce any serious power. Since each panel costs over $400, we are talking a good deal of money.

In any case, a solar system will always need to be tied to a battery bank in order to provide power during times the sun isn't shining. PV solar cells will produce some power even on cloudy days, but at greatly reduced rates. Unless you have a lot of panels, your batteries will not be completely recharged on cloudy days. I recommend that you have enough power to operate your system for one day without recharging, at a bare minimum. This reserve must be accomplished without taking the batteries down more than 50-80% of



SOLAR RADIATION CHART

THE DARKER THE AREA THE MORE SOLAR RADIATION

capacity, depending on battery type. If you discharge your batteries deeper than what is recommended, you will cause some partial permanent damage to the cells.

Home-owners who live completely off-the-grid should store enough energy in their battery banks to last at least 3 days. Storage for longer than 3 days usually requires too much investment in batteries. Money is better spent at that point on a backup generator that can recharge the batteries when solar power is insufficient. If the system provides a 30,000 watt battery bank, projected to give 3-5 days of reserve capacity, you will have to match this capacity with at least 24 solar panels of 75 watts nominal output. Twenty-four panels putting out an average of 400 watts each sunny day will give you almost 10kW of recharging power each day–enough to keep up with a battery drain of 10kW per day. If you want more daily power input, you must add more panels–up to the capacity of the charge controller.

Solar radiation will vary from area to area in North America. Most solar handbooks will give you the average figures for your area. In the eastern US, we might get 3 kW per square meter per day, whereas the Southwest will produce on average over 6 kW per square meter per day during the year. Now that doesn't mean we can convert that much power into solar output. The panels will convert less than 10% of that into actual power. See the Solar Potential chart for a general idea of the solar potential of your area.

Solar Panel Types

There are 3 basic types of photovoltaic solar panels or modules:

1. Single crystal cells (2 basic varieties: *laser grooved-buried grid*, and *standard*)
2. Polycrystalline cells (a matrix of silicon pieces, not a single-sliced crystal as #1)
3. Amorphous film technology (flexible sheets of silicon triple-junction plastic media)

Solar panels vary in construction, cost, performance, shade tolerance, and durability. Each of these is important for you to understand in order to make an informed choice.

Cost

The single crystal units are the most expensive, but also put out the best performance. Each solar cell is sliced from a single, large crystal of silicon. Polycrystalline modules are made up of small pieces of crystalline silicon, which allows them to use all the leftovers from single-crystal technology. But, though cheaper to make, the efficiency is not as high due to the non-uniform strata of the matrix. Amorphous panels are not rigid crystalline at all, but 3 layers of transistor-like material built up with 3 different solar junctions: one for blue light, one for red light, and one for green light. Interestingly, if you look at cost per watt of output, each type is close to the same overall cost. Single crystalline modules are about $6.60 per watt of output. Polycrystalline modules are about $6.50 per watt and amorphous are about $6.70. Always make this price/watt comparison when trying to determine what kind of price you are paying. A lot of people

buy the cheaper-priced panel without realizing they may be paying more per watt than the more expensive one. We must also factor in other reasons than cost alone, such as shading limitations, longevity and consistent performance.

Performance

In terms of outright efficiency in converting solar power to watts, the very best is the laser grooved, buried grid, single crystal type module. It is about 20% more efficient than the standard single-crystalline cells. Single-crystalline cells are about 20% more efficient than polycrystalline, and about twice as efficient as amorphous. So, even though a similar sized panel of amorphous will cost half of a single crystalline module, the total output is half–so the cost is about the same. But output in full sun isn't the whole picture. We also want to know how well they perform in *low light* on cloudy days, and also during conditions which may *shade* the panels. Low light performance also follows the pattern previously described. The laser grooved panels are the best. Only in the area of shade tolerance do we have a major difference. This is where the polycrystalline and amorphous panels outperform single crystal units. The cheaper panels will perform markedly better if part of the panel is shaded, as compared to the single crystal panel. While it is never optimal to accept any partial shading of panels, this does occur in almost any location where there are trees, especially during the fall, spring, and winter when the sun gets lower in the sky. The amorphous has one other major drawback. After initial use, the performance of amorphous panels drops almost 20% permanently and then stabilizes. So, this initial panel degradation must be factored into the performance figures.

One company is putting out a new product called "Shadow Guard." It claims that the panel is much less resistant to losing power when partially shaded. However, testing shows that this is only true under mostly low-load conditions. It does perform as advertised without a load. When under an electrical load, however, the panel loses power almost as much as normal single crystalline panels, and Shadow Guard doesn't come without a price. There is a measurable decrease in performance of this panel under normal conditions, so the shade system is costing some output. To me, it doesn't appear to be worth the cost in decreased performance to gain a small amount of shade tolerance under low-load conditions.

Siemens is coming out with a new amorphous panel with an improved 11% conversion efficiency of sunlight to electricity instead of the normal 7-8%. Single crystal cells go as high as 18%. The new Siemens is due out in 1999 and may be worth waiting for. But, still, always check price per watt to make sure you aren't having to pay a premium for the extra 2% efficiency. If it costs 50% more, for a 30% improvement, that's not a good deal.

Durability

Single-crystalline panels are warranted for 10 years, but none have ever worn out to my knowledge–they can almost be considered a lifetime investment. Not so with the amorphous. Any plastic based panel will degrade over time. These also usually carry a 10 year warranty, but this is probably the realistic lifetime limitation. Single-crystalline modules have a cover glass of tempered, low-iron, high transmitancy glass. This is

necessary to keep the embedded connections from shorting out or degrading in moisture. Because this glass is not unbreakable, this is a potential weakness for these panels, especially in conditions of vandalism. The amorphous module is nearly unbreakable and has no glass cover. It is therefore the panel of choice for RV and motor homes, where the panels may be subject to flying debris while traveling.

My Recommendation

I always select the best single crystalline panels as long as I don't have a shade problem and if I can put them up high (i.e., on a roof top) where they are fairly free from the threat of vandalism. I like the idea of a lifetime panel with top efficiency. But if shading or vandalism is a serious concern, I'll go with the polycrystalline or amorphous. I usually go with the lightweight amorphous panels whenever I need portable power to take along on camping trips as well. They are great for running small Koolatron 12V coolers during hot summer days camping–better than buying lots of ice.

Repairing a Solar Panel

Solar panels are covered with a tempered glass surface to keep the sensitive connections intact. If the glass gets cracked, you must seal it up so that water doesn't intrude. If moisture has gotten under the glass, leave it out in the sun till the moisture is driven out. Then proceed as follows:

1. The cracks on the front of the module could be sealed with a layer of transparent silicone rubber. This will be difficult to do evenly unless you use it sparingly and spread it along the crack with your finger. Don't go back over applied areas to try to smooth it out–it will just get rougher. Do this in the shade so the silicon rubber will dry slowly and more smoothly.

2. You can also put a thin film of Mylar plastic over it. Try to avoid thick glass or other heavy plastics, like Plexiglas, as these will cut the light transmittance by another 10%.

3. Do not try to glue a sheet of glass or plastic directly to the front of the module. It will be impossible to do this without creating bubbles or voids in the gluing process. Shatterguard plastic that comes pre-glued is an exception. It has excellent transmittance and can go on flawlessly if instructions are followed.

If the cell matrix on the crystalline surface is damaged, you may still get some voltage out of it. If the panel reads less than 14 Volts in full sun, the panel should be taken out of the group and used for camping as a stand-alone panel. A normal panel should put out 16 to 18 volts under no-load, full-sun conditions. Fourteen volts would indicate that some cells are not putting out any longer, and the voltage may drop even further under load. But I have found the panel can still do some work that does not require full voltage. For the fisherman who uses battery-powered trolling motors, try taking one of these panels out with you and hooking it up to your battery directly. It will extend the battery's ability to keep you going for a few hours.

Some Other Things to Keep in Mind

- Try to keep every solar module on a rack with other modules of the same size and output. Usually this means buying from the same manufacturer. If you ever expand the number of panels on the rack, the dimensions of the new panels will match.
- Keep the quantity of panels in even numbers (2, 4, 6, 8, etc.). This way, they can be rewired in pairs if you decide to change to 24 volts instead of 12 volts.
- Almost all modern panels come with built-in blocking diodes. Make sure yours has them. This is to ensure that current will not flow back out of batteries to your panels during the night.
- Make sure the panel you buy has at least 17 volts open circuit output. Some batteries require this higher voltage to charge correctly.

Racks and Trackers

All solar panels need to be bolted into a rack of some kind to facilitate mounting to your roof or on the ground. Racks should have some adjusting mechanism to change the angle to the seasonal azimuth of the sun. I prefer rooftop mounting for security and to avoid shading problems. This is not always possible when the house and roof system is not optimized toward the south. Roof-mounting offers several advantages. First, a roof that has at least a 4 or 6.5 pitch is well suited to direct mounting. There are some losses when the sun angle is not perpendicular to the panels, but if it is off by less than 10 or 15 degrees, it usually isn't worth adjusting. Second, in high wind areas, I worry about the ability of the wind to get under the panels and tear them off the roof. This is a particular problem with tracking racks placed upon a pole-type mount. The entire rack is up in the air, exposed to the high winds. True, these tracking collectors are rated for winds in excess of 100 mph, but sometimes winds can exceed this and the results would be very costly. Third, attaching directly to a roof allows me to build racks out of standard aluminum L-shaped stock that can be purchased in every major city. I can build a rack for a dozen panels for 1/3 the price of a pre-manufactured one. If you are not the handyman type, then follow my recommended sources in the "Recommended Equipment and Sources" section.

Since tracking racks are quite costly and sometimes have maintenance problems, I usually prefer to put the money into extra panels and then accept the inefficiencies of not having direct sun angles in the morning and evenings. I often will provide for some tilt adjustment so that one can change the tilt angle twice a year to better take advantage of the changing sun angle.

With all this said, if you want the most out of your solar system, and have a remote place with good security and low windstorm potential, tracking mechanisms certainly do optimize the cost of your system.

Other Parts of the System

In addition to the solar panels, we will need a combiner box to bring all the panel connections together before taking power to the batteries. From this grounded metal

combiner box, we will use heavy duty wires to lead the power to circuit disconnects, fuses, and a charge controller that will regulate the charging of the battery bank. There will be other aspects, such as metering and lightning and EMP protection. On the output side we must install more current protection devices, output metering, inverters, and output devices such as lights and appliances. All of this will be covered in the Systems Integration section where I will illustrate how to put all these systems together into one working whole.

Special Electrical Accessories

DC Motors

Use these replacement motors to convert belt-driven pumps, power tools, sewing machines and other appliances to DC. For continuous duty, use the same horsepower as the original AC motor. When running less than 10 minutes at a time under full load, you can use half the horsepower of an AC motor.

Voltage and Current Controllers

There are several products on the market which are supposed to handle two basic electric energy losses. One is the power factor controller, or motor controller, which essentially meters only as much power to the motor as it needs. When running under a full load, it doesn't save anything, but when running under no-load or partial loads, it cuts back on the power consumption. Motor controllers are inexpensive enough now since they are mass-marketed, that they are well worth the money. It takes a separate controller for each motor. However, motor controllers have only a few uses in a residence since most household motors are running on nearly half to full load anyway.

Motor controllers are especially important in the DC power field–especially when running DC motors, such as are found in water pumps with your solar panels, where the power and voltage may go up and down with the cloud cover. These devices will smooth out the variables and protect your motors. Highly recommended.

ALTERNATIVE TECHNOLOGIES FOR THE FUTURE

Cogeneration

Cogeneration is the use of engine-driven generators to produce both electricity and heat. By extracting the waste heat from generators to heat water or a home, you can more easily justify the costs of producing your own power–at least in theory. However, in reality, these systems so far have only been financially feasible in the large commercial applications that use copious amounts of heat in large industries or buildings. The typical cogeneration plant today uses a turbine engine (capable of running on a variety of energy sources) and an absorption heater/cooler for providing heat or air conditioning. These units are large and expensive. There are several companies attempting to adapt the technology for residential use, but so far, the cost of running any type of engine-driven generator nearly all day is prohibitive. Even in a commercial setting, the turbine has to

be overhauled every 3.5 years. If you ran a diesel engine like this, you would have to overhaul it every six months.

Residential Steam Engines

This is one of the original cogeneration systems–going way back to the 1800's. Steam engines are reliable old technology whose time may come again in the form of this smaller package. A 5 HP model will produce up to 2,000 watts and will heat 50 gallons of water every hour. Use one as a back-up generator for cloudy days without wind or as a sole power source. In warm locations, you may not want to produce this much heat on hot summer days. In cold places and during the winter, you can use the extra heat for hot water and space heating. A steam engine uses 10 to 20 gallons of water per hour without a condenser, so you will have to be next to a river. A condenser system increases cost and complexity but greatly slows water use, and heats a huge amount of hot water as well. Well-built steam engines should last at least 20 years.

There is nothing very complicated about setting up and using a steam engine and boiler, if you are mechanically inclined. But don't expect to be able to call a service man to come and repair one. Virtually all engines made today come with a good book of maintenance instructions. If you use a steam engine, plan on designing into the home multiple ways of using the excess steam: Install a hydronic heating system, build a steam bath and sauna, and heat domestic hot water via a heat exchanger.

The Fischer Engine System

What is proposed is a combination solar-Fischer engine hybrid with a 10kW generating unit based upon a series of concentrating collectors producing 400° F water, which drives an external combustion engine. The engine runs on heat and water. Water is heated externally by the concentrating collectors under high pressure (1500 PSI) to keep the water in liquid form. The water is then piped to the engine and injected into the cylinder, much like diesel engines, where it flash expands to steam and drives the piston downward. The steam condenses in the cylinder and the 200° F water is then recycled to the concentrating collectors for reheating. No water is lost, no cooling towers are necessary, and it produces maximum torque at low RPMs (250) for long life. This represents a 40% reduction in energy consumption as compared to steam turbine technology. While the unit now costs around $25,000, the costs could be down to diesel engine level as production increases. Even at present costs, it is only about 1/3 the cost of comparable photovoltaic power. The great residual benefit of the Fischer engine concept is that the residual heat can supply most if not all of your space heating requirements during the winter. The high-temperature fluid can also drive absorption air-conditioning equipment, though not at the same time it is running the generator unless increased collection capacity is installed.

I believe that the best tracking collectors for the Fischer engine generators are high-temp, parabolic dish collectors. It takes about half the number of collectors to produce the same amount of high-temperature heat as other non-parabolic concentrating collectors. The recommended application of these high temperature collectors is to use an oil for the heat transfer medium coupled to a heat exchanger so that the high pressure, Fischer

engine lines will not be in direct contact with the collectors (which would not handle that kind of pressure).

There is no reputable company yet building these engines. Several experimental engines are in operation, but there are a few shysters out there claiming to use them to produce "free electricity" without any external heat sources. These are bogus claims, and you should steer clear. Wait for a legitimate engine manufacturer to produce a working Fischer engine.

Sterling Engines

Sterling cycle engines are a similar technology except that they use a refrigerant gas at very high temperatures (such as hydrogen or helium) to run the piston of the engine. It is a closed-loop system operating at very high pressures, along the lines of 2,500 psi. To drive these engines one needs operating temperatures in the thousands of degrees– provided by concentrating parabolic mirrors. There are several of these in operation experimentally by large corporations. But none, so far, have been produced commercially due to the very high cost of manufacture dealing with these high pressures. Leaks in the seals around the shafts leading to the output side are a common problem.

Chapter

13

Plumbing and Sanitation Systems

The plumbing system includes a variety of sub-systems which transport liquid substances to or from the house. Together with the electrical system, these constitute the core "life support" systems within the home. In all of the key systems, there are many differences between standard construction and specialty preparedness needs. Trying to find a plumber or electrician who is willing and capable of deviating from his comfortable "ways of doing things" is always difficult. For this reason, you must have a broad understanding of all these systems yourself. As the owner, only you can make sure these systems get installed properly. It is not so important that you know how to do all the installation, but you must at least understand why they are essential and why you don't want to be talked out of them when you meet resistance. The following systems will be discussed in detail:

- An adequate water supply system from multiple sources
- A water softening and purification system, if needed
- A gray water (non toilet) waste system for water conservation, if needed
- A black water (toilet waste) disposal system
- A multi-source water heating system
- Storm and groundwater drainage system
- Hydronic piping for heating if a boiler is used

ADEQUATE WATER SUPPLY SYSTEMS

Water is so critical to survival that it should be of utmost priority in your preparations. Fortunately, in most parts of this country water is very abundant. Even in the arid West it is not difficult to acquire all the culinary and drinking water that is needed, although things have gotten much tighter in the last 5 years. Part of the problem is that local water districts have uniformly failed to provide dual use water systems, separating culinary water from irrigation water necessary for lawns and gardens. Someday society will regret not having the capability to provide homes with drinking water only, without the ability to keep people from wasting it on lawns.

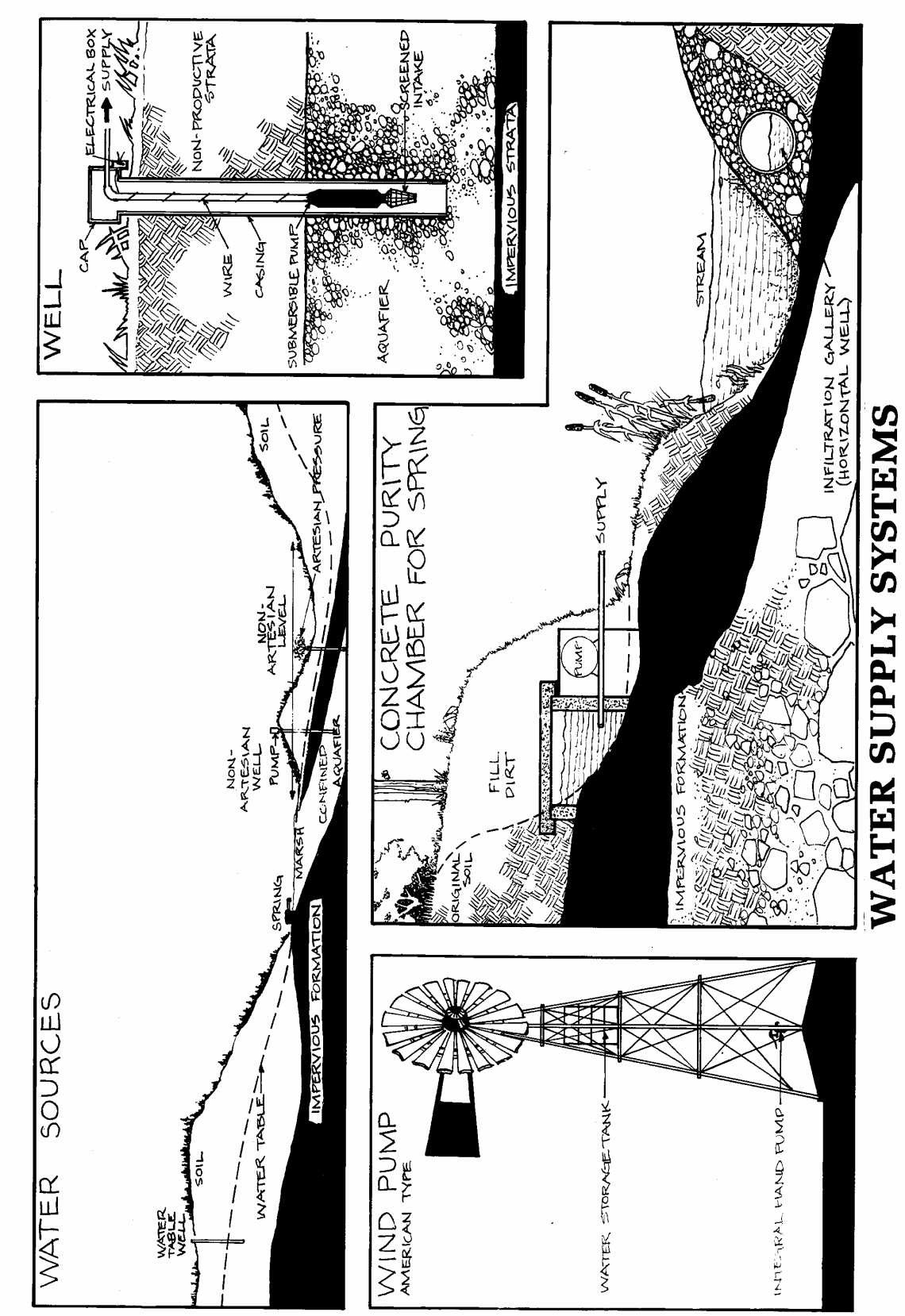
Irrigation water for large scale crop growing is another story, but we shall primarily be concerned with domestic uses in this book. Like any other survival system, multiple sources are a necessity. Storage of water in sealed containers is a last resort because of poor taste and chlorine which cities are required to add to public water supplies to ensure purity over a long period. As we discussed in the systems overview, I feel that every home ought to have an in-line water storage tank for emergencies. This is the easiest way to ensure that you will have a supply of fresh water during a temporary halt to your water supply. If you have an attic water tank, it will even be capable of gravity-feeding your faucets (if you provide a separate valve to allow air to enter the tank at its highest point).

Here in this chapter, we will review the essentials of developing multiple sources of water within the framework of your needs and financial capabilities. Naturally, you should hook up where practical to the public water supply even if you don't use it for drinking. It is usually the cheapest to install. For most residential applications, the best alternative source to the public supply is a water well.

Groundwater Supplies

Local ground water can normally be obtained by shallow or deep vertical wells or, in certain locations, by horizontal wells. In order to decide which type is preferable in your situation, a discussion on the groundwater system will be helpful.

Water which permeates the ground settles into water-bearing rock formations, usually consisting of at least one impervious layer beneath the surface. The highest level of water is termed the water table and varies significantly according to the level of precipitation and how much is being pumped out for large scale irrigation nearby. Many water-bearing formations have a downward slope between two impervious layers, much like a sandwich or conduit, that generally corresponds to the slope of the land. When penetrated by a well whose surface elevation is lower than the highest trapped portion of the underground supply (in the hills nearby), the water exhibits self-flowing, or *artesian* characteristics. The pressure is determined by the elevation difference between the well site and the higher water source. Normally, such deep-flowing wells are the most reliable and pure, although the drilling expense is high.


WATER SOURCES
WATER TABLE WELL
SOIL
WATER TABLE
SPRING
MARSH
IMPERVIOUS FORMATION
NON-ARTESIAN WELL
PUMP
NON-ARTESIAN LEVEL
SOIL
ARTESIAN PRESSURE
CONFINED AQUIFER
WELL
CAP
ELECTRICAL BOX
SUPPLY
NON-PRODUCTIVE STRATA
WIRE
CASING
SUBMERSIBLE PUMP
SCREENED INTAKE
AQUIFER
IMPERVIOUS STRATA
CONCRETE PURITY CHAMBER FOR SPRING
ORIGINAL SOIL
FILL DIRT
PUMP
SUPPLY
IMPERVIOUS FORMATION
STREAM
INFILTRATION GALLERY (HORIZONTAL WELL)
WIND PUMP
AMERICAN TYPE
WATER STORAGE TANK
INTEGRAL HAND PUMP
WATER SUPPLY SYSTEMS

Vertical Wells

Shallow wells can be drilled by homeowner-type equipment such as the DEEPROCK system which has been very popular for use where the water table is within 150 feet and as no difficult rock formations. Extreme care must be taken with shallow wells to guard against contamination by animal debris and other bacterial sources which may leach down through the soil. Do not locate wells closer than 100 feet to septic tanks or barnyards. Your wells should be checked for water purity at least once a year, preferably every six months. Many leakage fissures exist underground which can transfer contaminated water in unusual directions.

Deep wells are now very expensive, but are the safest and purest if you can afford the expense. Deep wells usually have more problems with soluble minerals causing the water to be hard. Hard water requires the application of filters and/or salt/resin bead type water softener treatments to remove these deposits. There are also some magnetic systems on the market which will be discussed. If mineral deposits are not removed or at least kept in solution, scale and other deposits can corrode, clog, and stain pipes and fixtures.

In addition we need to develop some security features to protect the wellhead from tampering, sabotage, or vandalism. With the modern submersible pumps, the wellhead can be completely underground for security and freeze protection. More often, it will be recommended that you build a small concrete block wellhouse with a concrete roof and a metal strong door. In cold climates, always wire the wellhouse for lights and keep two long lasting bulbs burning inside during cold weather to keep the wellhead from freezing. Place your pressure tank and controls inside the basement for further protection. If you cannot build a basement, place the pressure tanks inside an enlarged and secure wellhouse.

Horizontal Wells

When located near a river which is not suitable for drinking itself, a horizontal well can be constructed nearby to draw naturally filtered water from the surrounding water table. The earth will filter out silt and other large elements, but will not ensure or guard against pathogens. Shallow well water almost always needs to be oxygen-treated to ensure purity.

A trench is dug near the river until water begins to fill it rapidly. Starting the trench at the lowest elevation will avoid the need to pump out the water if the trench is too deep. Usually a hundred feet of trench is sufficient to obtain a good steady flow. A large 6-12 inch drain tile or perforated masonry pipe is laid in the trench on a gravel bed and surrounded by gravel and sand. It is wrapped in special filter fabric before being covered. Actually, the filter fabric goes in the trench first, and then the small gravel and perforated pipe. The filter fabric keeps small soil particles from clogging the porous gravel beds around the pipe. Within a few hours, the water should be flowing clear of any silt. At the bottom of the trench, install a large plastic barrel where you can collect the water in sufficient depth to install a submersible pump. Now pump the water to a gravity-feed cistern above your home. Do the treatment of water in the cistern or in your first in-line storage tank within the home (which is usually more convenient if you are

using liquid oxygen purification). If you use ultraviolet light or ozone equipment, as will be discussed later, place this equipment on the incoming pipeline just after the T-connection where your garden hose faucets begin. Don't use purified water for the garden.

Springs

Springs erupt from the ground when a waterbearing formation ceases its downward slope in relation to the surface and emerges into open air. To utilize a spring, a small infiltration reservoir must be constructed in the water bearing formation to allow a small pool to develop. This is opened up by excavating back into the hillside till you get slightly below the water-bearing formation. A waterproof membrane of at least two plastic layers is laid down in a bowl-like area to collect all the spring water. A pipe is embedded in the bottom layer of plastic at the lowest point in the bowl shape to contain the waterflow and lead it into a spring tank. The plastic collection layers are then covered with sand to protect against puncturing, and then with gravel. Once the spring is covered completely with gravel, waterproof plastic layers go on top to protect against contamination. The final shape of the gravel bed should be domed so that the plastic on top will shed water away from the spring bed area. Then cover with soil.

This small masonry spring tank should be covered with a concrete cap and fitted with a pipe tapping into the supply a few inches below where the water level normally is during the dry season. In no case should it be close to the bottom so as not to pick up matter which has settled in the bottom of the tank. Spring tanks can be totally buried by earth for privacy if you so desire, though you must plan on some maintenance every two or three years depending upon the quality of pipe and frequency of water-borne deposit build-up in the tank. Some springs have operated since their very inception without any maintenance at all. Extreme care must be taken to ensure that live animals do not get into the tank and drown. The carcasses will begin to contaminate your water supply with bacteria.

Streams

Many streams in North America are still pure and clean. However, simply because they flow from wilderness or mountainous areas, does not assure they are pure. Wild animal feces often pollute these streams though this is usually only temporary. Remember too, that fast-running water does not guarantee purity, though the oxygenation of the water will destroy many types of pollutants over the course of some distance. I always carry a small bottle of stabilized oxygen based water purifier with me (like Aerobic K07) when I go into the woods, or anytime I travel out of the country. A few drops of stabilized oxygen in the water will ensure that all pathogens are dead within minutes, without the need for testing.

Streams can be tapped directly (if you have water rights) by making a small pool sufficiently deep to place your screened pipe opening. If you have enough slope on your property you can build a complete gravity-feed system. Bring this pipe downslope so that it gravity feeds into a buried cistern, and then take the cistern exit pipe (near the bottom of the tank) to the house. Filter at the house and then add your water purifying equipment as before. If you do not have sufficient slope to run a gravity-feed system, run

the pipe downward to a buried cistern and then use a solar pump to bring the water up and into the house. You can also use wind-driven pumps, or 110 volt pumps coming off your inverter and battery bank. If the stream is below your home and cistern, you will have to use solar pumps to pump up to the cistern, and then into the house.

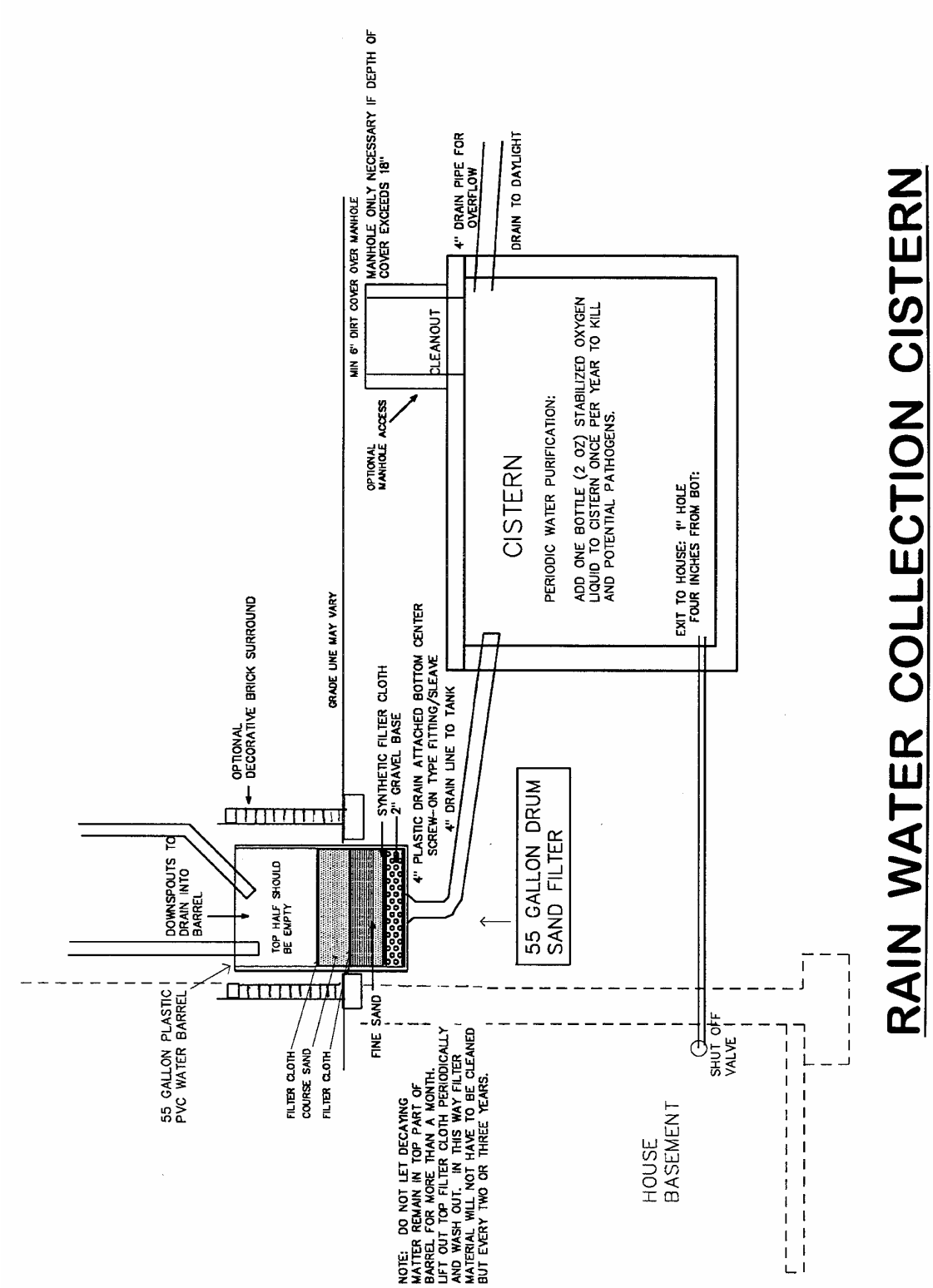
Rainwater Cisterns

First, a general note about cisterns. Cisterns have been used for centuries as a way of keeping water fresh. By storing water underground where it is cool and dark, it stays relatively safe and pure. Cisterns collect and store water from springs, windmills, solar pumping, and rainwater. If a cistern is used as a primary source of water, try to locate it *above the level of the house*, so that gravity can provide for basic water pressure. This can be augmented with a pressure pump and tank if you need higher pressures, but it will ensure emergency gravity feed if no power is available. By the way, the best range of water pressure in a home is from 30 psi to 75 psi (55-65 psi is the optimum). Higher pressures tend to wear out valves and faucet washers. If you use a well pump for your main supply in combination with a cistern, a float switch can be installed in the tank so that the well pump shuts off when the tank is full. This should only be installed when using a cistern that is higher than the house, otherwise you will have to have another pump to get water out of the cistern. Water storage can also be stored in multiple pressure tanks within the house.

One of the oldest, semi-reliable ways of obtaining water is by a rainwater collection system and an underground cistern (see illustration). While there are some places with sufficient quantities of acid rain or pollution to prohibit rainwater collection, most rural places are safe for this ancient practice. Even today, some island countries such as the Bahamas or Bermuda rely heavily upon rainwater collection. Essentially, the system collects rainwater from the roof, prefilters major debris, and then fine filters the water before entering the cistern. The cistern is an underground concrete or other masonry chamber with an access hole and various pipe connection penetrations. An overflow pipe (4 inches round) should leave the cistern from a position equal to or slightly below the inlet pipe filling the filter barrel. The filter barrel effectively acts as a screen so that no vermin or insects will enter. Cistern tanks are built of very dense cement so that no waterproofing is necessary. It does not hurt to waterproof the outside before putting it in the ground, but never use any waterproofing on the inside.

For most people, the rainwater cistern will be a backup means of having water. For this purpose, it is sufficient to put it in the ground close to the house and close to at least one of the filter barrels. If you have a basement, you can provide a gravity-feed line from the bottom of the tank directly into your basement. Since cisterns are usually only 5 feet deep, the bottom outlet will still be above the basement floor level, allowing gravity feed. I prefer that this line run into the shelter part of the basement so that no one can tamper with this ultimate supply system.

If no basement exists, it will be necessary to put a submersible pump into the cistern to extract the water. The run of pipe from the cistern submersible pump into the house


RAIN WATER COLLECTION CISTERN
55 GALLON PLASTIC PVC WATER BARREL
DOWNSPOUTS TO DRAIN INTO BARREL
TOP HALF SHOULD BE EMPTY
OPTIONAL DECORATIVE BRICK SURROUND
GRADE LINE MAY VARY
MIN 6" DIRT COVER OVER MANHOLE
MANHOLE ONLY NECESSARY IF DEPTH OF COVER EXCEEDS 18"
OPTIONAL MANHOLE ACCESS
CLEANOUT
4" DRAIN PIPE FOR OVERFLOW
DRAIN TO DAYLIGHT
CISTERN
PERIODIC WATER PURIFICATION:
ADD ONE BOTTLE (2 OZ) STABILIZED OXYGEN LIQUID TO CISTERN ONCE PER YEAR TO KILL AND POTENTIAL PATHOGENS.
EXIT TO HOUSE: 1" HOLE FOUR INCHES FROM BOT:
SYNTHETIC FILTER CLOTH
2" GRAVEL BASE
4" PLASTIC DRAIN ATTACHED BOTTOM CENTER SCREW-ON TYPE FITTING/SLEAVE
4" DRAIN LINE TO TANK
55 GALLON DRUM SAND FILTER
FILTER CLOTH
COURSE SAND
FILTER CLOTH
FINE SAND
NOTE: DO NOT LET DECAYING MATTER REMAIN IN TOP PART OF BARREL FOR MORE THAN A MONTH. LIFT OUT TOP FILTER CLOTH PERIODICALLY AND WASH OUT. IN THIS WAY FILTER MATERIAL WILL NOT HAVE TO BE CLEANED BUT EVERY TWO OR THREE YEARS.
SHUT OFF VALVE
HOUSE BASEMENT

should exit the cistern above the water level so that water will not leak out the joint around the pipe (which will always tend to leak because of pipe vibration). If the pump is in the house and not in the cistern, the suction end of the pipe should have a foot valve, which keeps the pump from losing its prime. Most pumps need to have water in contact with the pump mechanism to begin pumping again. A foot valve is at the bottom of any suction line and allows water to enter the pipe but not flow back out when the pumping stops. Manholes in the top of the tank for inspection or repair should be placed on a small circular manhole extension so that the entire manhole system is raised above the cistern. Thus, when the cover is lifted, dirt or other debris does not enter the chamber. In hot climates, this also allows the cistern proper to be lower in the ground without making it difficult to uncover the access hole. The same should be done with septic tanks so that periodic pumping can be accomplished without digging for the access hole.

Arranging Downspouts

One of the hardest things in developing a significant supply of water from a rain collection system is arranging the downspouts so as to bring all the water to one side of the house. If you can afford to have two cisterns, one on each side of the house, this solves much of the problem. This really isn't an outrageous idea. The cost of the concrete cisterns is not large compared to the overall project. Setting up filter barrels and connecting all the pipes is the biggest part of the job. If you only use one, you have to put the cistern low enough in the ground so that a sloping drain line from the front of the house can reach around the side, or forget about collecting the rain from all roof surfaces. In rainy areas, where even a portion of the roof provides sufficient water, this last alternative is fine. But in dry, desert areas where water is at a premium, utilizing all the roof areas is essential. If we are designing a home from scratch, I always put in a *cross-over drain line* through the center of the basement, allowing it to be hidden within a wall if possible, or at least in an overhead furred-down area. In this manner we can easily take water to the cistern without having to route it all around the house. In addition, this allows us to gather the downspout water near the center of the house. Gutters can only transport water so far horizontally before they run out of slope or start to look badly angled on the roof eave. Style also plays a role in this process since we can't allow a downspout to come down anywhere on the house. The most aesthetic places are where rooflines break, or at places where the walls jog or provide a corner. In addition, we cannot allow downspouts to conflict with windows, doors, or other decorative features.

Gutters and downspouts should have screens on them to keep leaves from entering the filter barrel in great numbers. Even so, there will be a need to clean out the debris in a filter barrel at least twice a year. However, bacteria will not be an appreciable problem if the cistern is underground. The lack of light and constant cool temperature lends itself to keeping water pure. Even so, I always recommend putting a couple of liquid ounces of oxygen purifier into the cistern once a year to ensure that any accumulated bacteria will be killed.

The downspout should empty first into a large barrel filter with progressively finer filter fabric and sand material before entering the cistern chamber, as illustrated. A final set of commercial water filters should be placed between the pump and your pressure tank, if you have a pressurized system. A lighter set of sediment and charcoal filters should be at

the end of a gravity-feed system as well, after it enters the basement or shelter area. In addition, I would opt for an ultraviolet light water purifier that will kill any pathogens that come out of the cistern, as they flow through the filter. Lastly, do not plant any large trees within 30 feet of the cistern or the roots may break or crack the cistern walls.

Filter Barrels

It is important not to get overly zealous about packing a filter barrel with fine sand. True, this is a very good filter media, but you will also end up dumping most of your available water as it cannot get down the filter fast enough to keep from overflowing. In desert areas, where these systems are particularly useful, much of the water comes with summer thunderstorms. When it rains, it does so in copious amounts. If your filter barrel is mostly filter media, the barrel is going to overflow within less than a minute and you might get a total of 10 gallons of water out of a 500 gallon storm. Make sure your filter barrel drains water fairly rapidly. If you fill it with water and it takes 10 minutes to filter through, you have too tight a filter. Use coarser sand until your filter barrel empties in 2 minutes or less. Make sure you fill your barrel no more than half full of filter material. This leaves room for the water to build up and add pressure to the filtration process, prior to over-spilling. For those who have no other source but rainwater, you may need to build several filters barrels side by side, with the overflow from one leading to the other. This ensures that you will salvage every drop without overflow. A good cheap source of filter sand is from masonry suppliers. Brick and block masons require a washed sand that has little or no silt in it. This makes good filter material and it can be bought cheaply. Flush it with water for about 5 minutes before you hook it up to the cistern. Don't allow leaves to accumulate in the barrel until they rot. This will promote fungal and bacterial growth.

PUMPING WATER FROM WELLS

The follow material covers the various pumping systems and pump types available to choose from. Many times we can place more than one type of pump down the well, as a backup.

Conventional Electric Pumps

The 220 volt submersible impeller-driven water pump is found worldwide. It is economical to build, efficient, durable, and fast – but it takes a lot of power. This is the preferred pump if you have access to utility power or a moderately-sized generator. These pumps are lowered down inside your well casing until well below the natural water level. This is to make sure the pump doesn't run out of water to pump when it is powered up. The water level in a well drops significantly as the pump is running. Because of this deep well placement of the primary pump, we can often drop a second alternate energy pump down the well and set it at some level above the main pump. If we lose utility power, we can use solar or battery power to bring the water up. These pumps do not pump as rapidly and thus there is less chance of running dry due to lowering the water level. Lower voltage units, driven by 12 or 24 volts, are not nearly as efficient for high power uses like water pumping. They draw a lot more amperage to do the same

amount of work as a 220 volt pump. The wire cables must therefore be much heavier to compensate for the higher amperage drawn. All of this means that low voltage pump motors cost 3 times as much as the 220V machines. That is one of many reasons why I like to use utility power or a generator for these kinds of heavy-draw facilities. Just having to replace a 12 volt pump will set you back about a $1000. We can also run medium sized 220V pumps off of a 220V inverter (actually two inverters in tandem). But that means spending about $5,000 for the inverters.

Variable Speed Pumps

There is a new technology pump on the market which allows better inverter operation of a 110 or 220 volt deep well submersible pump. Grundfos has developed an electronic control unit for their smaller 3 inch submersible pumps that effectively *eliminates the start-up surge* of electricity that would tax most inverters to maximum capacity. If any other load is attached to the inverter when a big well pump tries to start up, the inverter circuit breaker would usually pop. Now, with these new pumps, there is no high power surge. The motor starts up gradually, and thus allows for more accurate and full utilization of the inverter's size. Before this invention, one would have to keep the inverter nearly unloaded at all times just waiting for the well pump to come on. With the new Grundfos pump, due out in 1999, you only have to allow for the running current of the well, which is usually half of the start-up current on a conventional pump.

In some situations, it's better to tie into an automatic start switch for a generator to pump the water. Gasoline or LP gas generators start up easily and it doesn't hurt them to run for short periods of time for water pumping purposes. There are automatic switches on the market for about $300 or $400 that can take their signals to activate the generator from either a low battery bank or a well pressure switch. When using a generator to power a well pump, make sure you have at least two large capacity pressure tanks. Pressure tanks serve as reservoirs of both water and pressure and keep you from having to run the well pump too often. The more pressure tanks you have, the longer the generator will run every time it starts up. At the same time, this equates to fewer times per day that it will have to come on, since it will take you longer to use up the stored water pressure in the tanks. Extremely short run times for a generator would not allow it to come up to proper temperature and oil degradation would occur. Also make sure the well pressure switch is set properly with a fairly wide spread between the "on" setting and the "off" setting. If the switch pressure differential is too close, the pump will just turn on and then have to shut off minutes later. You want at least a 5 minute run of the generator every time it comes on; 10 minutes is even better.

Solar Water Pumping

The initial cost is high and the output is slow, in comparison to conventional 220V pumps. But the long- term advantages are sometimes lower costs and increased reliability. Solar pumps used to be relegated to shallow wells, but now they can even pump from depths as deep as 900 feet (with very small flow). I prefer systems that run straight off of solar panels, only using batteries for a backup – but there are combination systems as well. The SolarJack SCS pump is a top of the line, submersible centrifugal pump – just like the high voltage types but built to closer tolerances. The deeper you go,

the more watts of solar panels you will need. For example, to pump from 800 feet you will need a whopping 1750 watts of solar panels – that's 24, 75 watt panels costing over $10,000, not including racks and installation. So, let's hope you don't have to go that deep.

A competitor to the centrifugal pump is the high-powered solar piston pump made by SunRise. It is fully submersible and fits down a 4" well casing. Piston pumps are particularly suited for pressurizing since they are positive-displacement pumps. They are long-lasting and durable, and more efficient than centrifugal pumps--but not nearly as powerful. For example, from 600 feet the SolarJack SCS will pump 3.4 gal/min. using a little over 1600 watts. The SunRise will pump only a gallon a minute from the same depth. However, the compensating factor is that the SunRise pump only uses 220 watts.

So, if you need real volume, go with the centrifugals. If you can't afford a lot of solar panels and need low powered efficiency, go for the piston pump and combine it with a cistern to store water in advance so you don't have to worry about how slow the piston unit is pumping. The actual cost of the lower output piston pumps is only a little cheaper than the centrifugals. But the big cost difference comes with the cost of the panels needed to run the centrifugals. Both these types of pumps require a special controller, called a *linear current booster*. These electronic black boxes manipulate the current and voltage to maximize the power to the pump even during varying solar output at the panels themselves. They also save the motors from burning out under low solar output. Don't try to run these pumps without these linear current boosters.

There are even smaller and more efficient pumps available if you need small amounts of water for culinary needs only. The PowerLifter high head surface pump can drive water uphill over 1,000 feet, all driven by two 90 watt solar panels. Now that's efficiency! It only gives you about 10 gallons per hour, but if you live on a bluff overlooking a river 1,000 feet below, this little pump can do the job. Ten gallons an hour is plenty to live on.

Another type of pump is the single or dual *diaphragm pump* that is suitable for lower head applications. SolarJack makes the SDS-D series for this purpose.

Water Pumping Windmills

These relics from the past are making a minor comeback. Unlike wind generators, water pumping windmills can utilize slower wind speeds by using multiple blades. The reason is RPMs. Wind generators like high RPMs, but wind pumpers need lots of slow torque for driving piston pumps up and down in a well shaft. There are still a lot of these units sitting out in farmers' fields rusting away. Sometimes they can be had for the cost of hauling. But due to the reliability problem of the old machines, it's better to buy new. The Mexicans are making new ones for about a third the price of those made in America. See the Recommended Equipment and Sources section.

Another benefit of these wind-pumping machines, is that the pump mechanism can be converted to a manual pump handle in an emergency. Pumping depths are possible down to about 100 meters deep.

Hydraulic Rams

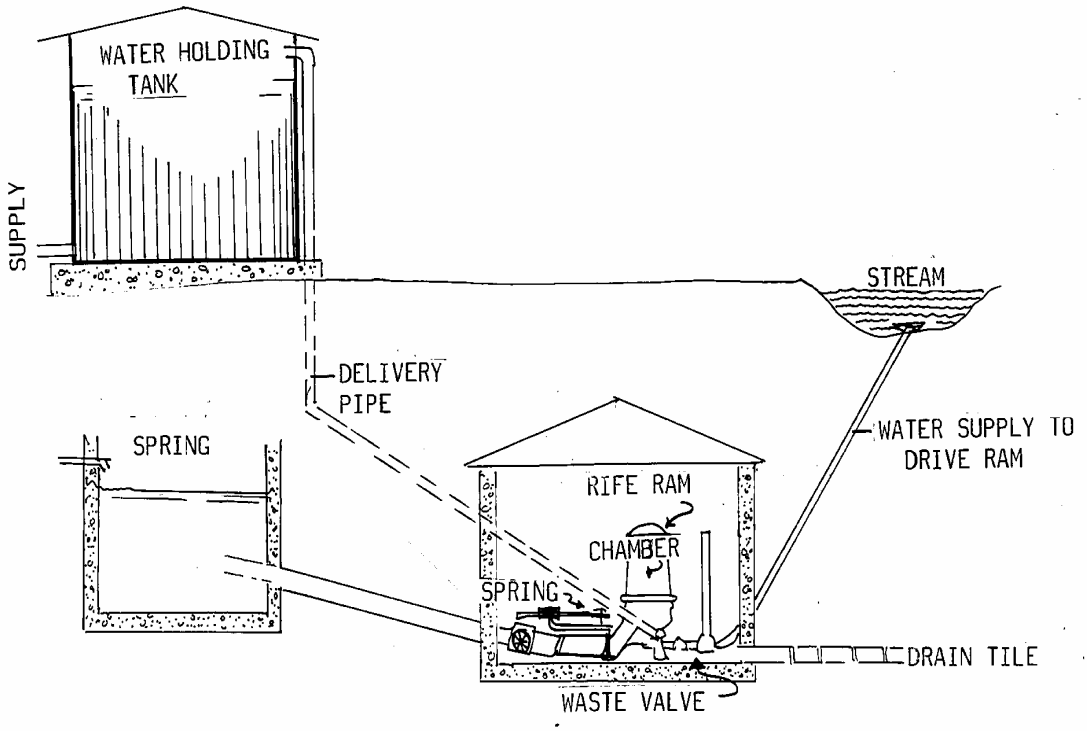
(See illustration.) The hydraulic ram is the ultimate in "free" water pumping. It is a mechanical valve device which uses a downward flow of water in a pipe (from a stream) to force open a spring-loaded valve allowing a small amount of water to enter an air compression chamber through a one-way valve. The air which was briefly compressed by the incoming water expands and pushes that same amount of water up a pipe to the storage tank, located higher than the source of water used to power the ram. This cycle is repeated 50-100 times per minute. The higher the head of feedwater, the more water the ram will pump in each cycle. The number of cycles is adjustable by regulating the spring tension. The object is to slow the cycles down until the ram reaches its highest pumping capacity in accordance with the supply flow. The valve connected with the spring is called the waste valve. In order to operate, the ram wastes about 10 gallons of water sent downstream for every gallon pumped. This is because water has to be dumped out in order to allow the downward flow to reach its original speed enough to force the spring valve open again.

The RIFE company has been for years the foremost American maker of the traditional bell-shaped rams, and even has a model which will operate on one source of water and pump from another. This was an important design innovation, because in most cases you may have a stream of water suitable for operating the ram, but not suitable for drinking water or for storage. This way, a stream can be used to drive the ram, which in turn can pump water from a spring to a storage tank. The minimum head required to operate any ram with a usable lift ability is about 24 inches. If you can develop a head of 3 feet, for instance, your supply pipe to the river should be at least 9 feet long (3 times the head) and have a minimum slope of 30" to the ram. Try to keep all lines as straight as possible to minimize friction losses.

There is a newcomer to the hydraulic ram field which takes all the difficulty out of setting up a system. The "HighLifter" water ram is a ready-to-go, drop-in-the water system that can pump a thousand gallons a day and run on as little flow as one quart per minute. The Recommended Equipment and Sources section has details.

WATER PURIFICATION EQUIPMENT

With the possibility of living off rural streams or springs, it is essential to have minimum purification equipment, should the water become contaminated. Those who live off public water systems should also be concerned due to the health hazards associated with trace chemicals and chlorine content. Some water sources in Arizona and California are considered by many to be completely unfit for consumption. The bottled water industry is very big in these areas and has even been accused of delivering merely filtered city water – just to keep up with demand. Rural farms should also be concerned even though



DOUBLE-ACTING "RIFE" RAM INSTALLATION

they may have their own wells. Farm fertilizers and chemicals leach through the soils and deposit traces of lead, mercury, and other hard metals in the water-bearing strata which is relayed to you through your "safe" well. There are several types of purification systems which we will cover in the chapter 16 on Household Appliances. What I want to cover here is the implementation and placement of such equipment. Your water filtration and purification equipment, like many other types of preparedness equipment, either operates full-time equipment or serves as a backup. Here's a list of suggested implementations based upon your water system or systems.

City Water Supply Detoxification

Every city water supplier is required now (by federal mandate) to provide some positive means of ensuring zero bacterial content. This is an excessively high criteria, based mainly on protecting a bureaucrat's liability rather than safety. The human immune system can handle minor amounts of bacterial contamination. But with today's liability laws, even a city which has a near perfect drinking water supply is almost always required to accept chlorination as the preferred way to comply with government edicts. The water police love chlorine because it is so easy to tell when you have a killing dose – they simply keep adding chlorine until there exists an excess of chlorine and it starts to give off *chlorine gas*. You can smell the chlorine in almost every public water supply, and it's done that way on purpose – regardless of the health side-effects. They don't care that it would be safer to put in a smaller dose. That would require more sophisticated testing. Cities want the easy way out. With their saturation policy they don't have to vigorously test, they can simply assume they have a killing dose. Trouble is, it is a killing dose to human health, over time, as well. There have been several valid studies showing the relationship between chlorinated drinking water supplies and cancer and heart disease. Even when there are other safer alternatives like ozone and ultraviolet light, cities are reluctant to adopt them due to the difficulty in testing. Another difficulty is the sheer volume of water that must be sterilized since cities do not separate culinary water from irrigation water which don't need to be purified. Sadly, some pristine mountain spring water supplies all over the country are ruined by chlorine treatment just to cover some minute possibility of contamination. What to do?

First of all, don't drink or cook with chlorinated or fluoridated water. The quantities of water used for these essential human consumption purposes are small enough that almost every family can afford to either buy drinking water or filter out the chlorine. The easiest way is to buy one of the excellent charcoal or mineral-based chlorine filters that attach with a small flexible hose right to your faucet. These don't require any plumbing changes except unscrewing the aerator and installing a new one with the hose attached. The anti-chlorine filters last about 6 months and are now cheap to replace. There are still some extremely high priced units out there, but there is no use in paying those extreme prices when the mass market is now providing some very high quality competition. Look for the newer KDF (kinetic degradation flux) filters. These are made of a copper-zinc alloy that chemically alters the chlorine rather than just filtering as carbon does. They last about 3 times as long as the carbon filters.

One step up in both cost and longevity are the larger under-the-counter models with a small, separate drinking faucet on the sink. These require some minor plumbing changes

but will be a more aesthetic alternative. Always check the price of filters before you buy. A unit whose initial price is low, but whose filters are high-priced or short-lived, is not a good deal. There is no need to do whole house filtration for chlorine since most heavy water use (washing and lawn watering) doesn't need the chlorine removed. Shower head filters should also be attached to each shower facility. Chlorinated showers put a lot of chlorine gas into the air, which is bad to breathe.

Well or Spring Purification

These two sources usually need water softening to eliminate some of the mineral content, if high. And occasionally, a bacterial problem may show up. I always recommend a couple of filters just after the water enters the house. First, a simple sediment filter. Always get the generic sizes that can be had at most Home Depot or other home improvement stores. Sediment filters will catch sand, flakes of rust, or other foreign particles that come from pipelines. Second, you should install a combination charcoal/ultraviolet light filter that is capable of zapping any bacteria that may come through. You don't have to run the ultraviolet light constantly, only when a problem develops. Some systems have pressure or flow sensitive switches which only turn on the light when water is moving. If you use these pressure switches, make sure these systems are installed after the T-connection leading to your garden hose outdoor faucets. These faucets should come off the main line right after the shut-off valve next to the wall and before any other water improvement equipment.

Cistern Purification

Cisterns with large vented tanks always have the capability of gathering some bacteria. It is rarely enough to cause a problem, but certainly a much higher probability than in a well. All cistern systems should have an ozone-ultraviolet purification unit on the inlet line as it enters the home, capable of purifying incoming water. This is especially true if the water is in storage for long periods of time. Constant flow systems tend to keep any bacteria from concentrating into dangerous levels. These new and safe methods of purification allow any homeowner to have safe water without the risk of chemical contamination. Whatever you do, do not use household bleach in your cistern. All bleaches are toxic and some are much more toxic than others. They are not effective against many pathogens, except in extremely high concentrations, so either way, they are dangerous to your health. If you have a bacterial problem, use oxygen purifiers only. In extreme cases, you may have to drain the cistern and clean it out manually with hypochlorite bleach, but under normal use only an occasional dose of oxygen should be needed.

Emergency River Water Purification

River water should be filtered and sterilized by either boiling or adding drops of stabilized oxygen.

Water Holding Tanks Purification

Technically, water holding tanks are like cisterns, except much larger and usually not buried. Rural water systems often rely on multiple thousand gallon tanks to supply gravity-fed water to several homes. There are numerous tank manufacturers around that supply these tanks. Most used to be large steel tanks, but now plastics are taking the lead in the small to medium sizes. The only liability of these tanks is that they are almost always placed above ground and therefore are subject to heat from the sun and to vandalism (kids shooting holes in them with hunting rifles). Even at the cost of a few more thousand, I always recommend these elevated holding tanks be placed underground.

Chemical Water Purification

There is only one type of chemical treatment that I recommend as safe – stabilized oxygen drops. These come labeled under numerous similar titles like Aerobic Oxygen, Liquid Oxygen or Aerobic K07. The best is now made by Aerobic Life Industries which has a new and improved version based on potassium, rather than chlorine--thus their product is called Aerobic K07 (K for potassium). All types of stabilized oxygen purifiers are safe for internal consumption when diluted. Thus, they can help cure dysentery in the intestines as well. Most say on the label not to add any citric acid to the product. Actually this prohibition only refers to internal use. The citric acid (lemon or lime juice) will immediately cause all the oxygen to come out of solution. This is what you want for water purification – but **not** if you are going to put some stabilized oxygen in a glass to drink.

Of all the commercial water purifiers (never to be taken internally) the only reliable way is to use a purifying solution made from IODINE CRYSTALS. Iodine crystals by themselves are poisonous and must be obtained from a chemical supply house. Pharmacies don't carry them, but food storage and survival suppliers do, usually ready to use. If you can only get the raw iodine crystals, here is how to use them: Place 5 grams of crystals in a one ounce bottle and fill it with water, using a bakelite plastic cap. The crystals will not dissolve, but will saturate the water with resublimed iodine which is the purification solution. Use 10 ml of the solution (not the crystals) per quart of water that you want to purify. Pre-measure 10 ml segments on your one ounce bottle so that you can use it without having to carry a measuring flask marked in ml. The iodine solution will kill bacteria, spores, algae, enteroviruses, amoebas and their cysts in less than 15 minutes. The taste of the water is good, and it will retain its purity for long periods over a wide range of temperatures and pH. This solution is different from the common 2% tincture of iodine which is unstable, of questionable effectiveness, and has a very short shelf life. Halazone only works under limited conditions when it is fresh, which is highly unlikely. It does not work well in cold, polluted water, and loses 3/4 of its potency within a couple of days if exposed to the air. Globaline tablets are also ineffective since they only work when the tablets are very fresh. Ordinary bleach (5% sodium hypochlorite) at 2 drops per quart is nearly worthless, despite wives tales to the contrary. There are several new types of bleach on the market that are poisonous, so don't mess with bleach. It is uniformly bad for your health. Also, the taste of water treated with bleach and tincture of iodine is very poor.

WATER HEATING

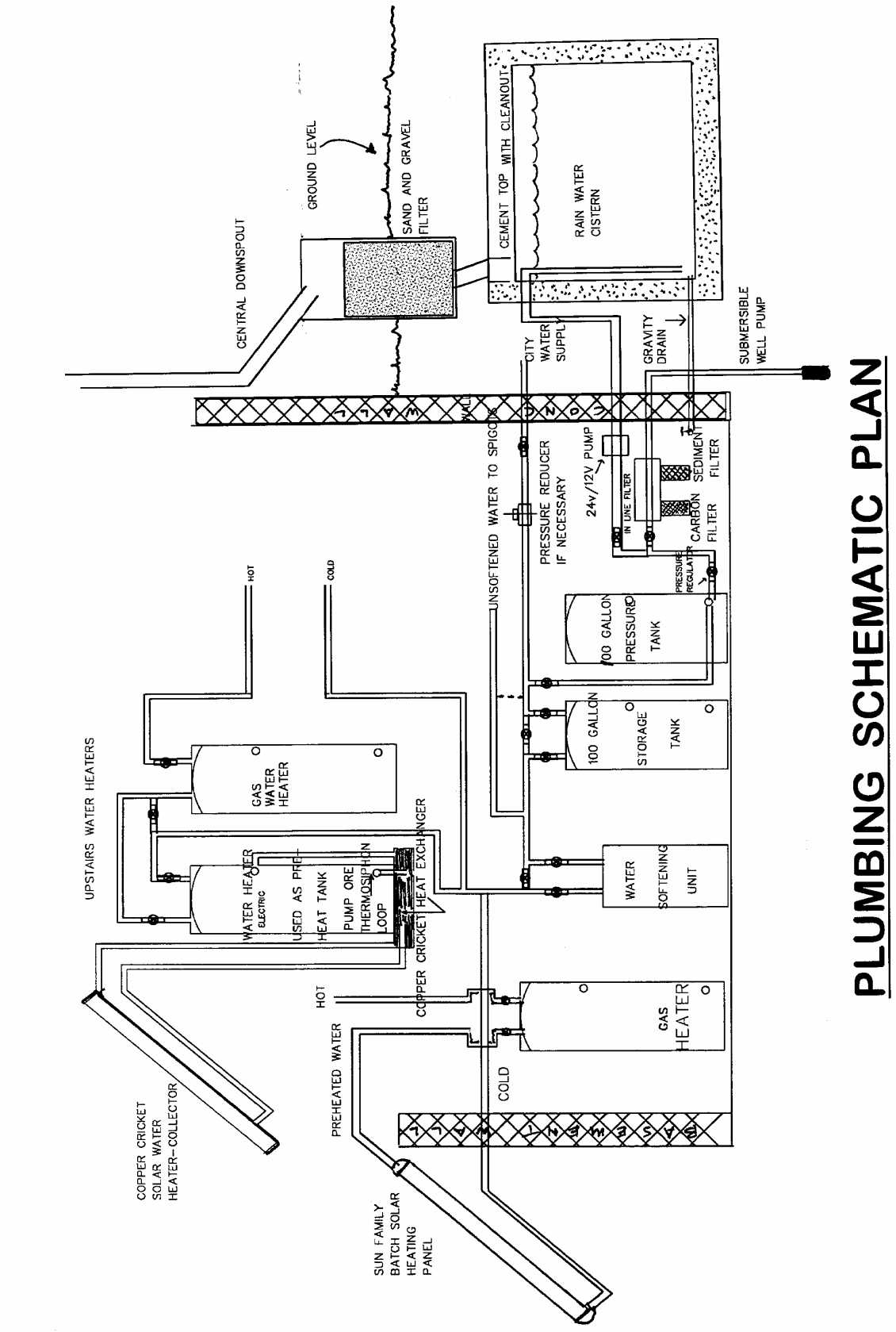
The next plumbing illustration (Plumbing Schematic Plan) depicts a variety of details relative to installing the various components of a water supply system and combining them with water heating systems. The basic components of a multiple contingency water system are:

- Dual or triple sources (in this case city water, a well, and a rainwater cistern).
- Filtration on private water sources, plus purification capacity (in this case we have a sediment filter, then a combination carbon filter with ultraviolet light for sterilization).
- Multiple tanks for in-line water storage. The 100 gallon pressure tank will give us anywhere from 50-80 gallons, depending upon degree of fill. The storage tank beside it will give a full 100 gallons. Each hot water tank is a storage tank as well.
- Multiple sources of hot water (two solar preheat units, gas as the main final source, and electricity within the preheat tanks as the backup).
- Water softening, as needed. (We use a conventional salt water conditioner here since we have chlorinated city supply. The magnetic softeners tend to release more of the chlorine into the air when using a shower, which is an undesirable side effect)

Note that the water line to the outdoor faucets takes off before we get to the water softener – no use softening the thousands of gallons going to the lawn. It might also be taken off before the water storage tank (see dotted line) to keep cold water from condensing on the tank walls during lawn watering. Note also that each tank has a set of 3 valves so that the tank can be taken out of service as necessary.

The solar water heater to the lower left of the drawing is a batch heater type. This is the most efficient of all the water heaters since the solar collector heats the water directly in the small, narrow tanks within the vacuum-insulated chambers. Heat loss at night is minimal. These collectors are only subject to freezing in the pipes that lead into the house, which should be well insulated and have some heat tape wound within the insulation for winter heating in cold climates. Since batch collectors have their own tank, we can attach them directly to a gas water heater as shown. The collector acts as its own preheat tank.

On the roof is a different system. This system was designed for a larger house with multiple baths. It is preferable to have more than one solar water heater so that you don't have to pipe hot water long distances, where you would lose a lot of energy as the pipe runs cool down. The upper roof system is a special thermosiphon design by Copper Cricket which has a special valve allowing a wider range of thermosiphoning options than would be possible with gravity alone. It is freeze-proof since it uses a non-freezing transfer medium and an external heat exchanger that is sitting below the attic preheat tank. The water thermosiphons through the heat exchanger without a pump. The final


PLUMBING SCHEMATIC PLAN
GROUND LEVEL
SAND AND GRAVEL FILTER
CEMENT TOP WITH CLEANOUT
RAIN WATER CISTERN
CENTRAL DOWNSPOUT
CITY WATER SUPPLY
GRAVITY DRAIN
SUBMERSIBLE WELL PUMP
UNSOFTENED WATER TO SPIGOTS
PRESSURE REDUCER IF NECESSARY
24v/12V PUMP
IN LINE FILTER
SEDIMENT FILTER
CARBON FILTER
PRESSURE REGULATOR
100 GALLON PRESSURE TANK
100 GALLON STORAGE TANK
WATER SOFTENING UNIT
GAS HEATER
HOT
COLD
PREHEATED WATER
COPPER CRICKET HEAT EXCHANGER
THERMOSIPHON LOOP
PUMP ORE
HEAT TANK
USED AS PRE-
WATER HEATER ELECTRIC
GAS WATER HEATER
UPSTAIRS WATER HEATERS
COPPER CRICKET SOLAR WATER HEATER-COLLECTOR
SUN FAMILY BATCH SOLAR HEATING PANEL

water heater (gas) draws its intake water from the preheat tank and heats it to final temperature, if necessary.

Hints on Solving Water Heating Problems

Your choice of water heating systems is very critical to your total energy cost, as water heating normally accounts for one-third to one-half of your electrical or gas bill, depending on the number and type of appliances you may have. In reality, the entire water heating concept needs improvement for suitability in a preparedness home. Because of the moderately high temperature of water necessary for household use (max 120° F), we have a 50 degree difference between the room air temperature and the water temperature (assuming the water heater is indoors). If this were the temperature differential between inside and outside air of a home, you would be deemed foolish if you only provided 2" of exterior wall insulation. But that is exactly what water heater manufactures have done to hold this much heat in your water tank. Water heaters really need at least double the present level of insulation. Many insulation manufacturers produce special insulation jackets for water heaters to remedy this situation. Every water heater should have such an extra wrap of insulation.

Some of the worst heat loss occurs in the uninsulated hot water lines that lead away from the heater. You should insulate at least the first 6 feet of lines, and preferably all hot water lines that you can gain access to. If you have a 50' hot water pipe running from the heater to the outlet, you not only waste the quantity of water in the pipe (trying to purge the cold water out while waiting for the hot), but you lose the heat in the entire run after you stop running hot water. The same amount of water and heat is wasted the next time you turn on the faucet as well. Compound this times all of the hot water lines in the house, and it really mounts up. There are lots of foam insulating sleeves that can be purchased at any home improvement store to wrap around the pipes. They are worth the cost. A plumber may try to tell you it isn't worth the money because the heat just goes into the house anyway. Technically, he is correct, but in reality, remember that you don't want the heat during the summer, and in the winter that's a very expensive way to partially heat a home.

In terms of efficiency there used to be very little difference between the commercially available electric resistance water heaters with similar warranties. But now there are. The warranty length will be in direct proportion to price and quality of the tank and lining. The lining prevents corrosion from the water, especially directly above the burner or heating element. Electric water heaters last longer, usually because they do not apply heat directly to the tank, as in gas heaters. But gas is usually cheaper, and can be stored in the form of propane. Although I prefer gas as the primary water heater, I usually specify two heaters – one gas and one electric. The electric one is normally kept off, and is used as back-up in case there is no gas or a solar preheater. The following illustration shows the valve set up so that you can isolate each water heater individually to utilize whichever source of heat is available. It never pays to buy a cheap gas water heater. Specify the new electronic ignition systems rather than the pilot light variety. It will save you about $2 to $4 every month in gas costs. The first of the real energy-saving water heaters is the RUDD brand of Chicago, which makes several other generic brands of water heaters. It was designed from the "ground up" with two additional inches of

insulation, heavy duty construction, and electronic ignition. It costs about $40 more than a conventional one, but well worth it. It comes with a ten year warranty.

Installation and Operation of Dual Water Heaters

The basic installation assumes the existence of a gas water heater installed next to a gas furnace, as is the normal case in areas served by gas or propane. I recommend the installation of a new or used electric water heater as the reserve tank. In the event that the supply of gas is interrupted, you could activate the electric tank and obtain hot water. If you have an all electric home with an existing electric water heater, installing a second electric unit will act as a back up in case the first heater fails. I would actually recommend an LP gas water heater as the second tank, with a supply of propane to run it. This would require installing a vent outlet through the wall, but it would give you dual fuel capability.

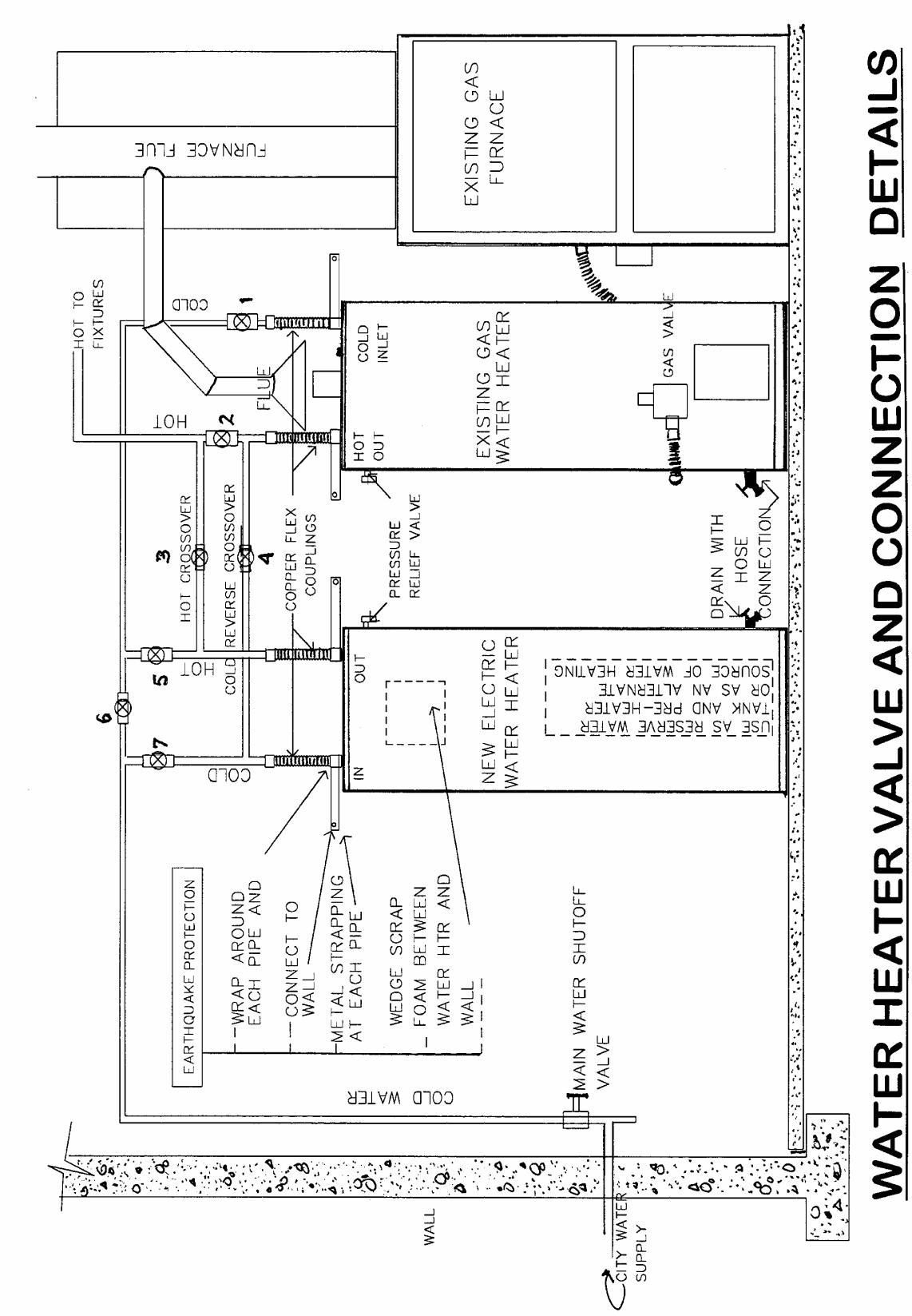
Under normal circumstances, the new electric water heater should have the power shut off at the circuit breaker panel so that it is not trying to heat the water automatically. In this mode, the tank then serves as both a source of constant fresh water for storage and as a preheat tank for the gas or primary water heater. Preheating takes place as the cold, incoming water goes first into the electric water heater (power turned off) where it slowly warms up to room temperature, thus saving on the amount of gas or electricity that the primary water heater uses.

The multiple valve and pipe connections illustrated in the drawing on the next page are intended to allow for the following optional functions:

1. Gas water heater acts as primary heater and electric water heater acts as preheat and storage only (valves 7,5 and 1, 2 are open and 3, 4, and 6 are closed).
2. Electric water heater acts as primary heater and gas water heater (without gas) acts as preheat and storage (valves 1, 3, 4, and 6 are open and 7, 5, and 2 are closed).
3. Both water heaters operate to heat water, offering maximum volume of hot water

- Valves same as in case 1 if one desires the electric to feed into the gas heater
- Same as in case 2 if one desires the gas heater to carry the primary usage,
- Or with valves 5, 4 closed and all others opened allowing both tanks to feed hot water to fixtures simultaneously. This latter arrangement is recommended if one wants to equalize both the gas and electric usage.

Note for systems with water softener installed: The water softener is always installed such that the incoming cold water line (from the street, through the main shut-off valve) flows through the softening unit before entering the existing water heater. The pipe the softener is connected to corresponds to the line in which valve number 6 is mounted in the illustration. It is usually best to leave the water softener pipe connections as they are and splice into the cold water line after it leaves the softener. If the present position of


WATER HEATER VALVE AND CONNECTION DETAILS
FURNACE FLUE
EXISTING GAS FURNACE
HOT TO FIXTURES
COLD
1
FLUE
COLD INLET
EXISTING GAS WATER HEATER
GAS VALVE
HOT
2
HOT OUT
HOT CROSSOVER
3
REVERSE CROSSOVER
4
COPPER FLEX COUPLINGS
PRESSURE RELIEF VALVE
DRAIN WITH HOSE CONNECTION
HOT
5
COLD
6
OUT
NEW ELECTRIC WATER HEATER
USE AS RESERVE WATER TANK AND PRE-HEATER OR AS AN ALTERNATE SOURCE OF WATER HEATING
7
IN
COLD
EARTHQUAKE PROTECTION
WRAP AROUND EACH PIPE AND
CONNECT TO WALL
METAL STRAPPING AT EACH PIPE
WEDGE SCRAP FOAM BETWEEN WATER HTR AND WALL
COLD WATER
MAIN WATER SHUTOFF VALVE
WALL
CITY WATER SUPPLY

the softener is next to the gas water heater, you will have to position the new auxiliary tank elsewhere. Try to keep it as close as possible to the existing plumbing to avoid long runs, and be sure to leave room to service or remove any of the existing heating units.

Earthquake Protection

To keep water tanks from moving during an earthquake (causing them to fall over and break plumbing pipes), secure them to the nearest wall with metal strapping like plumber's tape, as illustrated, making sure to place some firm padding between heater and wall so as to limit and cushion movement in either direction.

Heating Water with Wood

Hot Water From Your Stove

It has been very discouraging to discover that there are hardly any wood stove manufacturers that have a water heating option for their wood stoves any more. This used to be quite common. Nowadays, it seems only the wood cook stoves have these built-in options. However, none of these cookstoves have the sophisticated burn control systems that wood stoves feature, nor do they have a large firebox suitable for heating of a home all day long. In the winter, if heating with wood, it is natural to be heating hot water as you do it. In order to accomplish this, a little ingenuity is in order.

We can take advantage of this steady heat source by modifying an existing wood stove to accept a water jacket. Some do-it-yourselfers have cut holes in their stove and plumbed in a couple of loops of malleable copper tubing for water heating. However, it is difficult to seal up a hole in an airtight stove, once cut, and the copper doesn't last long in the intensely hot interior of a modern wood stove. Besides, internal water coils tend to produce too much hot water when a wood stove is burning all day long. Obviously we must provide some place for all this hot water to go – and that means more storage tanks. An internal coil or water jacket can heat 40 gallons every 2 or 3 hours with a steady fire, so unless you are using a lot of hot water, this can lead to excess temperatures which might cause venting of the safety valve.

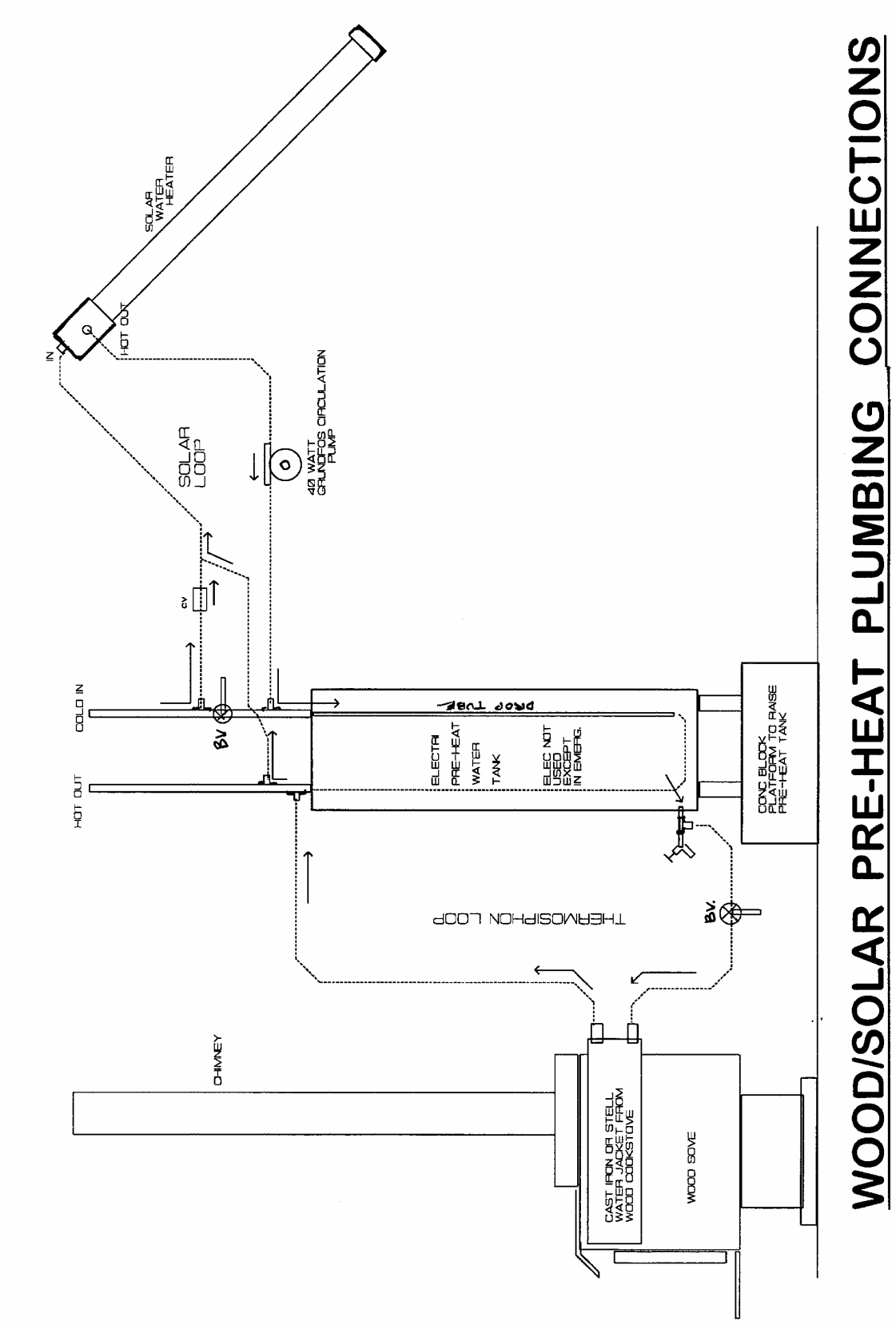
I have successfully added water jackets (the same ones that are made for the cookstoves) to the outside of a wood stove. This can only be done with the steel stoves, which have nice flat surfaces to connect to and whose steel sides lend themselves to modification. On my Regency, which has an extra layer of 14-gauge metal as a heat shield on the sides, I simply cut the top part of the heat shield down to a sufficient height so that I could bolt a water jacket to each side of the stove in the location where the metal was removed. I held them in place by small brackets. All the pipes connect at the rear where the connections are not very visible. On another stove, which had a flat top surface, I simply laid a water jacket on top of the stove surface with the pipes connecting to the side with flexible (accordion type) copper connectors. Both work just fine and don't produce excessive amounts of water.

In my own personal system, I found that using one preheating tank for both the wood stove heat source and the solar water heater works perfectly. When fall comes around and the sun gets low in the sky, the solar water heater production drops by about half –

just about the time I want to start using the wood stove. The wood stove, with its two water jackets on the sides, keeps our family of eight in plenty of hot water. We do have, in two different bathroom locations of the house, under-sink electric instant heaters which can bring water temperature up to a higher level, if needed, but they hardly ever come on – just enough to heat the cold water in the pipe coming from the preheat tank. In the spring, just about the time we stop using the wood stove, the sun is again intense enough to heat the water with the solar water heaters. So, for the most part, we have little water heating costs year round.

Here is how you connect such a system (see illustration). First, make sure the hot water preheat tank is set up off the floor about 8 or 10 inches to give it some more height – to improve thermosiphoning. I have found that the entire tank does not have to be higher than the heat source – just the majority of it. Next, unscrew the drain valve at the bottom of the tank (make sure the tank is empty first) and put in a 1/2 inch plumbing T between the valve and the tank. This connection will draw off the cold water at the bottom of the preheat tank. Connect flexible pipe (like polyethylene PEX pipe or flex copper) from this T to the *lower* pipe opening in the water jacket. The pipe connection openings in the water jacket that are mounted on the stove should be vertically different – one higher than the other as shown. If you have only one water jacket, connect a flexible pipe from the *higher* water jacket opening to another T that is placed at the top of the water heater tank (on the *hot outlet* opening). If you have another water jacket on the other side of the stove, like I do, then connect the *outlet* (the higher pipe connection) of the first heater to the *inlet* (lower pipe connection) of the second. Then connect the outlet of the second water heater to the top of the preheat tank. This gives you a complete loop from the bottom of the water tank to the top, running through the wood stove water jacket. When you have heat in the wood stove, the preheat tank will set up a nice circulation of hot water without any pumping. I always put a shut off valve (labeled BV, for Ball Valve) somewhere in this thermosiphon loop so that when the wood stove is cold, the hot water will not enter the wood stove system. Otherwise, small quantities of cool water will sometimes get to your shower – which is a little uncomfortable– when running on your solar system.

The solar hot water system is connected to these same fittings (if the collector is lower than your tank) so that it can thermosiphon. But if it is higher than the preheat tank, as mine is, then use a small Grundfos circulation pump to move the heated solar water down into the tank. Even though I have 40 gallons of water in my dual Sun Family solar collectors, they will still produce enough hot water in the summer to also heat my preheat tank sitting by the wood stove – so I use a circulation pump on a thermostatic switch to do this. This setup is accomplished with additional T fittings in the tank's two top pipes. Note, there is a ball valve in the incoming cold line to the preheat tank. The ball valve is placed just beneath the first T. This is to divert the incoming cold water to the solar water heater rather than the preheat tank itself. We will always do this, winter or summer, because the solar heater will always be warmer than the normal cold supply. As the water travels through the solar heater, it comes back out through the pump (which will not stop the water from flowing, even if the pump is not running) and back into the cold inlet to


WOOD/SOLAR PRE-HEAT PLUMBING CONNECTIONS
SOLAR WATER HEATER
IN
HOT OUT
SOLAR LOOP
40 WATT GRUNDFOS CIRCULATION PUMP
CV
BV
COLD IN
HOT OUT
DROP TUBE
ELECTRA PRE-HEAT WATER TANK
ELEC NOT USED EXCEPT IN EMERG.
CONC BLOCK PLATFORM TO RAISE PRE-HEAT TANK
THERMOSIPHON LOOP
B.V.
CHIMNEY
CAST IRON OR STELL WATER JACKET FROM WOOD COOKSTOVE
WOOD SOVE

the preheat tank. Note the presence of the drop tube inside the tank. This ensures that the cold incoming water goes to the bottom of the tank and doesn't mix with the hotter water which will accumulate at the top. You will also note a small one-way check valve (labeled CV) in the line leading to the solar collector. This keeps the water flowing in the correct direction. When the circulation pump is on, hot water from the solar collector will exchange places with the cooler water in the preheat tank. This is why we have the extra T-connection going from the hot outlet side of the tank back to the solar collector inlet line (right after the check valve). This may be a little complicated for those who do not have any plumbing experience, but if so, your solar water heater installer will know how to follow these plans.

You can buy any number of water jackets from Lehman's Non-Electric Catalogue Store. Have them send you a physical description of the various water jackets made for some of their cookstoves. Then pick the one that will best fit on the side or on top of your wood stove. Believe me, having hot water in a survival situation is very important for convenience and psychological and emotional comfort. Don't overlook this important issue.

A Dedicated Wood Hot Water Heater

Lehman's also sells a stand-alone water heater (their "System Two" unit) which heats hot water in only 12 minutes without electricity! It provides a continuous supply as long as the fire is maintained. After the fire goes out, the insulated tank keeps the 10 gallons of water hot for hours. It produces up to two gallons of water per minute.

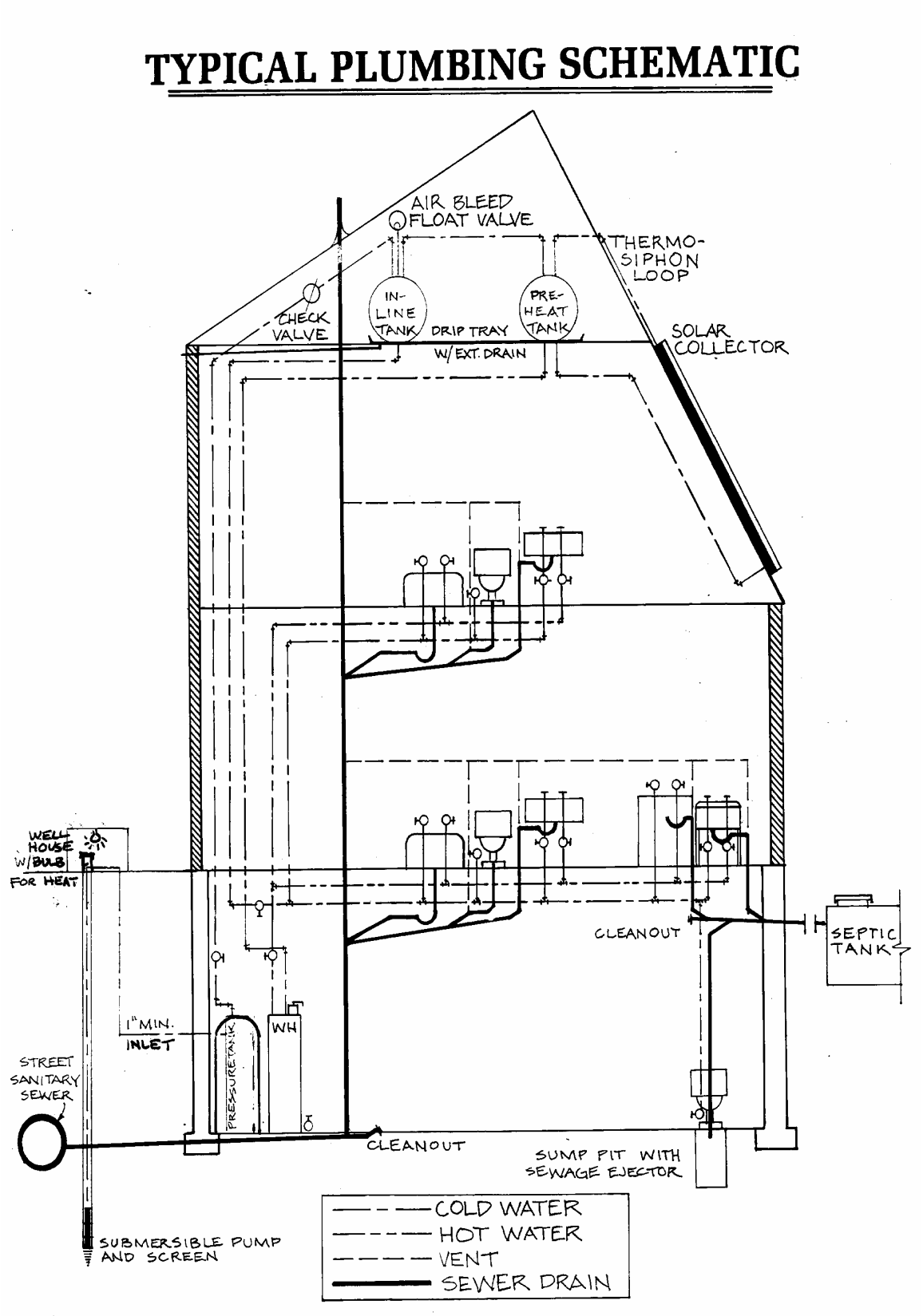
These stand-alone units can be installed by themselves or in conjunction with an existing water heater or storage tank. They burn any solid fuel other than coal (wood scraps, sticks, paper, corncobs, etc.), and are much more practical and durable than imported heaters. They are solidly built of #16 steel and cast iron with a baked enamel (tan), protective finish. The only real drawback of this system is that you have to manage a separate fire system just to heat hot water. If you have a water jacket on or in your wood stove, the water heating takes place without having to manage a separate fire.

Hot Water from Central Heating Sources

If you opt for a hydronic heating system, you can set your hot water system up so that the boiler produces all your hot water as well. This only works during the heating season, naturally. Some water source heat pumps can also dump excess heat in the summer when the heat pump is in its cooling cycle. This could also be done by an airconditioner if a manufacturer were inclined. Since neither of these systems in a residential application supplies hot water all year round, the complexity of changing to another system, when the central heating is not in use, makes most people choose more conventional heaters.

MASTER PLUMBING LAYOUT

We have already discussed the essentials of water supply and purification and hydronic heating. I will therefore concentrate on the basic plumbing layout as pertaining to


TYPICAL PLUMBING SCHEMATIC
AIR BLEED FLOAT VALVE
THERMO-SIPHON LOOP
CHECK VALVE
IN-LINE TANK
DRIP TRAY W/ EXT. DRAIN
PRE-HEAT TANK
SOLAR COLLECTOR
WELL HOUSE W/ BULB FOR HEAT
CLEANOUT
SEPTIC TANK
1" MIN. INLET
WH
PRESSURE TANK
STREET SANITARY SEWER
CLEANOUT
SUMP PIT WITH SEWAGE EJECTOR
SUBMERSIBLE PUMP AND SCREEN
COLD WATER
HOT WATER
VENT
SEWER DRAIN

alternate and nonconventional means of handling wastes. The previous illustration gives you a general overview of the plumbing system with the exception of the gray water unit. All of the units depicted would not necessarily be installed in the same house; rather, only as needed.

If these storage tanks are located in attic spaces, they should be insulated in order to minimize condensation and keep the cold water supply from getting hot in the summer. Even though we may want the attic heating effect for a hot water storage and preheat tank, we cannot accept the heat losses during the winter. So unless you want to take the insulation on and off depending on the season, I recommend you keep them insulated. Even in a hot attic, the heat will get through. Insulation of storage tanks is very important in extremely cold climates where there is danger of the water in the tank freezing.

Installing the water storage and preheat tanks is usually a challenge task for the plumber. Sometimes, to provide gravity feed systems, these tanks are in the attic space. Due to the additional weight of the water involved in such a system, it is important to make sure the attic floor structure is designed to handle the load. It is also important to provide drip pans under the tanks in case of leakage or dripping condensation. The drip pans are piped outside through the roof soffits or into the normal drainage system as they come up through the attic area. Even though this is an in-line storage tank, meaning in series with the incoming water supply, the hose bibs should draw their water from a pipe connection point that comes off the main line prior to any purification, water softening, or in-line water storage tanks. Otherwise, long periods of watering will cause considerable condensation if all that cold water flows through the in-line tanks. Condensation occurs when cold water enters the tank and cools the tank walls. The air next to the tank cools and loses its moisture to the tank surface. Whether you use one tank or two, you can connect the unit to a thermosiphon solar water heater as depicted. If the collector is below the tank at least 12 inches, the unit should operate with sufficient speed to avoid overheating the collector. If you are not able to thermosiphon, there are a number of low wattage solar pumps on the market (Grundfos) that will circulate the water as the temperature differential dictates. Every solar water heater manufacturer has kits to install positive pumping systems – driven either by low voltage, house voltage, or solar panels.

SEWER SYSTEMS

Sewage is composed of what is called *black water* and *gray water*. Black water is waste water that has dangerous bacterial or chemical content in it. Gray water is water that is dirtied by less harmful particles and bacteria. The problem with this distinction is that gray water, if left to sit long enough, can become black water.

For practical purposes, let's assume there are two clear categories to work with.

Black Water

Black water needs to be removed from the home in a way that offers no contact with humans – by either the liquid or the vapors. Sewers and septic systems both handle black

water effectively. Both are open venting systems, but the vent pipes are located in your home and are taken through the roof so that the odors and vapors will dissipate at some distance from you.

There are some major pros and cons about both city sewer systems and septic systems. Most people simply assume that the city sewer is always better. It seems to be able to take unlimited wastes away from the home, it never fills in with solids (except for the occasional blockage when the kids put too much of something down the drain), and never has to be pumped like a septic tank. But that isn't the whole story. What most people don't realize is that all the city sewage goes to a highly sophisticated and regulated sewage treatment plant. This plant has vast acres of ponds to treat this black water effluent before it is suitable to put back into the ocean or a major river. Due to environmental regulations (which in this case are good), if that plant ceases to operate properly, that water needs to be contained and kept from polluting the river or ocean. However, most sewer systems can only contain water for less than a day before their storage facilities are full. Now we have a BIG problem. Do we shut down the sewers and let it back up into people's houses or do we dump raw sewage and pollute the rivers and land? There is even another choice. The city can shut down the water supply so that no one can put any more water down the sewer. Obviously, none of these are popular choices, and all have potentially dangerous consequences. While a major sewer system breakdown very rarely occurs in modern society, it is an accident just waiting to happen. Think about it. What would you do if sewer water started backing up uncontrollably into your home? No home today has a valve to shut off the sewer system to prevent this from happening. If the sewer system ceases to operate, city homes have no way out.

For this and other reasons, the occasional maintenance and hassles of dealing with a private septic system don't seem so bad – at least you control your own waste destiny. Unfortunately, if you live in the city, you will never be allowed to have a septic system. However, there are many rural suburban homes that used to have a septic system and have been forced to link up to the sewer when it became available. In most cases, the septic system is still intact. If you live in one of these houses, prepare to have on hand the connections and pipes to make the switch back to the septic system if you need to. If you are building in the country and have a choice, go for the septic system.

Here are a couple of tips to make sure your septic system is easy to maintain and to keep it functioning properly. First, have a drawing showing the exact location of your system in case it must be opened up for repairs. This includes marking the spot where the cleanout lid is located on the main tank. Usually these are buried some few feet under the lawn. I went to a little more trouble on my system to cut out a 4" hole over the first chamber of the septic tank. I then glued in a 4" ABS sewer pipe vertically so that it stuck out of the ground a few inches. Now I have an access pipe through which the tank can be pumped without having to dig up the yard to find the manhole cover. Second, put in some septic system bacterial once or twice a year. These beneficial bacteria help to digest the solid materials and keeps your lines from clogging. Don't worry about buying those $100 bacterial treatments sold by telemarketing. Just go down to your local Home and Garden type of store and buy the generic kind. They work just fine and cost less than $15, as they should.

Septic systems are easiest to put in the ground just below grade level. In this way, the drain field needs only be a few feet under the surface. The only drawback with this common installation is that we are denied having a sewer system to serve the basement. City sewers are almost always set deep enough underground to accommodate basement construction, but septic systems rarely are. If you plan on basement plumbing, you have two primary alternatives. You can either install an ejector pump within a sealed sump under the basement floor, or install a basement level septic system.

In the basement ejector pump alternative, as shown in the Typical Plumbing Schematic, the plumber routes all basement drains to the waterproof sump (a preformed plastic cylinder) set down below the basement floor, in concrete. An ejector pump is plumbed and wired into this sump and covered with an openable sealed cover. The pump has a float switch which turns it on for a few seconds anytime the liquid effluent in the sump reaches a set level. The pump has a combination grinding and pumping impeller that liquefies all waste and pumps it up through a one-way check valve to the main level sewer pipes, and then turns off until needed again. These pumps are not heavy users of electricity since they are on so briefly. To run this pump with alternative electrical, you should have a battery bank/inverter set up so that this pump always has power. Ejector pumps can also be purchased in 12 volt and 24 volt models for those who do not install an inverter system, but run off of batteries. Always keep a spare pump on hand in case of failure. They are very reliable and long-lasting, but you would never want to be without something that is part of your critical home equipment.

Whenever feasible, I prefer the basement level septic option since no powered ejector pump is necessary. If you have the good fortune of having a sloping lot, you may be able to place your septic system lower on the property and not have to dig a deep system. If you have level land, you will need an installer with a backhoe that has a long boom, capable of digging about 14 feet deep. The leach field will be about 9 feet deep, but the septic tank sits substantially lower in the ground. If your septic installer says “it can’t be done,” search elsewhere for someone who can.

If you are building on property with a high water table, keep in mind that there are special septic designs that are approved for high water table areas. They are called “mound” systems, among other terms. Essentially, they use a normal ground level septic tank with an elevated leach field that is built up by bringing in several truckloads of good, percolating soil. The effluent from the septic tank is then pumped up to the leach field. As with a sump pump, you will have to ensure that you have alternative electrical to run the pump should normal utility power be unavailable.

Gray Water

Even though not shown on the illustration (due to complexity), it is nice to have a gray water system. There are “green environmentalist” reasons for having a gray water system (saves on waste water and cuts down on city sewage), and there are practical reasons as well (like reusing water for watering plants in times of water shortage, or using dirty water for toilet flushing in an emergency). But despite the reasons and benefits, there are many pitfalls. Some are biological and most are the fault of the safety and regulatory bureaucrats.

The biological problem comes from the question of what constitutes gray water. To be safe enough to not put down the sewer system, we must ensure that toxic chemicals don't get into the gray water and that the soaps we use are biodegradable so they don't pollute the soil and poison your garden plants (which you might want to eat). Anything that the bureaucrats can't control with absolute certainty (like people's living habits) they are inclined to prohibit or over-regulate. This is what has happened in the field of gray water technology. California, as usual, has set the regulatory standard. It is so overdone, so expensive, and so intrusive that it makes gray water systems almost impossible, and certainly impractical to implement if you have to comply with the regulations.

In short, the bureaucrats want gray water stored, filtered, purified, and then secreted via expensive underground drainage systems so that there is virtually no possibility of any human ever becoming contaminated by a single bacterium. So now you must spend thousands of dollars in engineering and installation costs to save $20 bucks in water each year. Ludicrous!

Besides, the California system doesn't work. They are, in essence, mandating a mini-sewer system that won't do the job. They want the water stored, settled, filtered, and purified before leaving the house. Storage systems never work. Gray water in any amount always turns black and fetid over time. The filters clog. The chemicals mandated to sterilize are bad for plants. Drip irrigation systems are always getting clogged. Deep gravel beds (as mandated in California) are built like costly septic drain fields and don't let the water get to where the plants can use it.

So what's the practical solution? The simplest and easiest way to take care of gray water is to let it all run out of the house as soon as possible – no storage, no complicated filters or treatment. True, there will be some food particles and disposal materials coming out of the kitchen sink. But rather than filter these, build a mini mulch pit outside your kitchen area. Make it big enough to handle as much water as you normal use during any one meal in the kitchen. This will become a mini compost pit which you can empty and bury in trenches in the garden as it gets full (about once a week). Burying compost eliminates any smelly problem and feeds the worm population which in turn helps the composting process dramatically.

Put a redwood 2x6 barrier around the pit and attach screening over the top to keep flies from breeding in it. Just under this screen box/cover install one or two 2-inch PVC perforated irrigation pipes (the walls are thinner than normal schedule 40 PVC plumbing pipe) to allow any overflowing water to be routed away to the garden or flower bed. Put a rabbit wire screen over the entrance of each pipe to keep floating food particles from traveling down the pipes. Make sure the perforations are at the bottom of the pipe so the water can percolate into the soil as it travels along. It is a good idea to put a tapered layer of gravel under these pipes (hardly any gravel at the beginning and more at the end) so that the water will only drain out the holes a little bit at the beginning and more at the end of the pipe. This ensures a more even source of ground watering along the length of the pipe. This water will provide deep root moisture. Don't try to water a lawn this way – but it's great for flower beds along the house and for vegetable gardens. You have to design your grading around the house so that all the land slopes away from this pit,

slowly. If your ground is perfectly flat, the pipes will have to be set deeper and deeper the further away you go, and will quickly be too deep to water any plant roots.

The kitchen gray water has the capability of being carried further away from the house if the drain pipe exits the exterior wall behind the sink (assuming the sink is on an outside wall) before the drain goes into the floor joist system. This would allow a sloping drain pipe to take the gray water further away from the house, toward the garden before emptying into the initial mulch straining and composting pit.

Because most plumbing systems don't allow for gray water systems (without complying with a California-type of code) you will most likely have to retrofit your drain system after the house is complete. Fortunately, with plastic ABS drain pipes (instead of the old cast iron) this is easy to do. In order to accomplish this without undue remodeling, leave your basement ceiling unfinished until the modification is done. If you have a crawl space instead of a basement, you will always have access. If you are building with a concrete slab on grade, as in California – switch to another type of construction. Burying your plumbing under concrete makes it impossible to change later on – or repair in an earthquake.

Changing over to a gray water system simply involves disconnecting the sink and shower drains from where they join the larger toilet drains, and rerouting the gray water drains to the outside at ground level. Do not close off the original connections to the black water drains in an irreversible manner. Use glue-on caps with sufficient distance from the original T or Y-connections that you can cut off the cap later and reinstall the original system if necessary. For example, if you ever sold the home, the new buyer may not want a dual drain system and may require you to change it back.

As a self-sufficiency measure, I also like to allow for another diversion pipe to be installed in the gray water lines before they exit the house. Install at least one of your gray drains with a downward pointing T-connection with a plastic ball valve right underneath so that you can open this if necessary and save the gray water inside the house if needed. Now, I realize this contradicts my advice about storing gray water. But in certain situations, you may need to store the water for use in flushing toilets during a water shortage. This is the only way to make sure you will be able to keep the water that would otherwise go outside and be lost forever.

Chapter

14

Mechanical Heating and Cooling Systems

In this chapter we will cover the advantages and disadvantages of certain types of conventional heating and cooling equipment as they relate to our preparedness residence. Multi-fuel and solid fuel equipment will be covered in another chapter. I do recommend the use of conventional heating equipment, especially when it allows us to use the cheaper, readily available fuels on the commercial market. Alternative sources should be added to these commercial fuel systems so as to provide a reliable backup. Even during good times, I use my alternative sources (wood and solar) as my primary system when I want to save money. Of course I use the automatic gas furnaces as the primary system when I'm not at home to feed the wood stove. You may choose to use the conventional systems full-time if you don't want the hassle of burning wood, or if you have limited supplies and want to reserve them for the times when you really need them.

FUEL CHOICES

Natural or LP gas and #2 heating oil are the two most common fossil fuels for residential heat today. Even much of the world's electricity is still produced by fossil fuels (coal, fuel oil, or gas). As has been demonstrated in recent years, fossils fuels are plentiful in terms of a usable reserve, but not always readily available due to excessive government controls of supply, price, and refining. Oil cartels used to have an almost unrestricted ability to curtail production in order to keep prices high. But in the previous decade the ravages of socialism in these oil rich countries have limited their political ability to cut spending of oil revenues. Once a nation starts promising free medical care, welfare, and education, even a huge supply of oil reserves will not pay all the bills. Low oil prices, however, have come to an end. Non-OPEC oil companies and their well-place politicians are now acting in collusion with some OPEC nations to curtail production on a long-term basis, but only enough to raise prices about 50%. In the long term, war or other strategic threats will intervene and create supply shortages once again. For this reason, we should always provide alternative sources of energy, heat, and power. We must never be held hostage by the worldwide fuel market for lack of alternate resources. The supply isn't the problem--but rather, its manipulation by powerful forces hostile to the free market and liberty.

CONVENTIONAL FURNACES

All of the major furnace companies (Armstrong, Lennox, General Electric, Payne, etc.) make gas, oil, and electric furnaces. They are, by virtue of competition, very plentiful and relatively inexpensive. If you choose a gas furnace (which usually has fewer maintenance problems than oil), you should also order a separate set of burner orifices (jets) calibrated to burn LP gas. This allows you to install a 1,000 gallon propane tank and store LP gas for the eventuality of a natural gas shortage. Propane is perhaps the ultimate storage fuel. It is compact, moderately high in heat value, and does not deteriorate. Fuel oil has the highest heat value per gallon and should be stored in l,000 gallon quantities also, or more, if you choose to use oil for other purposes as well. Keep in mind that the EPA allows a 1,000 gallon homeowner exemption from the onerous requirements to install the expensive EPA-approved underground tanks. Tanks larger than 1,000 gallons must be an EPA-approved installation.

The choice of fuel will most likely depend upon which is most available in your area. Some rural areas do not have natural gas lines and thus have to use either trucked-in propane or fuel oil. Oil is currently about the same price as LP gas but doesn't burn as clean and requires some periodic maintenance and cleaning of the burner orifice. You should try to be present for all maintenance calls of a service man. If you become friends he can give you some valuable tips on do-it-yourself maintenance, as well as help in getting spare parts in advance.

Storing fuel now costs about the same for either gas or oil (thanks to the costliness of EPA regulations on buried oil tanks). In either case, put your fuel underground. Almost every location allows LP gas tanks to be buried as well. This keeps your fuel supply private and relatively free from vandalism. There is nothing quite as dangerous as someone putting a bullet hole in a propane tank and then setting it on fire. Always plan on storing at least 1,000 gallons of fuel – enough to get you through one heating season without refueling. If your home takes more than this, either supplement with wood heat and/or tighten up the home's weather resistance so it burns less fuel for heat.

High Efficiency Furnaces

There is an Internet site that lists the government's ratings of appliance efficiency. It is worth checking before you buy. Take note, however, that differences between comparable classes of appliances are relatively small. Everyone is getting into the efficiency act. Check it out at the following Internet address: http://hes.lbl.gov/hes/ACEEE/intro.html#con.

Gas Pulse Furnaces

The most revolutionary news in gas furnaces in the last 20 years has been the development of the pulse burning technology – also referred to as "condensing" technology. These units burn small quantities of natural gas in pulses and extract so much of the heat that the residue can exhaust from the house without using a regular metal chimney. The efficiencies are finally above 95%. This is truly revolutionary. What's better, they are available everywhere. They are still the most costly gas furnaces

you can buy, but will pay for themselves in several years of gas savings. Don't forget to factor in the savings of not having a costly chimney to install through the roof. The plastic pipes can even exit through the side wall of the house. Solid fuels are difficult to meter in such precise, small amounts so this technology may never be usable for anything other than gas.

There have been some corrosion problems on early pulse furnaces. Here is the data on the LENNOX PULSE – the best seller of all pulse furnaces: According to Lennox, dealers have reported increased instances of corrosion in some Pulse furnace heat exchangers in units installed before 1990. The company urges owners of Lennox Pulse furnaces installed between 1982 and 1989 to schedule a furnace and safety check with an independent Lennox dealer. To identify a Pulse furnace, look for its name on the door. If the unit is a Pulse 21 furnace, it was manufactured after 1990 and is not part of the inspection program. If you buy a used furnace make sure it is a Pulse 21 or newer.

In 1998 the most efficient gas pulse furnace on the market was the Amana at over 95%, but every furnace in this category was over 93% – so they are all good.

High Efficiency Non-Pulse Gas Furnaces

Most new furnaces tend to be grouped in one of two general classes of efficiency: "power combustion" at 80%-82% AFUE (Annual Flue Unit Efficiency rating) and "condensing" furnaces that are over 90% efficient. Condensing furnaces are most economical in areas with long, cold winters. Homeowners in regions with mild winters may find that mid-level efficiency, power combustion furnaces are their best buys.

By improving the heat exchangers on conventional gas furnaces and by adding powered draft induction, regular gas furnaces are getting close to the 90% range as well. Frankly, these are probably the better buy because they don't have any sophisticated technology to maintain, and their initial price is about half that of the pulse types.

High Efficiency Gas Boilers

Hot water heat is the most comfortable of all heat, though more costly to install. Pulse type technology (sealed, condensing combustion system) is also available for gas boilers. The highest rated efficiency for small boilers in 1998 was the DUNKIRK brand. For larger boilers it was the HYDROTHERM brand. Hydronic heating systems should always be linked to solar hot water systems so that the boiler is only used to supplement the solar. This will also reduce the size of the boiler installed.

High Efficiency Oil Burner

The major innovation (no longer new) in oil burning is the high efficiency, flame-retention burner heads. While these are very effective in maximizing the burning of the actual oil, the oil furnace efficiency still cannot compare to the new pulse gas furnaces because of the lower heat exchange rate. Oil has a much higher heat value than gas, so it is more difficult for heat exchangers to rapidly extract this higher heat value. The 1998 ratings on oil furnaces listed **BARD** and **EnerRoyal** at the top. But all the other brands

were within 2 percentage points, so shop for price. In oil-fired boilers, DUNKIRK and AXEMAN-ANDERSON were on top, but the others were within 2 percent as well.

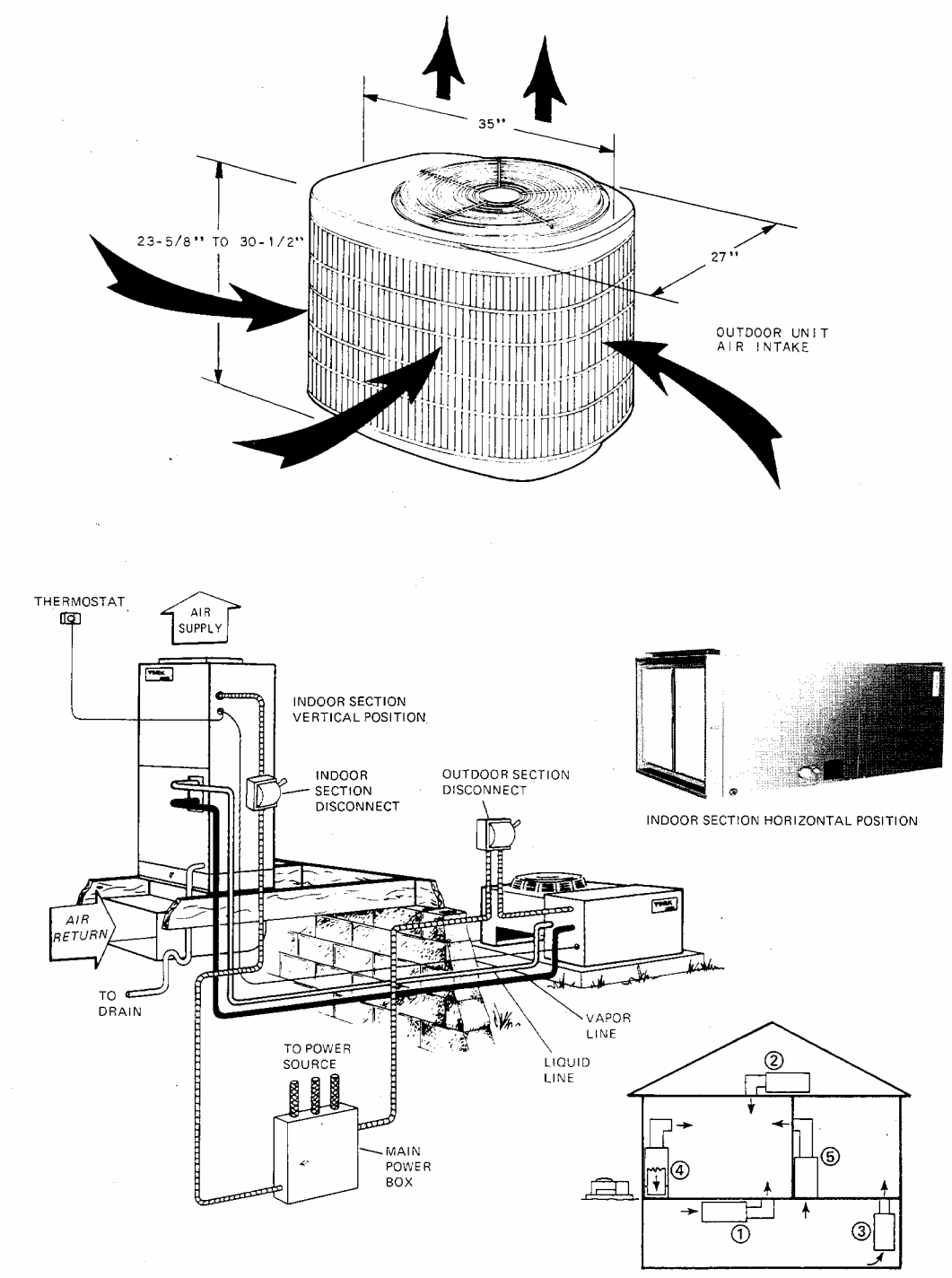
HEAT PUMPS

It is assumed that in future severe shortages of fuel, government bureaucrats will switch existing assets and reserves over to at least minimal electric power generation in areas not covered by hydroelectric power, due to our severe dependence upon electricity. For this reason it is advisable to have some means of generating heat by electricity without having to use the traditionally wasteful electric resistance heaters. Everyone should have a few small electric space heaters for emergencies, but not for regular use.

Heat pumps are special air conditioning units that can reverse the cycle through special valves pulling heat from the outside air, or from ground or water sources, to heat the interior of the home. The illustration shows a typical layout of a heat pump with the outdoor and indoor portions and their various connections. The outdoor unit contains the compressor and various valves, accumulators, filters, and controls – as well as the heat exchanger coil, which actually extracts the heat from the outside air. This unit is always slab mounted to provide a firm base and to keep it above any accumulated moisture. The illustration also depicts the various places the indoor unit can be installed. However, where a twenty foot difference in height exists between indoor and outdoor units, special loops have to be added to the gaseous suction lines to facilitate flow.

Heat pumps produce anywhere from two to four times as much heat per input of electricity as resistance heaters, which get a little less than a 1:1 ratio. This is because heat pumps take heat from an external source via a liquid gas absorption method and compress this gas to a much higher temperature, which it introduces into the house through a large indoor liquid/air exchanger in the duct work The ratio of efficiency varies according to the temperature of the original heat source. Most commercial units use outside air which has the disadvantage of containing less heat in the winter when it is needed most by the heat pump. The efficiency of heat pumps degenerates rapidly toward the 1:1 ratio as the temperature of the source approaches 0° F. This means they use as much electricity at this temperature range to produce a given amount of heat as an electric resistance heater would. However, the total capability of the heat pump to produce much heat at this source temperature is very limited.

The next illustration shows, in the form of a graph, how temperature affects output. The CHPO designations refer to the various capacity units available. Note that all units drop



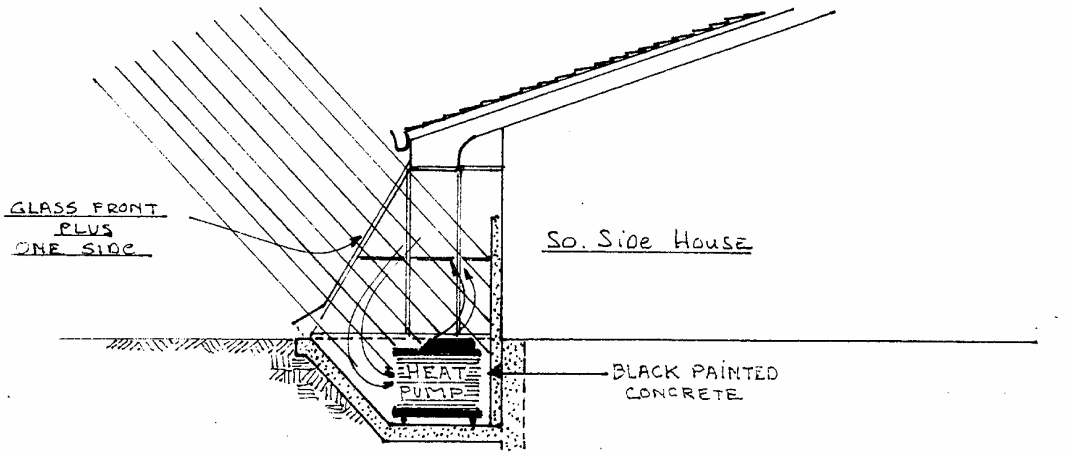
HEAT PUMP CONFIGURATIONS

down below the permissible heat loss line between 30° and 0° F. This is because the efficiency drops as well as total output. For this reason, all manufacturers simply install resistant heaters in the indoor air handling unit which kick in around 15-20° F depending on the manufacturer. The trick, then, is to provide the outdoor heat exchanger with warm air so as to maintain the efficiency of the heat pump and keep the resistance heater from kicking into operation. An additional benefit of preheating the air is less load on the compressor. Compressors are mechanical devices and do wear out. That is the prime reason that the manufacturers like to switch on the electric-resistant heat strips any time the compressor cannot bring the house up to temperature within 20 or 30 minutes. There is some deception involved here since the heat pump is sold to you on the basis of savings over resistance heat, and yet it is the use of resistance heat by the unit that prolongs the compressor's life. If you use the compressor constantly, it won't last nearly as long, and you will have to factor in the cost of a new compressor (which they don't want you to know about). Compressor lifetimes are 10 years at a maximum average and usually last a lot less under heavy loads. By all means, use some solar assistance to improve not only the performance but the longevity (see illustration).

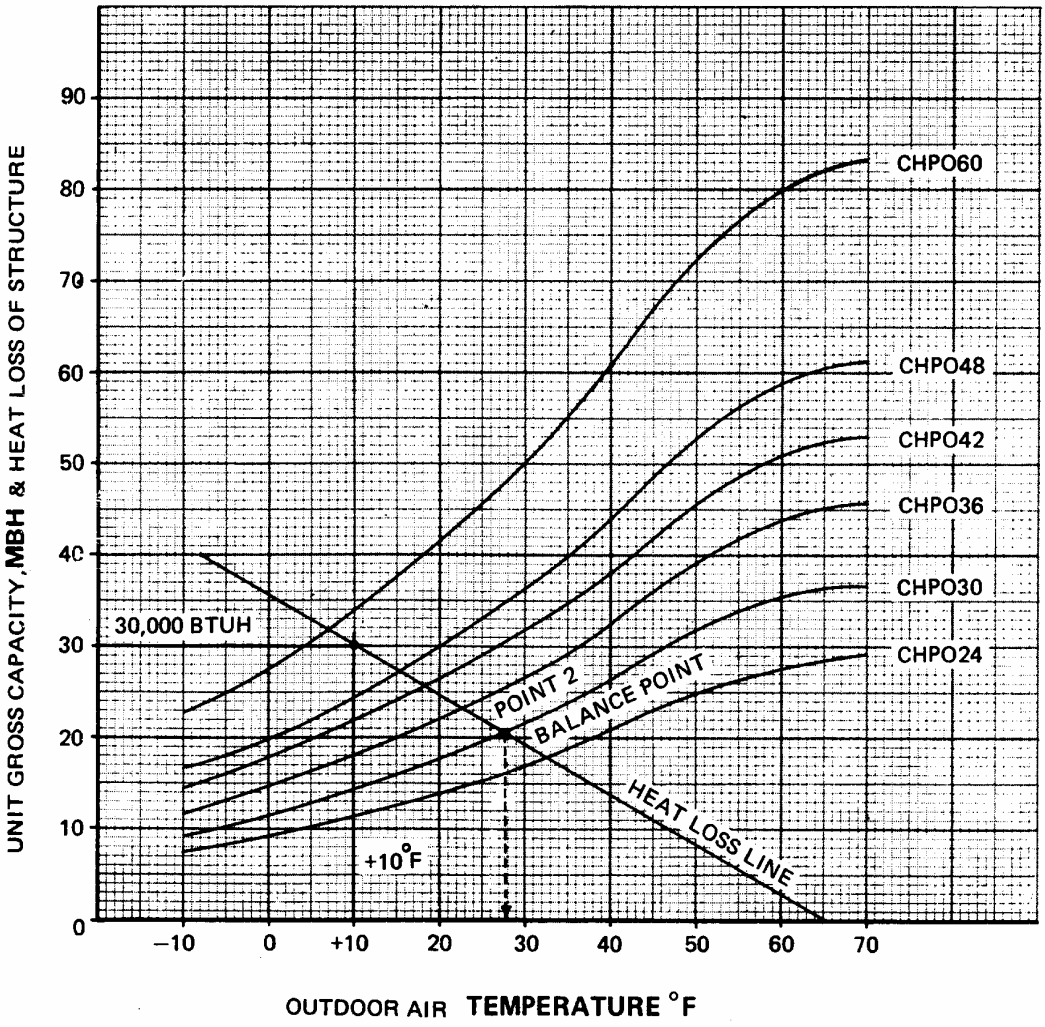
Earth-Coupled Heat Pumps

With the revolutionary innovation of inexpensive polyethylene flexible plastic pipe, it has finally become feasible to bury in the earth long loops of pipe coupled to the heat pump heat exchanger in order to extract warm ground temperatures during the winter, and expel heat in the summer. This system used to be considered experimental but is now so well proven that it is widely used in many mild climates. In Oklahoma, for instance, the average ground temperature is about 62° year-round, allowing an efficiency of 3.5 and better. This efficiency is higher than in the North, but even in Canada, the coefficient of performance is 2.6 to 2.8. The earth-coupled heat pump has four components: A small water circulating pump, a fan, a compressor, and a long loop of plastic pipe filled with water. The best plastic pipe material for the system is polybutylene or polyethylene (PEX). It is not as brittle as PVC and it comes in coils of 300-foot lengths so fewer joints are needed. Polybutylene is under fire for leakage due to the early use of plastic couplings, but my experience with the new copper or brass couplings has been flawless. I suppose that polybutylene will succumb to the bad press or the bureaucrats eventually, so if you have a choice, go with the newest plastic, polyethylene (PEX).

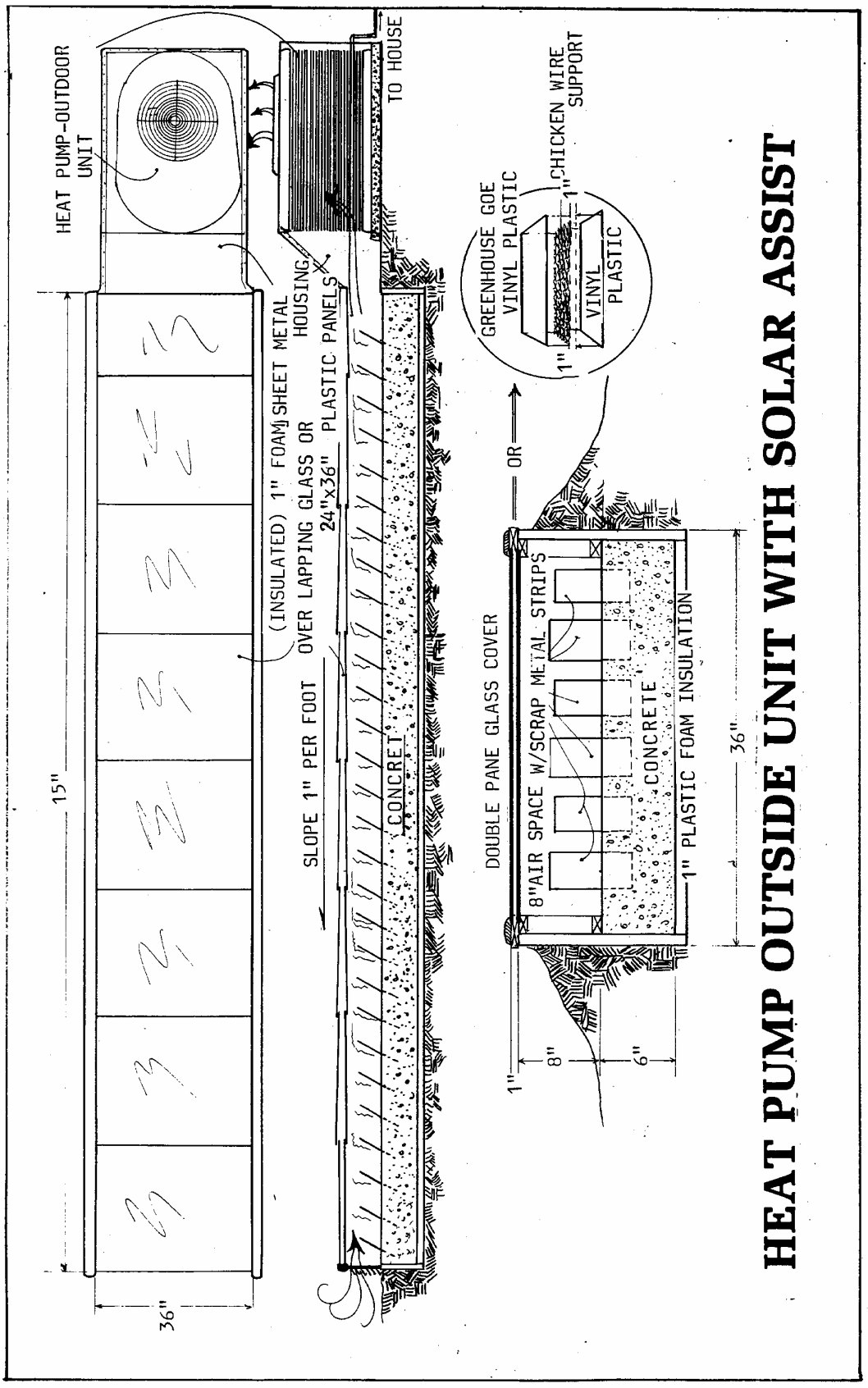
The principle of the system is simple. In the winter, the ground's warmth is collected by the water in the piping and absorbed by the heat pump's gaseous refrigerant. In the summer, the warmth of the house air is collected and either dumped into the preheating of domestic hot water or back into the soil. The residual warmth of the water is taken out by the cooler earth so the water can collect more warmth from the air inside the house. The cool earth soaks up heat more efficiently than warm outside air. Heat pump compressors used to work at only one speed, which is wasteful in terms of power. Now, manufacturers have developed heat pumps with a variable-speed compressor. The compressor in these heat pumps will respond to changing outdoor temperatures and reduce or increase their operating speed accordingly. Variable-speed compressors will reduce the amount of electricity needed to run the heat pump, thereby increasing the COP



GREENHOUSE TYPE SOLAR PRE-HEATER



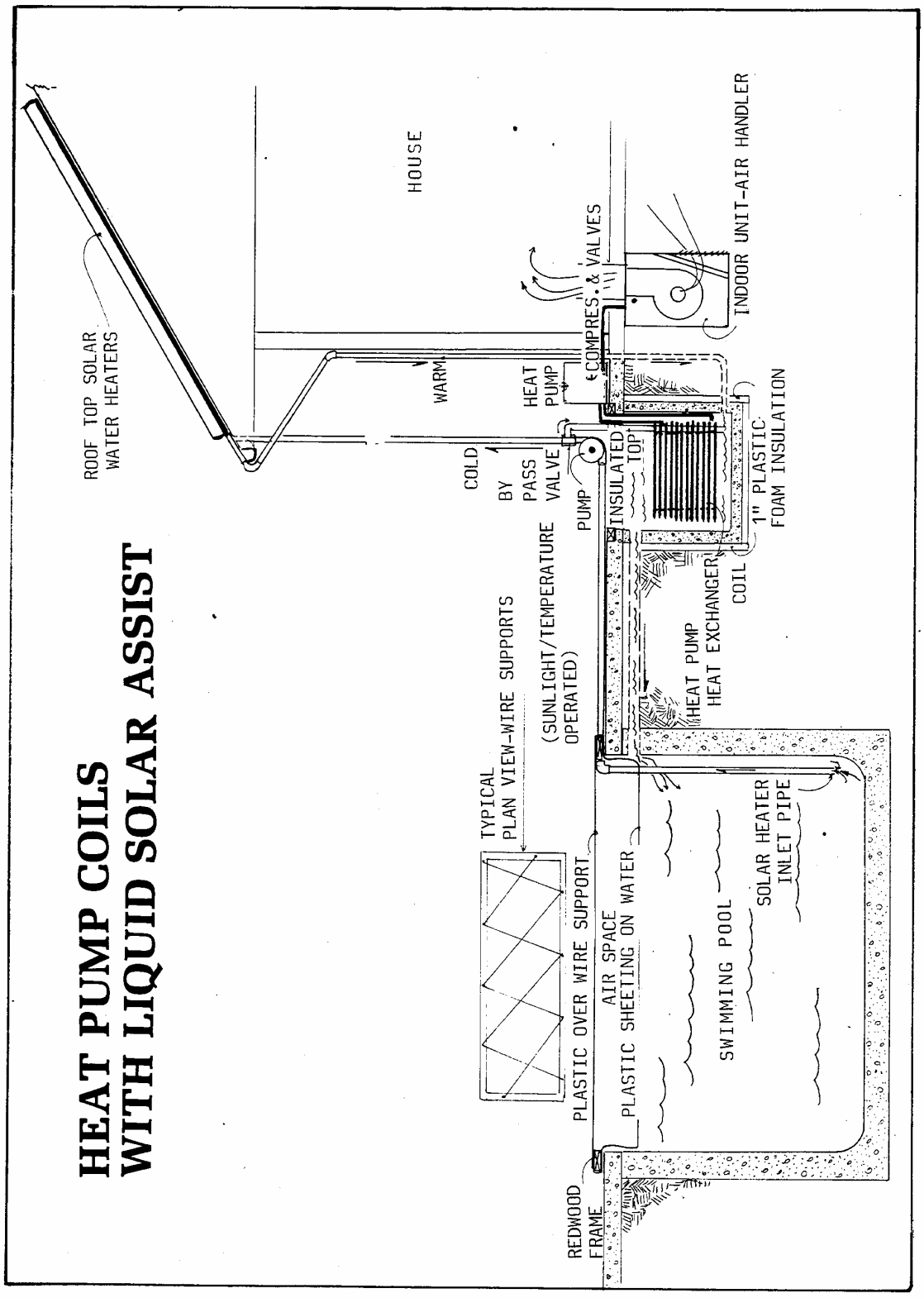
HEAT PUMP CAPACITY


HEAT PUMP OUTSIDE UNIT WITH SOLAR ASSIST
HEAT PUMP-OUTDOOR UNIT
TO HOUSE
(INSULATED) 1" FOAM SHEET METAL HOUSING
OVER LAPPING GLASS OR PLASTIC PANELS
24"x36"
SLOPE 1" PER FOOT
CONCRETE
15"
36"
GREENHOUSE GOE VINYL PLASTIC
CHICKEN WIRE SUPPORT
1"
VINYL PLASTIC
OR
DOUBLE PANE GLASS COVER
8"AIR SPACE W/SCRAP METAL STRIPS
CONCRETE
1" PLASTIC FOAM INSULATION
36"
1"
8"
6"

(Coefficient of Performance). One ingenious designer has also used the earth couple idea in combination with a septic system. He lays the pipe in the trenches of the drain field so that the residual warmth of waste water from the house keeps the pipe saturated with water that is even warmer than the earth. Since the heat transfer coefficient of water is much higher than earth alone, his performance is the best in the country.

Water and Solar-Coupled Heat Pumps

One of the most common ways of coupling a heat pump for greater efficiency involves the use of well water. The best system is where two shallow wells are drilled. One well supplies the earth-tempered water for the initial heat exchange, and the warmed or cooled water is then pumped back down the other well where it gravitates back to the original well. Performance is much better than air-to-air heat exchange. But water-source heat pumps are only practical if water is not scarce, and pumping costs are not too great. Single well systems simply dump the water into a river, or a pond. Other people have successfully used nearby private lakes or even swimming pools that act as the heat exchanger. A pool can be most effective if covered by a large solarium for passive solar gain to make up for the heat lost to the heat pump. The heat pump acts as a heater of the pool in the summer as it extracts excess heat from the air conditioning cycle (see previous illustration). Solar collection devices are the most effective means of enhancing water- coupled heat pump systems. Some connect heat pump coils directly to solar panels for direct heat absorption, and others submerge them in fluid-filled tanks which are heated by solar collectors.


HEAT PUMP COILS
WITH LIQUID SOLAR ASSIST
ROOF TOP SOLAR
WATER HEATERS
HOUSE
WARM
HEAT
PUMP
COMPRES. & VALVES
INDOOR UNIT-AIR HANDLER
COLD
BY
PASS
VALVE
PUMP
INSULATED
TOP
1" PLASTIC
FOAM INSULATION
COIL
HEAT PUMP
HEAT EXCHANGER
TYPICAL
PLAN VIEW-WIRE SUPPORTS
(SUNLIGHT/TEMPERATURE
OPERATED)
PLASTIC OVER WIRE SUPPORT
AIR SPACE
PLASTIC SHEETING ON WATER
SWIMMING POOL
SOLAR HEATER
INLET PIPE
REDWOOD
FRAME

MULTI-FUEL FURNACES

Wood/Oil/Gas

With few exceptions these dual purpose units burn a primary fuel such as oil or gas or propane, combined with wood. They are either a forced air or boiler type of heating unit, never both, so you will have to decide which type of heat distribution system you desire. The only two things common to all multi-fuel furnaces are an ash clean out and a dual stage thermostat. One stage regulates the wood burning cycle and the other stage, which is set a few degrees lower, activates the gas or oil burner when the wood ceases to provide enough heat. The blower and fuel burner cease to operate when the thermostat setting is satisfied. The primary differences in the various units are the following:

1. The number of combustion chambers (one or two)
2. The manner of supplying combustion air
3. Whether they have a boiler jacket or an air heat exchanger
4. Whether they have automatic ignition or hand kindling of wood
5. The types of fuels accepted and
6. Price

I have recommended the units I feel are most satisfactory in the Recommended Equipment and Sources section, so here I will discuss the criteria for deciding what you want from the foregoing alternatives. Manufacturers are about evenly split over the pros and cons of one vs. two chambers. With a few exceptions, the ones with two combustion chambers also require hand kindling of the wood or coal. The reason is related generally to the danger of plugging up the oil burner orifices in a single chamber. By separating the burning areas, this problem is totally eliminated. Some are also concerned about popping coal when ignited by the hot flames of fossil fuels. The single chamber manufacturers simply recommend that you let the burners ignite wood and you hand kindle the coal. Auto-kindling by the burner is a very nice feature to have. Simply load up the chamber and the burner comes on after the door is closed, igniting the wood. It stays on until the wood comes up to temperature and takes over the heating process.

As to the type of fuel they accept, I am not overly concerned about whether or not the furnace accepts coal. Coal, with its “clinker” residue, is not as convenient a fuel to use as wood unless you are using a good stoker type coal stove. Coal in small chips lends itself well to automatic stoking. A few furnaces accept either an oil burner or a gas burner, but they are not easily interchangeable after installation. Anyway, that is what the wood option is for.

I will not summarize the problems of primary and secondary combustion air systems here as a more thorough treatment is given in the section on wood-burning appliances in the next chapter. Wood cannot be shut on and off easily, like other fuels, and this must be compensated for in proper thermostat control.

Boilers

All of the commercial energy sources I have mentioned for furnaces are also available for boilers. Boilers are specifically designed to heat water for hydronic heating or steam for higher temperature radiator systems. There are gas boilers on the market with the new pulse-burn system, and there are units that are oil-fired, sawdust-fired, trash-fired, and multifuel-fired. Boilers have the advantage of extracting large amounts of heat quickly and efficiently, and effectively transferring this heat to radiation surfaces. They are excellent for heating concrete thermal mass floor surfaces which are one of the most pleasant types of heat available.

Note on proper sizing: Whatever you do, do not oversize a solid fuel combustion unit. These units burn best when burning hot all the time. If you get too much heat, you have to slow down the burn rate, the efficiency drops very rapidly, and the pollutants increase as well.

VENTLESS HEATERS

Heaters, by definition, are small furnaces that are only meant to heat a small portion of a home, or add auxiliary heat to a cold spot in the house. Two types of heaters, other than electric models, have achieved between 95% and 99% efficiency. This is only possible when the fuel is burned so completely that it is safe for ventless operation – that is, without any exhausting of the gases burned. There are numerous companies that manufacture ventless natural gas and propane heaters. They have automatic shutoff safety valves in case the room begins to experience oxygen depletion. The energy saved by using a ventless model is very significant, so much so that a much smaller unit can successfully compete with a larger furnace for a fraction of the price. Naturally, the drawback of this type of burning process is its limited heat output – that's why they are heaters instead of furnaces. But there is a great advantage they have over forced air furnaces or even boilers, besides much lower cost. The installation system is almost nil since they don't require a distribution network of ducts or water pipes. Further, they provide a super warm unit to sidle up to when cold – just like a wood stove. Getting super-heated next to a radiant heat source is a tremendous source of comfort that no regular furnace can provide. There are even thermostatic controlled models that will maintain a constant temperature in the room. These heaters would be my "best buy" choice for even normal homes if the codes allowed them as the sole heating system. But they are great for cabins.

KEROSENE HEATERS

The kerosene heaters have also achieved the same high efficiencies, though with the drawback of some noticeable odor, and the hassle of carrying around liquid kerosene to keep the units operating. At least one major company has come up with significant improvements to eliminate the drawbacks while still retaining a great deal of the efficiency. KEROSUN and other brands now have units which do vent to the exterior to avoid odor build up. The heat lost is partially recovered by drawing in combustion air

from the double wall pipe surrounding the exhaust. Since the unit is also fixed in location on an outside wall, fuel can be piped in from a 55 gallon drum or a regular oil tank on the outside.

AIR CONDITIONING AIDS

Most of the energy-enhancing techniques mentioned relative to heat pumps are also applicable to air conditioning. Air conditioning is a compression cycle like the heat pump. The only difference is in the charging level of the refrigerant, which is optimized for cooling only. Heat pumps are charged with refrigerant in the mid-pressure range and thus are not very efficient at either heating or cooling as compared to a single purpose cooling or single purpose heating unit.

There are many techniques on the market designed to enhance the heat exchange functions of the freon compression cycle. The major weak link structurally is the mechanical compressor, so the use of newer variable speed compressors save on wear and tear. Additionally, some units are tending toward rotary-type compressor technology rather than reciprocating units.

The most common innovations for air conditioning are the spraying of the coils with water vapor to increase the evaporative efficiency, and the direct cooling of coils with well water. The misting of the coils is only workable if the water does not contain a lot of dissolved minerals which tend to form large deposits of mineral scale on the fins of the exchanger. All in all, the water-to-water exchangers have made the greatest advances in air conditioning efficiency and are highly recommended. Virtually all manufacturers are conversant in this technology.

Units are appearing on the market to make other uses of the waste heat from air conditioning and refrigeration coils. The most innovative is to connect them to external heat exchangers like solar systems use, from which domestic hot water can be heated.

ACCESSORIES FOR YOUR SYSTEM

Programmable Thermostats

These units can program numerous features, from on and off times to changing temperatures. Costs are cheap due to the efficiencies of electronic manufacturing today.

Air-To-Air Heat Exchangers

In new, air tight homes, air stagnation is avoided by the use of the special whole house air-to-air heat exchangers. Old heated air is exhausted through the unit that draws in fresh air. About 50% of the BTUs of the exhausted air are recovered in the process.

Chapter

15

Solid Fuel Heating Equipment

SOLID FUEL COMBUSTION

In order to properly select wood heating equipment, we must understand more clearly the process of wood combustion. It is fairly complex and has given way to a myriad of false combustion theories and sales claims about how wood stoves operate.

Wood has a very high heat value, but it is extremely difficult to burn efficiently so as to extract this value. The problem essentially is one of applying sufficient heat and air so as to break down the organic fibers into a high carbon compound (charcoal) which then burns easily like any other fossil fuel. In this complex breakdown process, all water has to be vaporized along with much of the liquid tar and resin binders inherent in wood fiber. The presence of water vapor, with these liquid resins, forms the smoke which is visible. Smoke is the telltale indicator of poor combustion. Smoke causes up to 40% of wood energy to be lost up the chimney as well as heavy creosote and tar to be deposited on the chimney flue walls which is a fire hazard. To overcome this latter problem, most manufacturers have relied on high flue temperatures to keep the smoke from condensing on the walls and forming creosote. Even with high flue temperatures, there is considerable carbon build-up which requires periodic chimney cleaning. Fortunately, in the past decade numerous design innovations have been developed to burn more of the smoke and to extract more of the heat value from wood. A properly designed internal air combustion system and heat exchanger, if truly effective, not only burns a lot of the smoke (adding to the heat derived from the wood) but allows a much lower flue temperature, saving more heat in the total process. There is no wood burning system that can exceed fifty percent total efficiency without some secondary air burning process.

COMBUSTION AIR: Primary air is *any* air that enters the furnace and fails to penetrate the flame pattern. It simply combines with the body of air present in the firebox and only has a general effect on the rate of burn, but does not increase burn efficiencies throughout the fuel mass. Restricting primary air has been the common way of controlling the rate of burn, but it is a very poor method. It allows people to think that their stove or furnace will burn for many hours at a time, but in reality, it is merely *controlled oxygen starvation* of the fire so that the fire barely glows or smolders. So little heat is given off and so much wood energy goes up the flue as smoke, that I refer to this process as "smoking a log up the chimney." With only one source of air, there is only one correct

way to control the fire – by burning it hot, with the right amount of air. The way to control the heat is by burning a small amount of wood at a time, and sizing the wood stove so that it can be burned at maximum output. You might get the idea that you'll be tending the fire all day in order to get halfway efficient burning. This is true, unfortunately, and it is why you should get rid of the old style wood stoves and switch to the modern types with a working secondary air system.

SECONDARY AIR: To qualify as a secondary air system, the air must be superheated to at least 800 to 1,000 degrees F. by tubes running in or on top of the fire and must be injected into or just above the flames. The injection of the pre-heated air into the flame pattern causes sufficient turbulence to force all volatile particles into contact with oxygen at high temperatures. With a glass door, a true secondary air system will look like a series of fiery blue jets of flames above the fire, much like a gas burner would look. Secondary air must be supplied in regulated quantities to match the amount of wood that is under ignition. Too much air will cool the smoke and not fully combust. A good furnace or stove with a secondary system will have very little smoke after the first ten minutes of burning, and that is the real test. Don't be deceived by a smokeless fire when it is in the charcoal stage. Any fire in that stage is nearly smokeless.

Catalytic Converters

Let me explain how a catalytic converter works. The catalytic process is designed to cause the burning of volatile combustible particles at a lower temperature than would otherwise be required (using only primary air). The unit is a round or square honeycomb cell with multiple holes that are coated with platinum, palladium, rhodium, or a combination of these noble metals. The unit must be heated by the initial heat of the fire to over 500 degrees F before it will start to burn the smoke. Thus, a relatively steady hot fire must be maintained or the converter will not operate. Catalytic stoves, therefore, need a little more tending but will produce about 2 times more heat from a given quantity of wood than a conventional stove. Since the smoke burning occurs at the catalytic converter, which is above the fire, and usually at the very top of the stove, the heat derived is lost up the chimney unless a stack heat exchanger is inserted above the converter. Catalytic converters are designed to burn only natural wood. Don't use the stove as an incinerator, and do not burn coal. In addition, care must be taken with pitchy wood. Keep the sticks small, and burn them very hot. Catalytics are very hard to clog if burned properly. The basic design advantage of one catalytic over another will be in the heat exchange process. In my opinion, only those with a forced air heat exchanger will be able to extract the full heat value from a catalytic stove. Because of the high cost of replacement, I don't recommend this type of smoke elimination. The EPA-approved noncatalytic stoves accomplish smoke diminution almost as well without the extra cost and complexity.

Wood Stoves, Fireplace Inserts

There are too many stoves on the market for me to make definitive comments about individually, so instead I will list the basic criteria necessary to make a proper selection. See the Recommended Equipment and Sources section for my current recommendations. Here are some important features to look for:

- Some flat top surface for emergency cooking
- Solid construction of metal, soapstone, or cast iron
- EPA approval with a clean burn, noncatalytic combustion system
- Firebrick-lined so that coal or wood can be burned
- Glass front to view the fire
- Some flat surfaces on side or top for optional water jacket to heat water

FIREPLACES

The conventional fireplace is, without exception, the least efficient wood burning facility in existence. Flues are oversized, to meet excessive building codes, and designed so that the path of least resistance for the exit of all heat is straight up the chimney. Masonry materials are nice heat retainers but poor reflectors until they reach a high temperature. Since reflection of heat is the only method of heat transfer used by a standard fireplace, its efficiency is very low – around 10%. The least inexpensive modification of an existing fireplace is to install a large, flat plate of 1/4" steel on the back wall of the masonry. This simple addition will easily double the radiation ability of the back wall as compared to firebrick.

I do not recommend use of the hollow tube grates, such as "Thermograte." The heat which exits the top of the tube is almost entirely sucked back into the firebox because of the draft created by the fire. They have solved this problem by attaching a glass front to the fireplace, but this presents other problems. This is definitely an improvement, but not worth the price, especially when you realize that the glass doors cut down almost 90% of the reflected heat from the fire. So what you gain with the Thermograte, you partially lose by having the doors closed.

A fireplace has primarily an aesthetic and emotional purpose – one which I feel fairly strong about. I never realized how important it was to have a "warm spot" in the house until I lived in a home without central heat. The home was a lot cooler overall, but in having a hot heater within the major living area, I could go over and get some deep penetrating warmth any time I felt cold. The high level of infrared heat from a wood stove or fireplace warms you completely through. Central heating does not do this, unless you keep the whole house excessively warm. If your muscles are sore, the high heat level of a stove or fireplace has a great relaxing effect. Even emotionally, there seems to be a great feeling of comfort in its deep penetrating heat.

My primary design focus for fireplaces is not to provide a heat source for the whole house, but to provide a focal point of aesthetics in a great room that will heat individual people and provide them with emotional comfort. We will use better vehicles, such as already discussed, to heat the whole house. Here are the principles:

1. *Build it large enough to heat the whole body*. There is nothing worse than the typical American fireplace, built like a tiny cave sitting on a raised hearth. All fireplaces should sit on the floor level, or if raised, no more than 14 inches. The top of the fireplace opening should be at least 42" high, and preferably 48". The width should match or slightly exceed the height. If you want a hearth at sitting height, build it on

either side of the fire place, so that two people can sit right beside the fireplace and talk to each other while someone else can stand in front.

2. *Design for good draft and smoke draw*. There is no better example of the faulty design in building codes than the requirements for fireplaces. I'm sure it was designed by credentialed engineers who had a bureaucrat's mentality. American fireplaces have a high propensity to smoke simply because the designs are all wrong. Let me itemize these design flaws: First, the fireplace is designed too deep due to the mistaken theory that the further back you place the fire, the less likely it is to smoke. There is some truth to this, but it is a poor solution to a problem that can be overcome better through other modifications. Fireplaces smoke because of other reasons, not that. Secondly, the primary fault of the modern design is a smoke chamber (the air space located just above the top of the fireplace opening) that is too shallow. Most masons install the damper assembly within 6 inches of the top of the fireplace opening. So when a fire is just starting, the initial smoke rises and immediately has to find its way through this narrow slot (the damper). Since a draft is not yet established, it doesn't take much for the smoke to billow downward and spill out into the room. The solution is to raise the position where the damper is installed so there is at least 16" of smoke chamber to help funnel this smoke up into the narrow slot. A big chamber is like a big smoke hood – lots of capacity to gather warm smoke in one area and allow it to rise, rather than billow out the fireplace opening.

3. *Flue sizes are too big, and sized according to wrong criteria*. Flue sizes are at least twice as big in diameter as they should be. Building code engineers even have some absolutely absurd formulas worked out regarding fireplace opening size and the size of the flue. The trouble is, the two are not directly related. The key factor is how the fireplace opening interacts with the smoke chamber above it and the fireplace damper. Of course we do have to have a certain size flue, but normally it should be about half the size required by the codes. The building code still labors under the ridiculous theory that chimneys must be big enough to allow scavenging air to come down the same flue the smoke is going out, where it hits the curved smoke shelf and assists the smoke to draw. This is pure bologna. Others claim that the smoke shelf is necessary to stop down drafts from entering the fireplace. This is true only because the chimney is so oversized that downdrafts can and do occur regularly.

4. *Use outside combustion air*. Once the draft is established, its rate of draw will depend upon the height of the chimney and the resistance to air infiltration into the home to feed the fire. That is why we want an outside source of combustion air for the house. It will be the source of *least resistance* and will not limit the draft of the chimney by the air tightness of your house.

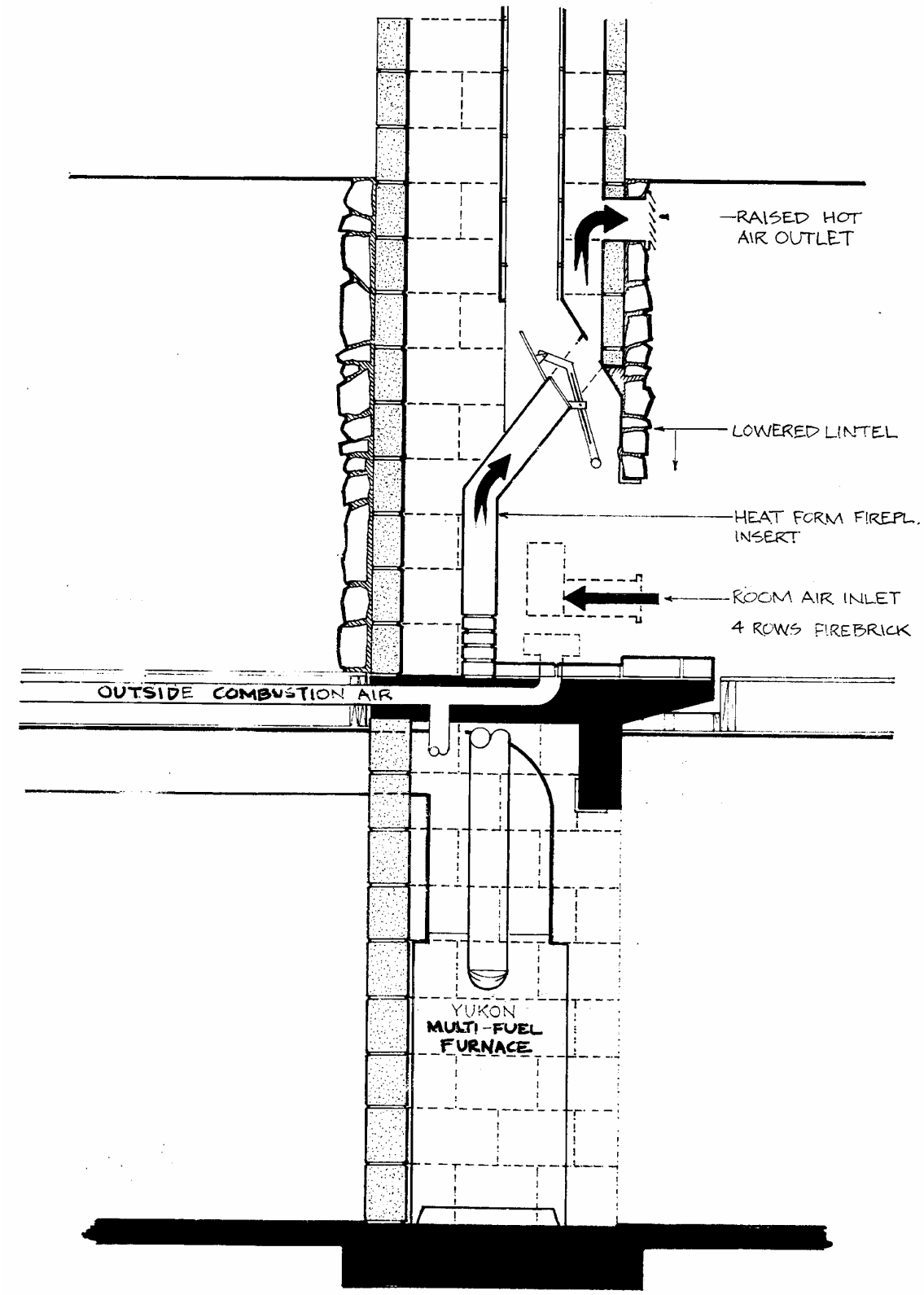
5. *Don't use glass doors when the fire is producing*. Closing the doors in an attempt to slow the fire down will only cut down the radiant heat from your reflector plate or the back of the metal firebox. Again, do not try to make a fireplace a furnace, unless it is one of the new gas log units that are designed for just that purpose. There are some new gas models that are quite efficient and that have a nice fake log system and glass doors that replicate a fireplace. But compared to a big roaring lodge fireplace, it is simply not the same. You regulate a wood fire by how much wood you put in it.

Accept the fact that a fireplace is for aesthetics and heat, but not for saving wood. Use your wood stove if you want to save on wood. Keep those glass doors open while the fire is producing heat and only close them if you are going to bed and the fire is not out. This way, your chimney will not continue to draft all night long, sucking out some of your household warmth. By the way, if you have outside combustion air and no glass doors (which I prefer), the chimney draft will take most of its draw from the combustion air source rather than the warmth of the house, if your house is tightly constructed.

6. *Place heatilator exhaust vents at the top of the masonry*. By the top of the masonry, I mean the top of the chimney system (inside the house) and not just above the firebox. This is important if you want your heat exchange to operate without a fan. The speed of heat movement in the heatilator form will be proportional to the height difference between inlet and outlet. Your mason may protest that all the heat of the heatform will go to the ceiling if he puts the vents high. Well, where does he think the heat goes anyway after exiting the low placed vents?...right up to the ceiling. At least, with my design, you get better speed out of the air movement which translates to more air circulation and therefore *less* stagnation at the ceiling, not more.

Building a Heatilator Fireplace

(See prior illustration.) If you want to use one of the metal heat fireplace chambers on the market, about the widest unit available is 48". That is OK for width, but the height is a paltry 30" and the smoke dome is of the wide and shallow variety. We can fix that. In the illustration you will notice I have set the heatform on a small wall of firebrick to raise the entire unit so that the opening height of the firebox lintel is now about 48". Notice carefully, and tell your mason 3 times that the heatform is <u>not to sit on a hearth floor</u>, it is to be installed on a wall of firebrick so that it is *elevated*. The hearth stays at the floor level. Several things are accomplished by this. One, the lintel (top of opening) is now higher, and the fireplace has a big lodge shape. It doesn't look like a tiny cave anymore, and it will heat the whole body when standing in front. Second, it is now easier to bring outside combustion air into the side wall of the fireplace since we don't have to cut through the metal heatform. Third, the hot coals of the fire do not directly contact the metal heatform, which preserves it from warpage. Fourth, and most important, we can now artificially lower (to 42") the raised lintel of the heatform. This is important so that we can form a bigger smoke chamber inside the top of the heatform. To ensure smoke



TYPICAL FIREPLACE CONSTRUCTION

control, we need at least 12 inches from lintel (top of opening) to damper at the top of the heatform. We lower the lintel opening by providing a steel angled iron, (the lintel) at the 42" height and fill in above it with masonry. Now we have a large and suitable smoke dome. It is not as good as the custom design out of firebrick that follows, but if you are going to use a metal heatilator type firebox, this is about the best we can do.

Lighting a Fireplace

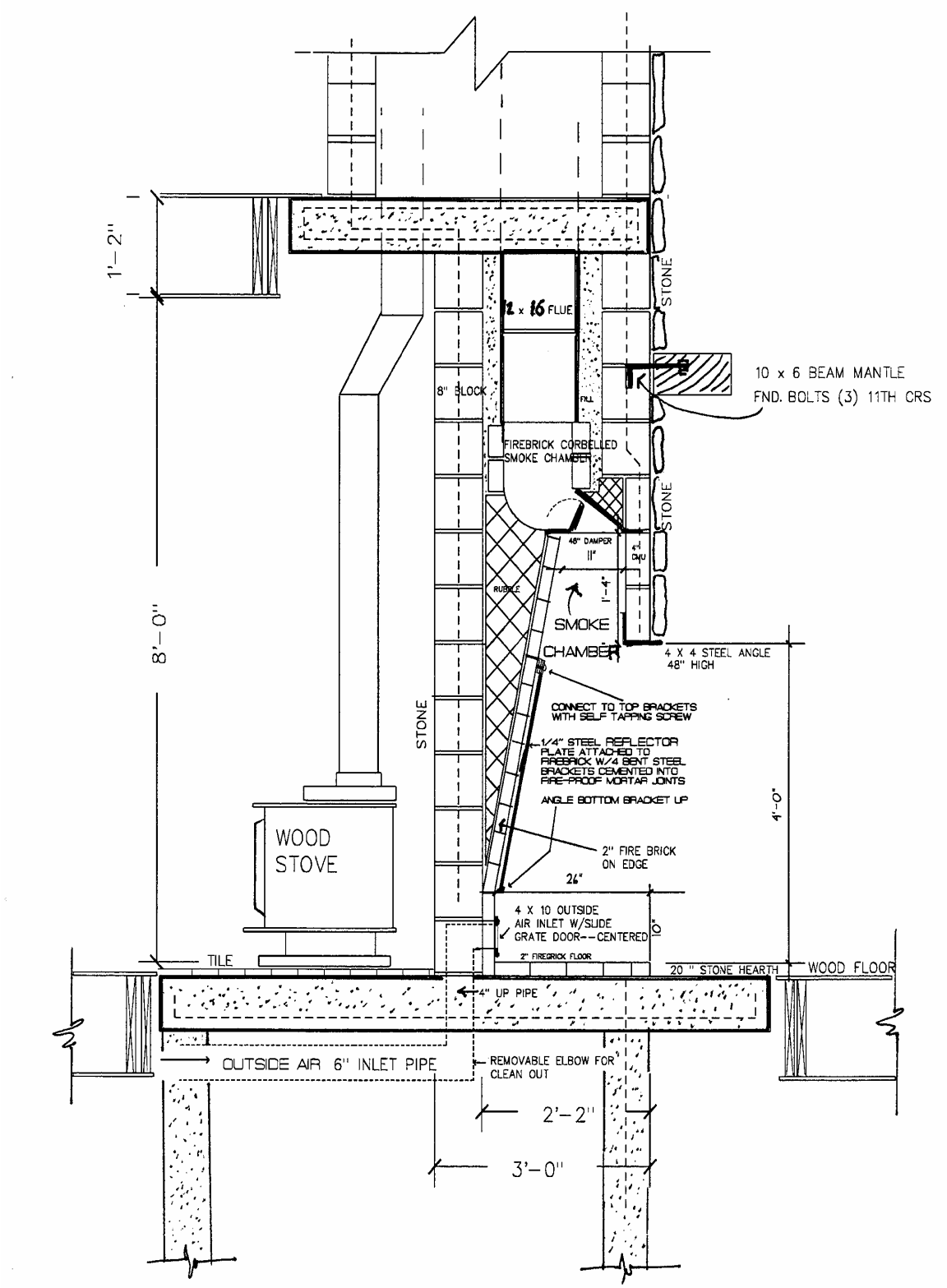
Remember that the unheated chimney is full of cold air which wants to fall down into the house when you open the damper. The initial warm smoke from the fire must overcome this weight of cold air in order to exit the chimney and start the draft. The smoke dome is the primary design element that builds pressure from hot smoke with sufficient upward force to push upward and out the chimney. You can help initiate the draft by wadding up a large piece of newspaper, lighting it, and sticking it up and holding it alight in the damper slot to begin the draft. When the paper starts to burn down next to your fingers, lower it and use it to ignite the fire you have previously prepared. The pressure of the initial puff of smoke up the chimney is directly proportional to the depth inside the smoke dome from lintel to damper.

Once out the damper, the smoke rises in the chimney flue lining and starts a draft. I never specify a flue over 12 x 16 inches even for the large fireplaces. An optimized flue is like a straw. If it is the right size, it will draw well. Try drinking a soda with a straw one inch wide and you will see how the smoke has trouble keeping a good draft in an oversized chimney flue.

Custom Built Masonry Fireplace

The second set of illustrations are some typical working drawings for a custom built masonry fireplace with a reflector back. The 1/4" steel is cut to the trapezoidal shape of the rear fireplace wall. The best way of securing it to the rear firebrick is to have the mason install 1/8" thick steel L- shaped brackets (two at the bottom and two at the top) into the appropriate mortar joints between the firebrick, to which the steel can be attached with bolts. Make sure the mason uses high temperature mortar and not regular brick mortar. Don't assume he will do it if you tell him. Make sure he buys the special firebrick mortar and you see him using it as he builds it.

As an aside, let me say, I have ***never*** had a single mason in all my career ever build one of the these special designs correctly. Masons are "know-it-alls" when it comes to their work. I'm not saying that to discredit their skills. They are good, but they don't like to do things differently than what is convenient or what they are used to doing. They are so confident that they know all about masonry, that they almost never use the plans, except to make the initial placement of the fireplace. They look at my special plans, superficially, and say to themselves, "Yeah, this is just like I always build 'em." But they are wrong. They ***always*** get it wrong – they never get the tall smoke chamber right. I have had to either stand beside them and demand they do it the way the plans show, or make them tear it down after they do it their way. You won't believe me until you try this yourself. I hope I'm wrong in your case, but don't assume anything. Have someone who



TYPICAL FIREPLACE SECTION

the plans work watch to make sure the firebox and smoke chamber are done right. Don't stop supervising until the system gets past the damper. Masons will swear up and down that none of their fireplaces smoke – but they are not being really honest. Given a nice tall chimney, most poorly designed fireplaces will work – most of the time. This system gives you complete assurance it will work all the time – and won't smoke.

The drawing has some large lettering indicating where the smoke chamber is. Note the dimensions. The smoke chamber must be at least 11" deep from front to back . If it is too narrow, it will smoke. The height of the smoke chamber from top of opening to damper assembly is a whopping 16". Make sure they do it that way. I assure you that if you follow these principles, you will really enjoy the fireplace year after year – especially at those holiday times when it brings into the home a spirit of warmth and friendliness. Note also that the sloping back of the fireplace begins about two or three courses high (of firebrick) or about 10 inches. This is to allow room to build the fire under the sloping back wall and to make room for the outside air duct, which is covered by an ash type door with sliding cover. It is important to have a way of closing off the inlet air when you don't have a fire burning.

Mantels

For stone fireplaces of the rustic look, I prefer to place the mantel about 6 feet high. This gives a good, balanced look to the fireplace and allows most people to stand in front of the fireplace without hitting the mantel. If you have taller people in the family and a taller ceiling, move the mantel up higher. Only traditional, carved mantels should be lower. The drawing shows how to install into the masonry chimney long L-shaped metal bolts to attach the beam mantel. The bolts are attached through large holes in the top of the mantel. Once the nuts are attached from reaching into these holes, a wood plug is used to cover the holes. In any case, they will not be visible except by a 7 foot tall basketball player.

PELLET STOVES

Pellet stoves are the most efficient way to burn wood particles today. They dribble small, compressed wood pellets into a small combustion area about the size of the palm of your hand and keep these pellets burning with a compressed jet of air. The burn is intense and efficient, and is almost smokeless. The only drawback is that you are completely dependent upon a manufactured source of fuel. If you choose this type of wood stove, make sure you have a year's supply of pellets. They must be kept very dry so they don't absorb moisture.

COAL STOKERMATIC

I recommend stoker-type furnaces for those who live in coal country and have access to stoker coal (finely ground coal suitable for automatic loading). These furnaces, which come in a variety of sizes, have automatic feed mechanisms which deliver small-sized coal directly to the fire chamber. Burning is very clean and efficient. These can be very effective as room heaters when the coal bin is integral with the stove. Three buckets of

coal will last a whole day in cold weather. Coal has the highest heat value of any fossil fuel. One ton of coal has twice the heat value as a ton of wood pellets.

WOOD HEATERS

Wood heaters differ only slightly from wood stoves in that they are fully jacketed and have a two speed fan to help the heat exchange process. I like wood heaters better than unshielded stoves in homes with young children, where stove burns are common.

Other heaters that are available are fuel oil heaters, which operate much like the kerosene heaters. I expect most to come out with the heat exchange flue concept soon. There are also waste oil heaters on the market, which burn used motor oil. Naturally, you have to have a repair garage to have a constant source of fuel for this type of heater.

FREESTANDING, ZERO CLEARANCE FIREPLACES

The freestanding fireplace is generally a cheaper alternative to the masonry fireplace, and therefore suitable for installation in several other rooms of the home where it would be prohibitive to install a masonry chimney. The only drawback of the conventional zero clearance units is their absolute lack of efficiency. By virtue of their "zero clearance" design, they provide so much insulating material between the fire and the combustible walls, that very little heat escapes into the room. For the most part, they are purely aesthetic, without utility. However, all that has changed recently. The new heat venting gas fireplaces have a built-in fan and high quality heat exchanger to extract the heat and circulate it into the room. Make sure the one you buy has a certified efficiency rating and tells how much heat in BTUs it will output when the fans are operating.

One last word of caution. Before you go out and design a fireplace into every bedroom, thinking how "romantic" it will be, take stock of all the wood that must be hauled, chopped, and stored to feed those fireplaces. My experience over the years indicates that most bedroom fireplaces rarely get used, unless they have a gas log in them. So if you are going to put fireplaces in the bedrooms, I recommend the gas log variety that actually puts out significant heat into the room. Leave the wood fireplace for the main living area. That's where the aesthetics justify the relative inefficiency of burn.

Chapter

16

Household Appliances

I do not intend to make recommendations on every piece of household equipment, only in those areas where there is a significant difference in energy savings or where a totally new design is presented with significant advantages. I will also cover areas where the entire product line may be unfamiliar to my readers. There have been many, many improvements in appliances since my last edition. There have also been several losses of fine products that could not make it in the marketplace because of financial problems. There are many new and dramatic scientific innovations on the horizon which promise major breakthroughs in almost every equipment area that I will mention in this chapter. But whether or not the world will remain in a stable condition to allow for continued progress in this area is unsure.

AIR FILTERS

There are several major innovations in filters. Filtering units have become very sophisticated and can now remove most contaminants from the air. The best filtering units have been designed for the medical community. There are 3 basic types of air filters that should all be present for complete filtration:

1. CHARCOAL prefilters to remove most of the primary dust and keeps the more specialized filters from clogging.
2. HEPA (High Efficiency Particulate Air filter) which filters particles down to 2 microns.
3. CPZ filters (Carbon, Pearlite, Zeolite) which filters out chemical contaminants.

Honeywell puts out several floor model units that uses all three of these filters (Model 63200 Envirocare is one unit). These are the filters (without the Envirocare unit itself) we use for fallout shelters, and they are readily available for purchase and use.

AIR PURIFIERS

The newest technologies in air purifying within the home do not rely upon filtration. They use a combination of ionization and ozonation to charge contaminants with an electric charge so they fall out of the air, to the floor. These charged particles are the

same you smell after a good rain or thunderstorm outside and thus it mimics nature's way of cleaning the atmosphere. These machines really work. They get rid of mold and mildew, fungus, and smoke particles in the air. Best of all, they work fast. ECOQUEST (used to be Alpine Air) is the lead company in the field of these new air purifiers (see Recommended Equipment and Sources section).

BREAD MAKERS

Bread makers are the newest rage. They can take you from raw ingredients to finished loaves of bread in one, automatic process. There are more models and features for me to review here, but I can refer you to an Online product review site that will give you some good, current answers: It's the "Bread Machine Digest" website at **http://www.sonic.net/webpub/bread-machine/breadmachine.html**. For self-sufficiency, you want a machine that is rated for baking whole wheat bread. This is the toughest thing for the automatic machines to handle. Several do a credible job, but I've heard the best reports about the Zojirushi V-20.

BREAD MIXERS

I highly recommend bread mixers to alleviate the heavy work load imposed upon mothers and wives in a survival situation. Some actually do prefer to knead by hand because they feel they get better texture, but it's nice to have the labor-saving equipment when you need it. In researching the various mixers in order to rate them, I found it easy to get hung up on *versatility* like most salesmen. With most appliances today, the major pitch is to overwhelm you with all the features. But features are only a wasted additional expense if you don't need them, or if you don't use them very often. So one must stand back and really analyze whether one needs 10 speeds, 3 bowls, 2 arms, and 15 attachments, etc. Just because a machine can blend, mix, grind, slice, and juice working off one motor, doesn't mean it is the most convenient. Separate machines can be more convenient, since they are ready to go, without switching parts. Ironically, the separate machines may even be cheaper in many cases than the combination ones with all the attachments. A high quality, multi-purpose processor is now marketed by **K-TEK**, which competes favorably with the **BOSCH**, and at a slightly lower price. They will both do a good job. Some don't like the Bosch motor on top, however, since it is a hassle to lift off when changing attachments.

In terms of BREAD MIXERS, the most important criteria is a powerful, reliable motor (bread dough is really thick) and a bowl with maximum capacity. Most of the machines do not have a bowl that moves, but have other features which make them more versatile for other mixing needs.

DISHWASHERS

While not truly an essential survival appliance, it is a great time saver and thus worthy of our use. In an alternate energy setting, the resistant heat portion of the drying cycle should not be used. My criteria for a high quality dishwasher are as follows:

1. Stainless steel or porcelain interior
2. Variable length of cycles
3. Air drying cycle (no heat usage)
4. Front loading with no-leak seal
5. Good water spray coverage
6. Low maintenance

The HOBART company, which specializes in commercial installation, used to market the very finest residential dishwashers under the name of KITCHEN-AID. But these are only middle of the pack now. The Swedish company ASKO builds the top-of-the-line dishwashers today, followed by BOSCH. These I give my highest recommendation, as they meet all of the specifications, plus many more. While the stainless interior is expensive, it will match the lifetime durability of the Kitchen-Aid inner workings. Don't bother ordering a stainless interior for the average conventional dishwasher, as the washer itself will not last that long. The only other dishwasher to come close to the Kitchen-Aid is WASTE-KING, noted also for their very fine disposal units. It also utilizes a stainless interior. You can also order porcelain in either brand. Cheaper brands use an ABS plastic coated interior which has a fairly limited lifetime.

FOOD DEHYDRATORS

Dehydration is one of the finest ways to preserve almost any food. It requires very little energy and the product will outlast wet-packed (canned) foods by a long while. Dehydrating cabinets are usually wood, metal, or plastic. A dehydrator must be sturdy and well built to stand a lifetime of use. The critical factor is the airflow design. Older units would place the heat source at the bottom with the result that the lower trays or racks of food would be over-dried and the top racks moldy. Then the designs went to back-mounted fans so the air could move side to side or back to front. Now the best units are back to round or square stackable plastic trays with special fan and heater at the bottom for upward movement. They must have solved the former problems because my experience with stackable units like the Magic Air and the Harvest Maid have been flawless. A proper intake of fresh dry air and subsequent exhaust of moisture-laden air is very important to properly remove the moisture from the foods to prevent spoilage.

You cannot choose a model based upon power consumption alone. Some 200 watt dryers may appear economical, but fail to dry effectively, and may run longer than another with higher wattage. The important thing is the combination of airflow and heat – not the wattage itself. All the modern plastic stackables have got this ratio down pat – they all perform well. The Harvest Maid 1000 can dry up to 30 trays stacked on each other. These stackable designs are particularly flexible in matching the dehydrator to your needs.

FREEZERS

In the science of refrigeration it is common knowledge that cold air becomes more dense relative to warm air, and falls at a speed related to the difference in the density of the two air masses. For example, the air will not cascade downward as fast when you open the door of a refrigerator as compared to an upright freezer. The upright freezer will lose its supply of cold air so fast that you can rarely find and secure what you are looking for without the freezer being filled to capacity with room temperature air. On the other side of the coin, the amount of BTUs lost in the freezer air is relatively minor compared to the mass of frozen food inside, but in any case, for this reason alone, I highly recommend the chest-style freezer, regardless of the inconvenience associated with extracting something at the bottom. A little careful planning and arranging of the frozen food can eliminate most of this digging for a needed item. Similar items should be stacked vertically so that every separate type of item is available readily. When the chest-type freezer is opened, very little air is lost. In terms of brands, Amana is still top-of-the line in chest freezer quality.

A word of caution on efficiency. Do not purchase a freezer or refrigerator unit where the heat exchange coils are built into the cabinet walls just under the shell (like most uprights). They may look better than the old style with the cooling rack on the back, but they heat up the insulation of the freezer unnecessarily. Always buy the kinds with external cooling coils either under or in back of the freezer. The best uprights put the coils on top, so the heat rises away from the cooled section. If you already have an upright, keep it packed full and it will run more efficiently. Also, do not place a freezer in a small room where the external freezer coils acts like a heater, working against its own purpose of keeping things cool. Freezers come in all sizes and energy sources: DC or AC plus propane and kerosene. Check the energy labels on the door or check the following website of the American Council for Energy Efficiency for a listing of each appliance's energy usage: http://hes.lbl.gov/hes/ACEEE/intro.html#con.

DC Coolers

There are DC operated cooling/heating elements on the market that produce small amounts of heating or cooling without refrigeration technology. These elements are completely solid state electronics with no moving parts except a small fan to distribute air better. These thermoelectric devices, often called "cooling modules," are semiconductor-based heat pumps. By applying low-voltage DC power to the device, heat will be moved through the module from one side to the other. One side will therefore be cooled while the opposite face is simultaneously heated. This phenomenon, known as the Peltier Effect, is fully reversible. Simply switching the polarity of the applied DC voltage will cause heat to be transferred in the opposite direction. Consequently, thermoelectric devices can be used for heating or cooling, making them highly suitable for small ice boxes or portable coolers. I use them on camping trips, connected to one 55 watt solar panel.

LAUNDRY APPLIANCES

Clothes Washer

The automatic clothes washer is an absolute survival necessity in my opinion. Considering the frequency and labor involved in washing clothes manually, it would be an extreme hardship to face, especially in a survival situation where many pressures and demands are added to the parents of a home. While it is true that women in many countries still wash clothes by hand, it never is looked upon as anything but drudgery. Having viewed such circumstances personally, I also noticed that the life of articles of clothing is drastically reduced by hand scrubbing and washing.

My highest recommendation in top-loading washing equipment goes to AMANA (who also builds SPEED QUEEN). MAYTAG has dropped to second in quality. Maintenance and designwise, they have been the top of the line for many years, but have not maintained those same high standards, in my opinion. They are still very good machines, however. Most washers have a great deal of built-in obsolescence which means that they purposely design certain parts to fail after five years or sooner. This, combined with highly overpriced parts and service, is designed to make you pay an additional price so as to compensate for the initial low purchase price. Beware of these tactics, which are involved in nearly all appliances sold. This is the main reason I usually recommend the most expensive appliances since there is such a close relationship between price and quality. In the low price range I recommend FRIGIDAIRE (also makes GIBSON brand). They are the best buy right now.

Front Loading Washers

This is the newest innovation in residential laundry equipment and I predict it will soon become the standard. Front loading washers are a very efficient and effective type of clothes washer. They use 40% less water, energy, and detergent than conventional top-loading machines. Much of this is due to the tumbling action they use in the cleaning process. These machines rotate clothing through water on a horizontal axis (the tub sits sideways), as opposed to the upright, agitator-style cleaning process of traditional top-loading machines. The results are cleaner laundry, cost savings, and more efficient use of our precious natural resources. The tumble action eliminates the “tangling” of laundry around the agitator which helps ensure more thorough rinsing action. Front-loading washers are easier on clothing than conventional agitator machines: Clothes are tumbled into a pool of water, rather than twisted and rubbed. The cleaning action in front loaders causes less lint than conventional top-loaders. Front-loading machines can have capacities as big as the conventional machines, although the Euro machines rarely have until recently. You can wash bedding, comforters, and other large items without the risk of damage or getting “stuck” due to imbalance, twisting, and tangling. Since front loaders remove more moisture from clothes during the spin cycle, they actually save drying time.

The biggest drawback for front loaders is cost. They cost 2 to 3 times as much as a conventional top-loading machine. I suspect that these prices will fall with increased competition. There is some increased quality in construction which partially justifies the

higher price: stainless steel interiors and well-engineered, shock-absorbing tubs that are able to spin faster while remaining quiet and stable on the ground. In addition to this, costs can increase based on special features such as digital control panels, special colors, or even timing functions that allow you to program the washer to begin the cycle during off-peak energy hours. I don't recommend you get all the fancy electronics – just more to go wrong. The bottom line is that you will pay a premium with this new technology, and even the meager savings in water will not pay back this huge difference. However, if water is in short supply, these machines will help. Look for significant price reductions in the future.

The top-of-the-line washer is the ASKO from Sweden, followed by the new BOSCH. The MAYTAG Neptune is the most popular sales leader in the middle of the pack. The FRIGIDAIRE/GIBSON is the price champion and only one considerably less than $1,000 – but also less quality.

Clothes Wringers

The final washing machine contingency for total power failure is the hand wringer and scrub board. The HAND CRANK WRINGER should be mounted near your stationary tub in the laundry. Chammy (chamois) wringers, used by car washes, can be purchased from some auto parts houses. They mount on a barrel or a countertop. For about the same money you can buy the wringer unit that is built for the James Hand Washer--the only manual washing machine still in production. See the Recommended Products section under "Household Preparedness Equipment".

Soaps

It is well to remember that no automatic washer will function without a high quality *bio-degradable detergent soap*. Keep this well stocked. Only handwashing of clothes will be suitable if you run out of detergent and have to switch to hand soap. For the sake of space savings in storage, I suggest you stock up only on the high quality concentrated soaps. Many are now available through cut-rate discount houses and stores without having to buy through such quality outfits as Amway, whose prices are very high.

Dryers

As in all heat-producing appliances, I recommend using natural gas or LP gas whenever possible due to its higher efficiency, economy, and storability. This is especially true in an off-the-grid home since one can rarely produce enough electricity to run 5,000 watts through a clothes dryer. I don't recommend that a dryer be used anyway in a survival situation except in rainy day emergencies. I am fully aware that it is more time-consuming and less convenient to use a clothes line. A unique home addition to improve the air drying situation in winter times is to install a small greenhouse enclosure on the south wall similar to the design for the outdoor unit of the heat pump that we mentioned earlier. A little more top ventilation must be provided to prevent steam build-up. This type of enclosure will allow air drying of clothes even in rainy weather. When you do use a dryer, I suggest you duct the hot moist air into your solar vegetable greenhouse for nocturnal heating. At least the heat will have double utility.

RANGES, STOVES, AND OVENS

Electric Ranges and Ovens

Within the general category of countertop ranges, drop-in ranges (range-oven combinations placed in a counter), and built-in ovens, there is a tremendous amount of competition among a variety of manufacturers. In the residential grade of appliances, I would rate THERMADOR as the top, followed by AMANA. In the middle of the pack you find the high volume, price competitive brands of GE, WHIRLPOOL, KITCHEN-AID, JENAIRE and MAYTAG. At the low end of the price spectrum, you find MAGIC CHEF, ROPER, CALORIC, etc. Kitchen-Aid used to be a very high-end quality company. But it is a sub-brand of the Whirlpool organization and is only medium quality now. There are other big conglomerates that have been formed. Maytag, for example, controls JenAire, Magic Chef, and Roper. Each of these is designed to cover a different market in price and quality. Ultimately, you can only trust the brands that do not build appliances for other brand names to maintain a unique and consistent quality.

In the higher priced market we find some commercial grade equipment being marketed by a few high-end manufactures. Thermador brand is the top-of-the-line in both residential and commercial grade residential. Second would be VIKING.

I do not recommend self-cleaning ovens for preparedness homes, since they are a tremendous energy waste. I prefer the special oven surface treatments which do not allow baked on materials to stick well. The JenAire is very popular and versatile, but somewhat overrated, in my opinion. The JenAire concept of drawing smoke and grease downward is good; however, grease-laden smoke is usually too heavy to be extracted by anything less than noisy fans moving air at 1,000 CFM. JenAire has made some improvements lately to quiet the fan noise, which is welcome.

A comment on burner elements. Large, thick elements may last a lifetime, but they waste more energy due to longer warm-up time and residual heat, which makes it more difficult to control the temperature. This also applies somewhat to the ceramic element varieties.

Gas Ranges and Ovens

THERMADOR is tops again here, and also the price leader. ROPER and CALORIC (sister company of AMANA) are two who market the widest range of moderately priced electronic ignition gas appliance. ROPER is a little better known, but CALORIC pioneered the ignition systems that are so popular with energy-conscious consumers. For self-sufficiency, only buy electronic ignition units that do not require a separate source of 110 volt electricity. Kitchen-Aid has an especially good anti-spill system to keep the gas flame from being quenched. BROWN from Lehman's markets a pilot light version that is very clean burning – it gives off no carbon monoxide.

Liquid/Gas Fuel Stove Burners

For those who don't feel they can afford the expense of a dedicated wood range, you might consider the purchase of some small, portable camp type stove with liquid fuel or

gas burners. While they do not give you an oven option, there are metal box ovens available for placing on the burners. The best type of fuel for odorless cooking is propane. Propane stoves are perfectly reliable, clean, and very available due to their high use in trailers, campers, and cabins. Propane is not the cheapest fuel, but it does have indefinite storage capacity. Kerosene stoves have a higher heat capacity than propane, but are more expensive. They must be primed and pre-heated, so they are not as convenient to use. Both propane and kerosene give off small amounts of carbon monoxide. This is not a problem in a large room with some minimal ventilation. Do not use them in enclosed tents or small shelters for long periods, however.

While I don't recommend gasoline stoves indoors due to the danger of fire, they are good to have around for camping and emergencies. They will produce moderate carbon monoxide fumes, so it is best to use them in the garage or outdoors. The newest types are single burner, multi-fuel types used for camping, but you can still find a lot of the older and cheaper two and three burner Coleman stoves. The familiar white gas camp stoves are not as prominent today due to the limited storage life of gas and the proliferation of the cleaner propane models. As white gas became harder to get at local service stations, COLEMAN started marketing the fuel in outrageously priced gallon cans in supermarkets at 4 times the retail value. We think people objected to purchases of this nature, and perhaps this was the motivation for many to switch to unleaded gas from the service station. While not as pure as white gas, it still lacks the lead which made regular gasoline prohibitive in past years (the lead content would clog burners). Many families have used these stoves at one time or another for emergency cooking and have found them just barely satisfactory. They have always been subject to starting difficulties, mostly due to ignorance of the user, or cold weather. It must be remembered that liquid fuel must be first pressurized in the tank (by using the small pump) and then vaporized by the heat of the burner which sits on top of the feed tube. This is where the initial flame is of poor quality. In very cold weather, it helps to hold a match under the feed tube to pre-heat it.

Microwave Ovens

I used to recommend microwave ovens as the only electric alternative for cooking that was efficient enough to run on alternate energy. However, due to the number of significant scientific studies that have shown microwaves to be damaging to all the key sensitive structures in food (such as enzymes, vitamins, immunal factors, etc.), I can no longer recommend that you use them. The kind of damage done to food is quite different from normal convection cooking, which also destroys enzymes and many vitamins (the prime reason we should eat a good portion of raw foods every day). Rather than simply being deactivated, as in conventional cooking, many food elements are in fact altered and made into substances that cause adverse reactions in the blood and immune system.

Wood Cooking Stoves

As mentioned previously, I do not feel that any of the wood stoves are suitable for cooking facilities except on a very temporary emergency basis. Since they are usually composed of a single large firebox, there is entirely too much heated surface, lending to discomfort as well as lack of control over heat distribution. Metal box ovens are

available that can be heated over a camp stove or a wood stove which works quite satisfactorily. But nothing beats a dedicated wood cook stove if you have to cook with wood on a regular basis. They are still being manufactured and come in all sizes, shapes, and prices. All the medium and high priced units are excellent in quality, so pick the style you like. Make sure you have the following features:

1. Wood stoking door so that you don't have to feed the fire from the top.
2. Water heating capabilities, internally
3. Double-walled, insulated construction for summertime use

There used to be an ample line of multi-fuel ranges available on the market. Since the products were expensive, and could not compete with either gas or electric ranges, the manufacturers have all gone out of business. The Cadillac of ranges was the MONARCH RANGE from MALLEABLE IRON RANGE CO. The company is no longer in business, but you can find used wood/electric ranges in the East and Midwest. The range, model CE119Y-1, has an electric burner stove top with a "duo oven" which operates either on electricity or on wood or coal from the wood unit built into the left side of the stove. It comes with an optional waterfront which heats water internally for your hot water system. There are two other models with either an all-gas range and oven or all-electric (both in combination with the wood/coal unit). However, only the CE 119Y-1 has an oven that heats with both electricity and wood. The closest thing you can get to a multi-fuel range now is to find one of the Monarch wood-only cook units and put it side by side with a gas range. These small Monarch wood cookers are only about 18" wide and match the style of a normal range, so they won't take up a lot of space in the kitchen .

Most of the traditional wood ranges are styled somewhat after the ornate wood stoves of the 19th century. These are aesthetically attractive and have water heating units. However, they are almost never built with insulated double wall construction so your kitchen will get very hot in the summer if cooking with wood. That's where an outdoor kitchen comes in handy.

REFRIGERATORS

Refrigerators used to be fairly efficient in terms of energy, at the expense of having to defrost the unit about once a month, depending on the humidity of the climate. Today's units try to do too much, in my opinion, and therefore require convenience heating units inside. Few realize that the way a frost-free refrigerator works is by turning on an electric resistance heater every few days to melt the ice that has built up on the internal coils. Then, the refrigerator turns back to the cooling cycle to remove all that heat. Add to this, special heaters to keep butter from turning hard and special temperatures for different compartments, ice cube makers, drinking fountains, etc., and you have a delightfully complex machine that uses a lot of energy.

I suggest that you avoid as many of the convenience automatic features as you can if you are going to buy a standard refrigerator. Get only the size you really need, as large refrigerators are harder to cool than small ones. Today's refrigerators are only moderately insulated. They will all use between 1.5 and 2.5 kwh per day, which is a lot

of energy. Listen to your fridge someday and you will notice the compressor is running a good portion of the day. When you shop for one, look at the energy usage tag on the front and compare size and features with the energy tags. To be fair, conventional refrigerators have reduced their energy consumption significantly. The energy leaders today are the KITCHEN-AID, KENMORE and WHIRLPOOL brand, although, like furnaces, the differences between the major brands are only a few percentage points. AMANA is still top-of-the line in overall quality, though not always the best in energy conservation. If you are going to get a fridge with a water dispenser, get a new one that has a built-in activated charcoal filter for filtering out chlorine from your public water supply. Most of the filters are changeable from the front of the machine.

There is another entire tier of quality in refrigerators that I must mention. The foregoing discussion has been about stand-alone refrigerators. In the higher quality built-in type fridges, nothing tops the quality of SubZero. They are energy efficient, quiet, and will outlast the others by many years. They are truly top-of-the-line, and you will pay a premium for them as well.

Smaller, NonConventional Types

There are numerous alternate refrigerators on the market. They all use far less energy than the conventional fridges, but they also have one major drawback – they have approximately half the internal usable space as what you are used to. And to make things even more maddening, they still cost more than twice what a normal mass-produced fridge will cost. The best will cost almost $2,700. But competition is coming to the alternative markets, and hopefully prices will drop without a sacrifice in quality. These refrigerators are different not only in overall size but in compressor size and insulation values. To cut down on energy usage these alternative fridges have about 4 inches of insulation around them. Conventional fridges have less than 2 inches.

Price/Energy Comparisons

But let's compare the best conventional fridges with these alternative ones, and match size to see how much different they really are. Let's look at a 12 cu. ft. Simpler Solar Fridge of 12/24 volts that costs $2700 versus a small 15 cu. ft. Magic Chef (the most efficient of the small, conventional fridges), costing around $700. The Magic Chef uses 1.2 KW/day which is .08 KW per cu. ft. The Solar Fridge uses .7 KW/day which is .058 KW/cu. ft. Thus the solar fridge is about 38% more efficient. This will save approximately $14 a year in electricity. However, it will cost about $2,000 more than the Magic Chef which means it will take 142 years to break even on the savings. Not a good deal except in survival mode.

Now let's compare one of the big machines to two of the Solar Fridges. A large 25 cu. ft. Kenmore or Kitchen Aid side by side unit will cost about $1,500 and use 1.75 KW/day or about $54/year in electricity. Two 12 cu. ft. Solar Fridges will be comparable in space but cost $5,400 and use 1.4 KW/day. That's a 25% energy savings or about $13.50 per year. But we have $3,900 difference in price to consider. Our measly cost savings will take 288 years to pay back.

In reality, the savings are a little better when we consider what we would have to do to run these two types of refrigerators in the alternate energy mode. Running the big 25 cu. ft. monsters from an inverter would have added costs in battery wear and tear and inverter inefficiencies. An inverter running a fridge is only about 80% efficient. But still, our savings in costs between the two fridges will almost pay for the inverters and batteries. Frankly, I think there is little reason why the alternative fridges should cost so much. I don't recommend them as long as they are this high priced. An interesting alternative for shelters is to buy the small 110 volt 4 cu. ft. fridges by GE or SANYO. They only cost about $150 and run on 150 watts/hr. In emergency situations, fridge space needs are drastically reduced. Opting to downsize temporarily to one or two of these small fridges is by far the most cost effective thing to do.

Absorption Refrigerators

These are refrigerators that run on heat. There are two major fuel types, and then some combinations of both. Both propane and kerosene refrigerators have absorption cooling equipment. This technology can generate a cooling cycle with any heat source. The only downside of this technology is that most of these units are not particularly efficient. They will burn a fair amount of fuel each day. Even so, they have been used for years in RVs and motor homes where electricity are not readily available. There is a new unit on the market that burns only 1.2 gallons of LP gas a week. This is very efficient and cost effective. Propane and kerosene refrigerators are not nearly as expensive as the low voltage units like Sun Frost or Solar Fridge. See the Recommended Equipment and Sources section for brands and sources.

SEWING MACHINES

A high quality sewing machine is essential for long-term repair and mending of clothing, not to mention the making of new clothing. As with any professional tool, never buy a cheap sewing machine. The ability to make suitable clothing efficiently and cheaply depends on having a machine that takes the burden out of sewing. Many women have sewn for years with inferior sewing machines, who essentially don't know that something better exists. Others have totally rejected sewing after experiencing costly and aggravating delays caused by the necessity to change tensions, gadgets, needles, feet, threads, or cams for different sewing operations, not to mention the minor malfunctions of cheaper models.

One learns far more about any type of appliance or machine by talking to those that repair them than from the salesman, especially if he is selling only one brand of machine. I have talked to a lot of repairmen in the various fields of equipment I recommend, and the results are always interesting as compared to each brand's respective marketing approach. The best machines sell themselves to some degree. My general criteria for good sewing machines for all-around usage are:

1. High quality metal construction
2. Internally designed automatic tension (no adjusting necessary)
3. Simple, fast threading

4. Internally designed cam mechanism
5. Quiet, smooth, and high quality gear and cam operations
6. Foot pedals to control speed and a knee lever to control pressure foot operation
7. Internal buttonhole mechanism
8. Low maintenance (lifetime guaranteed)
9. Sleeve arm
10. Reasonably priced with respect to quality
11. Quick change of pressure feet
12. Ease of cleaning, oiling
13. Power and tension-adjusting ability to sew very heavy and light materials
14. A good stretchable stitch for sewing knit fabric
15. Adaptability to manual power
16. Noncomputerized control

My highest recommendation for overall design and quality goes to the noncomputerized BERNINA 1008. It matches all of the criteria. The reputable Bernina is so straightforward and easy-to-use, directions are practically unnecessary. It is a strong and durable machine. Most importantly, the tension is self-correcting because of the special hook system. Even these noncomputerized machines have lots of decorative stitches including straight, zigzag, blind, and buttonhole, as well as special stitches for stretch fabrics.

My second recommendation goes to the noncomputerized Viking Sew Easy 330. This machine offers excellent utility, simple controls, and many features that make it a superb choice. It has a whopping 44 built-in stitches (including buttonholes). Other important features include an easy and efficient control system; a feed system that feeds all weights of fabrics evenly; a free-arm design for sewing cuffs, sleeves, and hems; an accessory tray and flatbed extension for sewing large items; drop-in jam-proof bobbins; adjustable stitch widths and lengths; twin needle sewing; a built-in bobbin winder; and electronic speed control.

The only American machine worthy of mention is the WHITE. I cannot recommend the machines from Singer. Many repairmen I have talked to over the years complain about the difficulty of adjustment and repair of these machines. Maintenance on the Singer is considered by some to be tedious and difficult, due to the lack of room to work with. Japanese machines, like BROTHER, according to our experts, are either good or horrible. In other words, you have to judge each one as an individual machine, since all brands are susceptible to bad workmanship and poor quality of parts. Unless you get one from a friend, who can verify its quality through long experience, I recommend you avoid them.

WASTE DISPOSAL SYSTEMS AND EQUIPMENT

Garbage, trash, and gray water need to be disposed of in several different manners so as to extract their residual value.

Paper garbage should always be burned. The ashes are very beneficial to your soil (if acidic). If you burn in your fireplace, be sure you use a screen as paper burns quite violently and often lets burning pieces fly in the rapid draft it creates.

Composting

Wet garbage should be composted rather than sent to the dump. If this seems too much of a hassle for you, then I suggest a more sophisticated composting system. The basic idea is to have a separate drain attached to half of your double sink which contains your garbage disposal. This gooped- up mixture of water and wet garbage goes into a stainless steel or galvanized container with drain holes in the bottom (located outside the home in an insulated housing next to the kitchen sink wall). The excess liquid is drained off underground with PVC irrigation pipe and distributed to your garden area, or to a leach field under your lawn. The solid matter remains in the container, which is small enough to be portable and is emptied about once a week into your composting pit. This simple arrangement saves a lot of effort in this beneficial use of wet garbage.

Trash Compactors

These have only a limited value in the overall waste disposal system which I espouse. Their primary use is in the crushing of tin cans and glass bottles in areas without garbage collection service. Paper should be burned, and wet garbage composted.

Disposals

The two basic differences in garbage disposals are the starting switch and the method of handling jams. I prefer switch-starting rather than hole covers with internal magnetic switches. Having to use the cap to start the disposal is a fine safety feature, but a real hassle when you have a lot of material to dispose of. Since hands are wet, be sure and have a Ground Fault Interrupted (GFI) switch installed with the disposal. This type automatically cuts off the power to the circuit if a shock begins to occur. KITCHEN-AID has a new anti-jam switch which reverses the motor half a revolution to dislodge jammed pits, etc. But it doesn't produce enough power to dislodge some heavy jams. This is a benefit, however, for a metal jam in which you want the metal piece to stall the machine until it is extracted. WASTE KING uses centrifugal cutters which simply bounce off of jams until they are pulverized. In the case of the metal jam, this is a disadvantage since the machine will not stall, but you should be able to hear the difference.

The only new technology on the market is a remarkable water-drive disposal. It is the only one which does not use electricity – great for the preparedness home. HYDRO-MAID is the first totally nonelectric, water-powered food disposal. Touted as safer, cheaper, quieter and more environmentally-friendly than traditional garbage disposals,

the system cannot damage silverware accidentally dropped in the unit while it's running because it will drop into another compartment.

WATER PURIFIERS, FILTERS, DISTILLERS

Sadly, it is very difficult to find pure water except high in the mountains away from any humans. Thus, having the capability to turn bad water into pure water is essential. Here are the key methods utilized in water purification technology.

Ozone and Ultraviolet Light Water Purifiers

These are the two best alternatives to using chlorine to kill bacteria. It is well-documented that chlorine causes long-term and serious health problems in humans. Free radicals and trimethylhalines (TMH) are by-products of chlorination which are linked to cancer and heart disease. Using oxygen or ozone to kill bacteria, virus, and parasites is not only effective but completely non-toxic and without free radical by-products. Ultraviolet (UV) light also kills bacteria. UV light penetrates the cell walls of pathogens and damages the amino acids and other structures. However, UV lights will only purify – they do not remove any other harmful substances. They have been used in limited ways within public water supplies as an alternative to chlorine, but have only recently been available to the residential market. EcoQuest (Alpine Air) puts out a simple on-demand unit that hooks directly to the faucet of your sink. It does require electricity to run the ultraviolet light and ozonator, but these only come on when you activate the button on your sink to take drinking water. I have been told they are planning a "whole house" unit in the future. This should be a welcome addition to any self-sufficient residence or retreat.

Reverse Osmosis (RO) Water Purifiers

This process involves forcing contaminated water through a synthetic, semi-permeable membrane, removing almost all dissolved solids, volatile organic chemicals (VOC), metals, bacteria, and other pathogens. RO is at its peak efficiency when the membrane is new, reducing certain contaminants by 70-90%. The purity of the water depends on fluctuating water pressure, age and subsequent breakdown of the membrane, and clogging of the membrane pores. Bacteria growth can also be a problem. Some bacteria will damage the membrane, so it is always preferable to have a water bactericide on the front end. Ultraviolet light or ozonators are common choices. RO systems use a large amount of water – anywhere from 5 to 20 gallons to get 1 gallon of treated water, so homes with minimal water supplies should use other systems. Although the RO systems use no electricity, they can be quite costly ($500 - $850) and must be installed into the plumbing system. They do require routine service, monitoring, and replacement of the membrane periodically.

Desalination

If you have a retreat on the seashore or on an island, or if you are using a seagoing vessel for a retreat, you will need a solar operated desalinator. AQUA DEL SOL has a small solar panel that evaporates sea water and turns it into pure drinking water There is an

osmotic membrane type that operates manually or on 12 volts: One such device is the PowerSurvivor which costs a whopping $2,115 (smaller life raft model is $800). The 12 volt model will generate 1.4 gallons of drinkable water per hour.

Why so much expense? Desalinators use reverse osmosis under pressure to separate the salt. Osmotic pressures to extract drinking water from sea water are nearly 800 psi – that's a lot of pressure and requires a lot of energy. The 12 volt electric motor in one model is used to generate this pressure. If electricity is not available, you can still use the water maker by removing the motor assembly and attaching a long handle, which would then have to be pumped periodically throughout the day to keep up with the water usage. PowerSurvivor has devised a unique system of assisting the pumping action so that you don't have to produce the entire 800 psi in every pump stroke. Here is how it works: The sea water in front of the piston is forced over the surface of the membrane at 800 psi, where 10 percent passes through as pure water. The remaining 90 percent is routed through a special valve to the back side of the piston, where it balances the pressure on the front of the piston, making it much easier to pump. This system not only saves your energy in a crisis, but dramatically reduces the electricity required to operate the unit under normal conditions. The unit only draws 4 amps from a 12 volt electrical system.

Sea Recovery and HRO are two major companies that make medium to large-sized systems for yachts and larger ships. They range from $4,000 and up. The smallest units produce 8 gallons a day. Not very efficient, but they are used worldwide simply because it is the only option some people have.

Water Filters

Filters also lose their effectiveness with continued use. Most have capacity ratings somewhere between 500 and 1,500 gallons; however, by the time they reach the point of needing a replacement cartridge they may only be removing a fraction of what they did when new. Unfortunately, there is also no convenient method of determining exactly how much water has passed through the filter. Here is a rundown on how the various types of filters differ.

Sediment Filters

These are simply fine strainers. They range in filtering size from 1 to 25 microns. These are best placed first thing in a line of filters to remove suspended soil and other particles. They don't remove anything except particles and the water must be purified later. Their main purpose is to keep other more expensive filters from being clogged. Always use them as the first thing on your water line as it enters the house. Always get the generic brands available at home improvement stores. For these you can find replacement filters anywhere. If you buy specialty brands with odd-sized filters, you will be held hostage to a limited and expensive supply chain.

Carbon Filters

Carbon particles or solid blocks of carbon are used as filtering elements. Filtering water with carbon works well in removing pesticides (like DBCP), chlorine, suspended particles, and "precipitated heavy metals." Only the high compacted carbon block filters

are effective at removing radioactive particles, as well as most nitrates and bacteria – but not all. In fact, bacteria from contaminated water colonize and grow between the carbon particles after a period of time and eventually may be randomly released into the "filtered" water. This is much more of a problem with ordinary carbon filters than with carbon block filters. Carbon block filters will reduce water flow significantly. When used, they should always be placed after a sediment filter.

Consequently, carbon filters need to be coupled with some sort of technology that kills pathogens. The more expensive carbon filters are silver impregnated. Colloidal silver is an excellent bactericide. But even these have a limited life, and need to be replaced at the manufacturer's recommended intervals. One of the newest and best ways to use carbon filters is in conjunction with an ozonating and ultraviolet light system. By regularly flooding the carbon filter with ozone, no bacterial contamination is allowed to build up. Carbon filter manufacturers normally specify how well the filter removes "dissolved" metals and minerals in the water. Unfortunately most heavy metals (lead, cadmium, barium, nickel, etc.) are in a dissolved state and carbon filters are not able to remove them. There are other filters specifically designed for metals, however.

Ceramic Filters

Ceramic filters work by making holes so tiny that nothing but water can get through. They take considerable pressure to force the water through, and they get clogged easily. They are therefore usually used on portable camping systems. They can be back-flushed to keep them from clogging, but it is essential to have a good sediment filter on the front end to prolong the life of the ceramic element.

Kenetic-Degradation-Fluxion (KDF) Filters

These filters are the best for removing chlorine from city water. They are composed of a high purity alloy (copper and zinc), which has a high potential for electrochemical reduction and oxidation. Chlorine is converted to a zinc chloride. KDF filters are much more effective than carbon filters, and last 3 times longer, but cost more. They also are resistant to bacteria build-up. But KDF filters can't remove certain volatile chemicals and gases. KDF is technically not a water purifier and therefore is used in conjunction with other systems – such as ozonation or ultraviolet lights.

Distillation

Distillation is a method whereby water is removed from the contaminants rather than trying to remove contaminants from the water. Distillation involves boiling water, capturing the steam, cooling it, and condensing it back to liquid. Materials that have a higher boiling point than water will not rise with the steam. But some, like chlorine, have a lower boiling point than water and will flow into the distilled chamber. It changes to chloroform gas and can be carried into the "treated water" with the steam. Therefore it is essential that distilled water be put through a charcoal or KDF filter before drinking. Most modern distillers are built with a post-carbon filter to filter out chlorine. Distilled water filtered through a post-carbon filter is the purest water available, but it's not foolproof. It stops foreign particles, and most pathogens, but some chemicals can get through, and beneficial minerals in water are removed. Thus, this "empty" water is

highly attractive to other minerals in the body, and should not be used on a regular basis – only for those health regimes which are trying to remove toxins from the body.

Here are some things to look for in distillation products:

- NAME BRAND: As in any product for which you may need replacement parts, buy from a company that will be around when you need it – although no such thing is guaranteed in the future we are preparing for. A good water distiller will last 30 to 50 years with some minor maintenance. The water distiller heating element and solenoid will probably need to be replaced in 10 years, so you may want to stockpile these items in advance. The big 3 water distiller companies worldwide are: Polar Bear, Durastill and West Bend.
- PRODUCTION RATE: This specification measures the rate at which the distiller produces water. Distillers vary from 3 gallons/day to 12 gallons/day
- TYPE: Distillers are either manual or automatic types. Manual distillers can only produce one gallon of water at a time because they are limited by the size of their fixed boiling chambers. Automatic distillers produce water continuously. They are connected directly to the water line (simple plumbing changes are required).
- WATER PURITY: All distillers go through the same basic process. Distillation is a very effective process which removes 98 - 99.9% of most contaminates from the water. One brand of distiller will not make significantly purer water than another brand.
- CONSTRUCTION: Steel parts will leach trace amounts of metallic contaminates back into the water. Pyrex glass is the cleanest material to heat water without adding contaminates back into the water. The problem with glass is that it's not durable and will crack if you drop it. The next best material is surgical quality stainless steel – the type surgical knives are made of. Do not use heat-resistant plastic or aluminum under any circumstances.

WHEAT GRINDERS

Many new brands of wheat grinders have recently come onto the market due to the high interest in storage foods. These have mostly been developed in the western US where the market is strongest (which is ironic, considering the East should be the most concerned about food storage). All home-type motorized wheat grinders used to use some form of milling stones to do the grinding. Most now use a high speed micronizing process, which will be described shortly.

Hand Mills

There are several types of hand grinders. The cheapest and oldest technology is the traditional CORONA-brand hand grinders. They are made of cast steel or iron – very sturdy, simple, and cheap. I don't think you could ever wear one out. But they don't grind very fine. They are best for cornbread and cracked wheat cereal. On the other end of the spectrum, there are some very expensive hand grinders that cost almost as much as an electric mill (THE COUNTRY LIVING GRAIN MILL is the most expensive – over

$350 in 1999). They will grind very fine flour, but it is very labor intensive. I wouldn't want to bake much bread if I had to spend a half an hour at hard labor producing the flour.

There is a new German import on the market that is excellent and in the middle of the price range. It's called the FAMILY MILL and it comes with a grinder head or a rolling head. You can get both with the hand crank base for about $190. Either one individually will be about $140. Check the equipment source list for details.

For long-term emergencies, make sure you get one of the moderately priced hand grinders that has a bicycle sprocket attachment so that you can rig up an old exercise bicycle to make the labor easy. You can find old exercise bikes at second-hand shops for a few dollars. With some make-shift brackets welded to the frame it is not too difficult to figure out how to attach a wheat grinder to the pedaling mechanism. Since exercise bikes already have the floor stand integral with it, your job is made a lot easier.

Stone Grinder Mills

In the *stone grinder* arena there are several cutting designs which determine the flexibility of the milling heads. Fine milling stones rotating at higher speeds will render an excellent grade of flour, but will not make "cracked wheat" which is suitable for cereal. Like the micronizer metal burr technology, it ends up as flour mixed with milled kernels of wheat. Centrifugal spin units have hollow shaped areas between the two stones, and the wheat is pushed into an ever-narrowing slot between the stones by centrifugal force. These types are excellent for the finest flour, but they are slow in producing quantity, and cannot do cracked wheat. Other mills have what they call a "scissor action." These have slanted grooves in the stones which tend to crack each kernel before it reaches the milling portion. Some even have embedded metal bars so that a wide range of flour and cracked wheat is obtained at a higher quantity of delivery. All of these machines are highly versatile without much degradation in the quality of fine flour. Settings are usually obtained by varying the distance between stones. Some people have erroneously stated that stone-ground flour will wear down your teeth with the stone powder that gets into the wheat. This was only true for hand-ground flour from stones. The stones in modern mills do not touch each other. It is true, however, that the stones will tend to get glazed over or clogged with a lot of use and have to be cleaned.

Modern Micronizer Mills

These units pulverize wheat at a 40,000 rpm with small stainless steel plates with burrs on them. This is the same process used by modern commercial micronizers. While these units do an excellent job making flour, (wheat is ground down to talcum powder size) they have the limitation of being electric only – you cannot use these machines with any sort of manual drive. The old ones used to be very noisy and have limited capacity (3 cups) for holding the wheat. But no longer. These mills are now far quieter than stone or stone/blade mills. They do cause the wheat to become hotter during the grinding cycle, but this is not a problem if you are going to use it right away for cooking (where the temperature will get much hotter). Higher heat would be a problem if you were going to

store the flour. But why store flour when you can grind it fresh? What a difference fresh ground flour makes!

Wheat Grinder Recommendations

If you want a stone/steel grinder with a hand crank option, the Golden Grain unit is excellent. It has self- cleaning stones and grinds with good speed. If you are going to make a lot of flour during the good times, I recommend that you buy one of the micronizer type grinders (like the K-TEK or WHISPER MILL). There is no question that they grind finer, quieter, and faster than the traditional stone mills. If you have an alternate energy system with an inverter, you can run your wheat grinder on 110 volt power. However, it is imperative in this case, that you have a separate hand grinder for making cracked wheat cereal and for grinding flour by hand.

OTHER KITCHEN EQUIPMENT

The following miscellaneous kitchen appliances are useful in the survival context, as well as normal living.

Baby Food Grinder

If you care about your baby's health, buy up several of these inexpensive food grinders. Cook up some organic vegetables and grind them up. They are much more nutritious than commercial baby food.

Blender

Heavy-duty type. Most bread mixer units have blenders as standard accessories.

Butcher and Kitchen Knives

Buy only the highest quality high carbon steel alloy. Shiny stainless steel should be avoided as it doesn't hold a good edge. Thin molybdenum steel is good for general kitchen use, but high carbon steel is better for butcher-type knives. Most knives sold in supermarkets and department stores are the shiny cheap variety with a fancy name and moderate price. Always buy your knives at a knife store that specializes in fine cutlery. Since the salesman probably won't be able to quote you the steel content of the various brands (trade secrets) you are better off buying the quality brand names. Manufacturers that put out the best mass-produced hunting knives also put out some of the best kitchen cutlery. If you want the ultimate, you can always order from the several custom knife makers. But as with all knives, they are only as good as your skill at sharpening and honing them. A good set of grinding stones and steels are essential for an efficient kitchen.

Canning Supplies

Each survival home ought to be well-stocked with canning supplies: at least 100 canning bottles per person and at least three times that number of sealing lids unless you use the

new type of reusable lids. These are a rubber type of lid. They are expensive but do work well. I have tested the BALL brand canning lids, and they have proven to be capable of multiple uses (if not damaged when opened after first canning). The KERR lid does not lend itself to multiple uses. Substitutes for canning jars may serve in a pinch, such as mayonnaise jars or peanut butter jars and lids – but they are not nearly as strong.

For acidic vegetables and fruit canning, the common water bath method (non-pressurized) is most familiar. A much simpler, safer, and more nutritious method of steam canning has been used for years too (Graniteware). Non-acidic vegetables and meats have to be canned at a higher temperature by using a pressure-cooker canner, such as made by AMERICAN brand canners.

Victoria Strainer

This is a hand-crank, screw-fed separator/strainer which automatically separate cores, skins, seeds, etc., from pulp and juice in tomatoes, pears, apples, grapes and other non-pitted fruit or vegetables. Sadly it is no longer available. The company went out of business recently. But other companies are gearing up to build similar units. It originally sold for under $30, and was a canning “must have” item. If you can still find any around, grab them up. Check the Recommended Equipment and Sources section on my website Online update.

Apple/Potato Peeler-Corer

A great asset when processing a lot of apples.

Cherry Pitter

For pies or canning. Usually only pie cherries are canned pitted, but sweet cherries must be pitted to be dried, so this is a very nice piece of equipment to have. Dried cherries are the premier tasting dried fruit (very sweet).

Cast-Iron Cookware

Large pots, griddles, skillets, and grates are useful for cooking over open flames. Get a good book on dutch oven cooking. This technique makes camp cooking a gourmet experience.

Food/Meat Grinder

A must when you process your own meat in times of need. There are manual grinder attachments for Corona-type grinders, or motorized models. Many all purpose food processors like the Bosch or K-Tek have meat grinder accessories.

Juicer

There are two types of juicers. The most common and cheapest is the centrifugal juicer. The food is turned to pulp with a burred bladed and then rotated against an out drum screen with high speed centrifugal force. It works well until the screen begins to clog.

The better juicers like CHAMPION brand use a high speed cutting screw inside a screen that keeps the screen from being clogged.

Waterless Stainless Steel Cookware

VOLRATH makes the finest stainless steel cookware, but is marketed at fairly high prices. Don't buy any sets in combination with "free gifts, prizes," etc. Better to buy from a reputable discount catalog such as Spiegel's of Chicago. I recommend this self-sealing cookware because it requires far less energy when cooking over a conventional range (as well as offering greater nutritional benefits). There are many cheap competitors, but only heavy duty 7-ply stainless steel will compare with Volrath. Check the weight and the structural makeup before you buy. This is one area where there are no good bargains in the cheap price range. If it's cheap, it's junk.

Yogurt Maker

SALTON is a good brand. Your dehydrator can be used as a yogurt maker if it has a thermostat. Make sure you use a high quality organic, nonpasteurized yogurt to start with. Don't use any of the low-fat, sweetened yogurts common to most grocery store shelves.

Chapter

17

Other Survival Equipment

Food and water are two of the key survival factors every home must have. While this book does not cover gardening and food production, it will concentrate on food storage rooms and other essential survival equipment to fulfill the overall purposes of a preparedness home.

FOOD STORAGE

Because of the high cost of dehydrated survival foods, I increasingly recommend that people concentrate their food storage dollars on whole grains, beans, rice, and a year's supply of the normal canned goods they consume (*excluding* all junk food). This system has several advantages over the dehydrated storage foods.

- First, this system is more suitable to regular food storage rotation. The dehydrated foods are way too expensive to be using regularly – no matter what the sellers may tell you to the contrary.
- Second, ten year old dehydrated food loses a lot of its flavor. It will keep you alive but some of it can taste pretty poor. On the other hand, stored grains do not lose their flavor.
- Third, there are presently no shortages of the conventional foods so there are no delivery delays as there are occasionally for storage foods. Obviously, there will be shortages someday, so don't count on conventional food availability in the future.

Shelf Life of Canned Goods

Now, let's look at the downside – shelf life. Regular canned goods do have a limited shelf life. But it's much better than the industry claims, if canned goods are stored in an unheated basement storeroom. All the homes I design have a large set of basement storerooms coupled with a large pantry closet upstairs to handle day to day needs. Kept in cool conditions, most canned goods will last 3-4 years. The only exceptions are the tomato products. They tend to go bad sooner than other foods due to high acidity. The ultimate indicator of a can's condition is whether or not it is ***bulging*** from internal pressure. A bulging can is proof-positive that some bacterial action is going on inside. That's the time to throw a can away – regardless of the due date.

How to Read Date Codes on Canned Goods

The reason the manufacturers put a coded date on the cans is to discourage buyers from selecting fresh cans over older cans. If you call the companies they will readily provide the information on how to read the codes, but they want to make it just a little difficult so as to discourage choice.

Below is a summary of the dating systems employed by various American canned good suppliers. This will help you determine the freshness of the product. Remember, that most case good sales consist of canned goods that are at least a year old. This is not always the case, depending upon the store. Learn to read these date codes to be sure. For storage purposes, it is better to buy fresh at regular prices than 2 year old canned goods at a discount.

Some manufacturers use a Julian date where the days of the year are all ordered by numbers 1-365. Think of every 90 days as a quarter of the year, roughly. When a letter is used to represent a month or year, they are in alphabetical order.

Brand	Sample Code	Explanation
B&M	D8E01	D=April, 8=1998, 2 year expiration
Campbells	USE BY date printed on can	All dates are 2 years after production
Del Monte	8209N	8 = 1998, 209 is Julian date, N is the plant. All canned products, 2 – 2.5 years.
Green Giant	8J	8 = 1998, A – L represent the months (A=Jan, L=Dec). Corn and Peas 3 years; Mushrooms 4 years; others 2 – 2.5 yrs.
Healthy Choice	81	8 = 1998, 1 – 9 = month, and ABC = Oct. – Dec. Soups, 2 years from manufacture date.
Mountain Home Dehydrated Meals	8163	8 = 1998, 163 = Julian date. 5 year shelf life for all dried meals.
Progresso Soups	J8H18	A – L = month, 8 = 1998, H = plant, 18 = day. 3 year shelf life, tomato products 2 years, due to acidity.
S&W Products	3528	3=1998, 5=May, 28=day. 3 years beans and fruit, 2 – 3 years tomatoes.
StarKist Tuna	X176G	176 is Julian date and G = 1998 (H=1999). 4 – 6 years from canning.
Tyson	2468	246 is Julian date, 8 = 1998. Canned Meats, 4 years.

Mormon Canneries Open to the Public

Few people know that the preparedness-oriented Church of Jesus Christ of Latter-Day Saints operates canneries around the nation as part of their internal welfare system. The canneries are open to the public on most days during the year. The canneries have a schedule for canning

certain products as they become available, and anyone can participate by simply paying the cost of materials. It is an interesting adventure. Most everything is done by volunteers so don't feel you will be out of place. There are jobs on a shift for everyone, and you get to take home what you order. They also have specialty items available such as oxygen absorbers. On certain schedules you can even dry pack your own wheat for long-term preservation. To locate the LDS cannery nearest you, call 1-800-453-3860 ext. 4164.

CLOTHING

Great progress has been made in clothing fibers during the past ten years. This is an area where little change had taken place since the beginning of earth's human history where feathers, wool, cotton, and linen fibers have served well for thousands of years.

Goose Down

Down feathers, especially goose or duck down, is the warmest material in the world. It is extremely light and lofts better than synfills (synthetic filament fibers). To get the best, buy "100 percent down;" otherwise, your bag could contain up to 20-percent poultry feathers. Fill-power refers to down's ability to loft. A bag with 700-fill is better (and more costly) than one with 550-fill.

Wool

Wool is an excellent insulator and does not pick up moisture as much as cotton. It will maintain much of its warming ability if you have a wicking layer of synthetic cloth next to the skin. Wool is very resistant to picking up odor. However, it is hard to care for and requires cold washing or dry cleaning to avoid warping and shrinking.

Cotton

Cotton is comfortable because of its softness. Its great liability is that it absorbs moisture and the odors that might come with that moisture. It has only mild resistance to abrasion. It is easy to wash and care for.

Linen And Silk

These natural fibers have little or no use in the preparedness context. Obviously in a time of shortage, if that is all you have to wear, do so. But these fabrics have little benefit other than beauty.

Modern Comfort Control using Clothing Fabrics

Modern outdoor clothing systems make it easy to prevent discomfort in every type of weather, from a breezy summer evening to a howling January blizzard. The newest fibers listed below are different types of lightweight, hollow, and synthetic designs that offer the best characteristics of wool and cotton combined. Some will even outperform goose down feathers in every environment. They are still expensive, but the performance is worth it if you are going to be in

extreme weather for any significant period of time. Their major disadvantage is odor absorption. Cotton absorbs odors but all synthetics *radiate odors* and must be cleaned regularly.

Generally speaking, we are comfortable when we are neither shivering nor sweating. This occurs when a successful balance is achieved between the heat our body produces and the heat it loses to the environment. We use our clothing to control heat balance. The biggest factor in heat control is *moisture control*.

The harder we exercise, the more heat and moisture we produce. Perspiring is the body's most efficient way of cooling itself when overheated. To prevent discomfort, clothing systems and footwear must breathe well enough to allow evaporative heat transfer (cooling) to take place.

Heat transfer is the primary element of discomfort and moisture is a large component of that transfer. Heat transfer through clothing is achieved through *evaporation, conduction, and convection*.

When clothing gets wet from perspiration trapped within, or from outside moisture, we experience the discomfort of accelerated heat loss caused by wet conductive heat transfer, which occurs 23 times faster than dry conductive transfer. Convective heat transfer is caused by the movement of air. The wind-chill we experience when a cold wind blows through a sweater is a good example of convective cooling.

Layered garments that can be easily removed and ventilated are among the most effective ways of achieving comfort, although the newest technology promises an integrated system of fabric layers that does it all.

Modern clothing systems consist of three basic layers which are used in a wide variety of combinations and thicknesses to control heat transfer and prevent discomfort. The *wicking layer* (base layer) is made from nonabsorbent synthetic fibers and is worn next to the skin. This layer protects the skin and facilitates the movement of moisture away from the skin. The *insulating layer* is worn over the wicking layer and can consist of a wide variety of insulating fibers and fabrics. Modern clothing systems often include synthetic insulators because, unlike many natural fibers, synthetics tend to retain much of their insulating ability when wet. They also wick better and may dry faster than natural insulation. The *weather protection layer*, usually called "outerwear," can be waterproof to prevent water from outside sources getting inside and to protect the insulating layers from the accumulation of moisture from internal sources. To prevent convective heat loss, the weather protection layer must be windproof.

Wicking Materials-Inner Layer Next to Skin

Wicking fabrics tend to move perspiration away from the source (you) to any place that is drier–preferably to the outside. However, in a cold environment, when exercising heavily, it is not unusual to find the outer garment soaked and the inner wicking layer comparatively dry. This is because unless it is warm enough for evaporation to take place, the upper layer is as far as water transport can go before colder temperatures slow it down. This saturation will eventually work backward, building water closer and closer to your skin. When that happens, you are going to get cold as soon as you stop exercising. The solution is to open up zippers and let the large portions of the moisture escape during heavy exercise so that it doesn't build up such large concentrations. Polypropolene is the most popular of the wicking fabrics. Wash these often as they pick up and hold body odor.

Warmth Fabrics – Mid Layer

Of the natural fabrics, wool is the best here. The synthetic fabrics of choice are the "fleece" fabrics. These fabrics are tightly woven meshes of microfibers that provide air entrapment, wicking, and high insulation properties while retaining light weight. Probably the best known is Polartec from Malden Mills, however there are several others such as Synchilla fleece and Capilene fleece. They all work well. These fleeces are far lower in maintenance than wool, they dry quicker, and provide wicking so that moisture wicked up by your base layer is moved away from you. Fleece garments don't shed water, however, so they require a shell of some sort. The only problem with fleece is that it is not durable and needs an outer shell to protect it. It also picks up odors if not washed frequently. An older mid layer insulation fabric is Thinsulate by the 3M, which continues to come up with new variations. Thinsulate is a blend of polyester and olefin and is a microfiber material that can often be found in some of the same types of garments as fleeces.

Insulating Fibers

Here is a description of the most modern fabrics in use. Look for these fibers on the labels of outdoor clothing and sleeping bags:

Hollofil is DuPont Dacron insulation popular in entry-level bags because it is among the more affordable insulators. *Hollofil II* is made of four-hole, coated fibers designed to trap air for warmth. *Hollofil 808* is made of single-hole hollow fibers and are warmer than solid-core polyester. Light in weight, the fibers also dry quickly.

Quallofil, also from DuPont, is a seven-hole, specially coated fiber designed to be soft, durable, and quick drying. Along with the Hollofils, it has been around for years and is more used in sleeping bags than any other synfill.

Microloft is DuPont's newest entry into the synfill wars. Five times thinner than a human hair, the insulating fibers are designed to retain warmth when wet. Ounce for ounce, Microloft is supposedly warmer than down.

Lite Loft is 3M Thinsulate's new synfill that uses heat, instead of resin, to bind two different sizes of fiber. The result is a lightweight insulation that lofts even when wet.

Primaloft is what Albany International calls "true synthetic down insulation." Designed for extreme wet weather, the synfill is designed to be light, warm, and highly compressible. *Primaloft PL2* is a newer and less expensive clone.

Polarguard HV from Hoechst Celanese is a second-generation synfill that is made as a continuous filament. A little bulkier to pack, it tends to hold up longer than other fibers.

Thinsulate Lite is perhaps the oldest and longest lasting synfill on the market. It is used in boots, gloves, and clothing.

Breathable Fabrics – Outer Layer

Breathability is the ability of a fabric to pass water vapor while blocking water. It does this usually by utilizing micro-pores (holes too small to allow liquid water in, but large enough to allow water vapor out). Microporous fabrics, such as *Gore-Tex*, work on a partial pressure

differential between the sides of the fabric. It must be more moist and warm inside the jacket than outside or it will not pass water vapor in the preferred direction. Rain or moisture on the surface tends to block the holes preventing some of its ability to carry away water vapor. The Gore-Tex layer is not wet, just the outer shell. The Gore-Tex treatment is actually sandwiched under the shell, that is, it is laminated to a base fabric, which is always treated with a water-repellent finish.

Lowe Alpine and Unitika Industries manufactures a fabric called *Triplepoint Ceramic* which uses two coatings to achieve the breathability. The first base layer is the microporous water repelling layer, and the second is a water attracting nonporous layer. A water repellent finish is then added on top.

After a good soaking, your breathable fabric does stop breathing to an extent. Tests showed that all fabrics lose an element of breathability in wet conditions. The various configurations of Gore-Tex lost between 34 and 43% of their breathability. Helly-Tech's decline was just short of 75%, but Lowe Alpine's Triple Point Ceramic 1200 lost just 15% of its breathability. Thus, none lose all their ability to breathe – just part of it. All breathable but waterproof fabrics rely heavily on the water-repellent outer finish to prevent the microporous layers from getting plugged by rain. You should replenish this water-repellent layer as it ages. Use spray-on commercial products such as Nikwax or “Scotchgard Water-Repellent for Outdoor Fabrics.” Just give a light spray to the outer shell – don’t try to soak it into the pores.

In addition to waterproof fabrics, there are windproof fabrics for use in outer shells. These may be the heavier pack-cloth, Cordura type of fabric, or the newer microfleeces which incorporate a windproof layer. The windproof microfleeces are some of the better fabrics for winter outdoors activities at sub-zero temperatures. They are highly breathable, very warm, and light. These garments often weigh less than half as much as a conventional winter garment and are less restrictive to movement. And, since they are highly breathable, much more so than any of the rain gear-oriented fabrics, you will not get as clammy wearing them when working hard. These garments can typically serve as a mid layer or an outer layer and as such are very versatile.

LATEST MILITARY GEAR

The second generation Extended Cold Weather Clothing System (ECWCS) is a head-to-toe cold weather clothing system capable of protecting soldiers between +40 degrees and -60 degrees Fahrenheit in fairly dry conditions. The Army claims it is an “extreme” weather system, but since it will not function well when soaking wet, I would not agree with the “extreme” classification. The ECWCS is a layered system adjustable to the metabolism of the soldier and the prevailing weather conditions. The layering sequence is as follows: polypropylene undershirt and long johns, polyester fiberpile shirt and bib overall, polyester batting coat and trouser liner, nylon/cotton sateen field trouser, nylon tri-laminate hooded parka and trousers in woodland camouflage, and appropriate headwear, handwear, and footwear. Snow camouflage over-whites may be worn.

PALS System

This is *the* system to have if you want to survive in the cold without any external source of heat, and even when wet. PALS stands for the Phillips Arctic Living System. Jim Phillips is a second generation student of cold weather living. He, in conjunction with his father, James G. (Gil) Phillips, Sr., developed this unique cold weather living system of clothing, equipment, and philosophy. Their system has been taught to and used by many thousands of individuals around the world. Their equipment has been to both the North Pole and the South Pole and has been used by world class expeditions. Jim's clothing has been credited with saving several lives. His clothing designs are now in use around the world by numerous corporations, special military units, expeditions, and individuals who need the *ultimate* in cold weather performance. Popular Science Magazine honored Jim with an award for the "Best of What's New, 1989's Greatest Achievements in Science and Technology" for his clothing technology.

In a nutshell, it is a combination wicking and insulation system that is totally integrated into *one layered fabric* – it is *not* a layered system of *separate* garments. It uses an inner wicking mesh fabric that is bonded to 1/2 inch of polyurethane open cell foam and covered with another wicking layer. Finally this unitized fabric/foam is placed within a breathable wind and water resistant shell of Gore-Tex type material. The system is used for coats, overalls, gloves, boots and hats – and it works like nothing I have ever seen. I have a set of these clothes and they are nothing short of amazing. The above Army "state of the art" system can't compare to this system in severe wet situations. The PALS system is so good that people who have fallen into ice water have been able to come out of the water and survive for days without changing clothes and without external heat. The PALS system simply keeps you warm as the suit slowly wicks the water out. I know of no other system that can do that.

That's the good news. The bad news is that this system is not presently commercially available. It used to be, but due to some financial problems not related to this system, the company which produced them is no longer in business. But Jim Phillips is now making this system available to the do-it-yourselfer in either *partial ready-made inner suits* or *pattern* and *material kits*. You can buy the PALS material already sewn together into two-piece suits (without the outer jacketing material) or you can order patterns and material kits to sew yourself. See the Recommended Equipment and Sources section for contact information. Either way you can purchase this super system for a fraction of the cost I paid for a ready made suit. I'd recommend getting the ready-made inner suits and then attaching them to a high quality Gore-Tex or other similar water/windproof outer shell. If you get a large-sized windbreaker outfit, it should make a perfect outer shell for the PALS system. You can do the same with gloves and boots by buying them oversized and using the PALS system as the inner lining. The PALS system is meant to be worn next to the skin, like a thick set of long johns. Most people feel more comfortable wearing some personal undergarment. If you do, buy one of the sets of polypropylene undershirt and long johns (thin wicking- type fabric) from a sports shop. There are many brands to choose from.

The ultimate application of these suits is two-fold: If you either have to spend a long time in an unheated home or you have to travel in a severe winter storm area with the possibility of being trapped without shelter, these suits will save your life. If you are trapped out in the open during extreme cold, you can sleep in these suits by simply laying down in the snow. I've tried it and it works.

COMMUNICATIONS EQUIPMENT

I have always suggested that each person or family desiring self-sufficiency prepares in conjunction with others who may be similarly motivated. Banding together for mutual assistance requires communication, and these friends become your prime sources for establishing branch communication networks, should conventional sources fail. Few are aware how rapidly telephone lines can be saturated in a crisis. Thus, a tight knit self-help group who lives within a mile or two of each other would be well to consider the installation of a small radio network. Develop some private codes so that you can say sensitive things with some degree of privacy.

For adequate communications flexibility under all situations, the preparedness home should have the following forms of reception and communication equipment, if you can afford them:

- Television set (for seeing and hearing establishment news sources. I don't recommend the political content, but sometimes during a crisis you can get some visual data on the severity).
- World Band Short Wave AM/FM/SSB receiver. While there may be future destruction communications within your nation or region, during the next war, the world-band short wave allows you to reach out and find out news from around the world, where communications might still be intact. Buy Grundig, Sony, Sanyo, or Sangean radios. Even their cheaper models (under $100) will outperform off-beat brands).
- Cellular telephone. Get a car phone, the type that has a separate or remote antenna system built in. Then extend the connection cable and mount the antenna in your attic. It will increase your cell phone range dramatically over a handheld unit.
- Scanning receiver for monitoring other frequencies nearby (fire, police, etc.).
- Ham radio multi-band transceiver: This is essential if you want to communicate long distance with your grown children. A license is necessary, but it is getting easier to get. The difficult Morse code requirement is being reduced to only 5 words per minute. Ham clubs have repeaters set up all over the country, which act as a sort of secondary cell telephone-like network. These repeaters allow even a small handheld portable to talk to another unit many miles away.
- Family band two way radios, portable. Use these as walkie-talkies around the house as necessary. They can reach out a couple of miles in open terrain with a little better antenna, so they are infinitely more usable than cheap walkie-talkies. No license required.
- CB Radio. It's hard to find an open frequency on these radios due to the volume of traffic, but they are the least expensive of all the serious radios on the market.
- A computer with Internet access.

Now that's a fair amount of communications equipment. Not everyone will need this much. But the first 3 are essential for everyone. You will need special antennas for every different radio you use. This is one of the most difficult things to arrange in setting up your communications. The specific equipment is too involved to discuss within the scope of this book, but the concepts

are important to cover. There are many specific books on the subject (see bibliography). One of the best resources in any location are your local ham radio operators. They know a lot about antennas, which will help you through one of the most technical aspects of this project.

Morse Code

One of the reasons Morse code is so important is because it allows you to send and receive signals that are too weak to hear if done in voice mode. Hearing a tiny beep is infinitely easier to decipher than voice messages. The code is not that difficult to learn with the help of ham radio operators and their tape-recorded lessons. You can even make up your own variations of the code to further secure your communications. UHF and VHF transmitters are necessary if you wish to communicate with aircraft, television stations, and local authorities. You may not be authorized to talk on the police frequencies, but if my life were in danger, I would certainly make a call for help (if the telephones were down).

Short Wave

Shortwave is really a misnomer. It is actually "long wave" radio since it uses frequencies that have very long wavelengths. This length of the electromagnetic wave allows it to travel long distances by bouncing off charged layers in the upper atmosphere (ionosphere). Shortwave reception is dependent upon the charged status of the ionosphere, which in turn is dependent upon the number and frequency of sun spots. The sun spot cycle varies every 11 years. It will be reaching a high point around the year 2000 so you can expect excellent transmission and reception abilities. In the low part of the cycle (next 2004-8) we can expect weak conditions to prevail. Short wavelength transmissions (like high frequency cell telephones use) just punch right through the ionosphere and don't bounce back to earth. That is why these radio signals are limited to "line-of-sight" (meaning, the signal can't bend around mountains or the curvature of the earth). FM radios are in this line-of-sight category as well. However, AM radio is in the longer wavelengths, which are reflected by the atmosphere. That is why you can hear strong stations halfway across the country on clear nights. The atmosphere reflects radio waves better after the sun sets.

Ham Radio

Amateur radio (called *Ham radio*) takes some study and training to get a license, but is invaluable if you desire to communicate with fellow members of your group in various parts of the United States or even the world. Ham operators are the only civilians allowed to use these long distance radio bands. Fortunately, anyone who qualifies can become one. A good, rotating antenna is necessary since you will want to send out a directional signal. Equipment is also available which permits you to tie your telephone into shortwave radios (called a phone patch). In a crisis, this will allow you to skip over an area that is telephone jammed into another area with a fellow "ham" who can get you a phone patch to anyone else you want. Most newer versions of ham radios have *duplexing* (separate frequencies for transmit and receive) capabilities like cell telephones, so that both people can talk and listen at the same time. With single frequency radios (family band) only one person can talk at a time.

Other Sophisticated Radio Gear

Within the ham bands you can send "packet" radio and television signals, and even communicate with satellites. There is also a growing market for scrambled or coded digital communication which you can integrate with your radio transmissions. Packet radio equipment is usually hooked up with a PC computer and there is software to automatically translate the codes or other signals.

Computers and the Internet

The Internet is becoming an essential part of the private communications network every family ought to have. Forget about the bad stuff on the Internet. Each family must get family members controlled enough to avoid these temptation in life. The bottom line is that despite increasing government control and monitoring, the free market is staying alive by communicating on the Internet. This is one form of communication that the government cannot seem to control yet. The private sector has developed not a few new encoding systems for sending messages on the Internet that the government cannot decipher.

The Internet has also become my main source of up-to-date, honest news. Because of the economic efficiencies of electronic news, the conservative minority view of the world can now find expression without having to compete head to head with the dollars of non-ideological advertisers (who shun anything but mainstream publications). No one should go without a daily look at WorldNetDaily.com or NewsMax.com – two of the hardest-hitting investigative Internet news groups in the country. Conservatives of liberty often feel isolated in life. One of the best ways to meet other like-minded people is to visit many of the numerous discussion groups and "chat rooms" on the Internet. You'll be surprised how many new friends you meet. You can find groups on gardening, sewing, preparedness, relocation, science, bicycles, auto mechanics, and cooking. Even if you have never operated a computer before, you can be up and on the Net with just a few hours of instructions. There are plenty of computer savvy friends and neighbors who would be happy to help. Highly recommended. Soon you'll be one of those discovering that the biggest problem on the Net is information overload – too much information and too little time to read it all. There is also a lot of misinformation on the Internet. You must not believe everything you read, especially on the Net.

A Note on Security from Government Snooping

More and more, government is trying to induce Americans to let them eavesdrop on all communications without a court order. They already do to a large extent – even without permission. But the free market keeps developing codes the government can't break. The latest tactics by government involve secret deals with big corporations like AT&T, INTEL, and others. The government has developed certain high power encryption devices and is offering them to telephone makers like AT&T. When these telephones are sold to the consumers as "security phones," buyers think they are getting military quality security. They are, with one exception. All these devices have "trap doors" built into the software so that government can snoop.

Intel built into their new Pentium III chip an encoded, numerical signature to help government track whose computer each message is coming from. The Internet exploded with protests and boycotts of Intel's new chip. Intel promised to turn the switch off, but nobody trusts Intel any

more – and for good reason. Don't buy any computer with an Intel chip except Pentium II and earlier. Some of the laptops with Pentium II had the snooper chip, so avoid those, too. Buy computers with AMD or other chips instead. Even Microsoft has betrayed its customers' privacy. They embedded an encoding scheme into Windows 98 that tags every Email and MS Word document with a code linked to the registered owner. If you have to use Windows 98 or 2000, don't register the software – this way the code won't be activated with your name on it. Also, don't buy any secure phone from the big telephone companies. Use regular or computer telephones that have privately generated encryption schemes. The Internet has many discussion groups about encryption. Check these out before you buy. This is the free market at work for your liberty. Support it wherever you can.

Pagers

These units should be a part of every house for alerting family members of danger, or simply calling them home for dinner. The newest pagers can even leave detailed messages. As we get closer to nuclear war, this technology might save your loved ones' lives if you have only a short time to round everyone up and get them to safety. Telephone lines may go down or be overloaded.

Telephones

Telephone communication is still a real necessity. With the advent of cellular phones, we have a much greater degree of mobility and safety. Many lives have been saved on the road by the numerous drivers with cell phones. Prices are plummeting, so almost anyone can afford the basic minimum service, which allows you 10 or 20 minutes free calling each month as well as access to 911 emergency services. Get a system that allows you to use your phone at least for emergencies even though you may be a long way from home.

It used to be that wireless telephones within your home were very insecure. There was a narrow band of frequencies allocated to these phones by the FCC and it was easy for local scanners to pick up any telephone calls in the neighborhood. Now, almost all new phones on the market are digitally encoded types within the 900 MHz band. The DSS encoding scheme makes these phones nearly impossible to eavesdrop on. Their prices are also falling rapidly. Here's what to look for in current technology. Almost all high quality phones come with these as standard features:

- Caller ID/Call Waiting
- Caller ID Memory/Log
- Flash (get a new dial tone)
- Hearing-aid Compatible
- Last-Number Redial
- Hold, Mute
- Digital encoding (DSS) 900 MHz
- Speakerphone
- Speed-dialing Memory

- Three-way Conference Calling

Binoculars

For compact binoculars I like the dovetailed prism type. The amount of clarity and magnification within a small package is astounding. ZEISS builds a very high quality prism binocular in rubber armor and has an attachment that turns your binoculars into a table microscope. However, there is no substitute for aperture and good optics. Buy a set of 7x50 standard adjustable focus binoculars to get real light-gathering power.

Telescopes

Probably the best portable refractor telescopes you can buy for tactical purposes are spotting scopes. These are small, rugged, versatile, and come in very high powers at a reasonable price. I am not including the celestial scopes of the reflector variety since they are not easily portable and need visual rectification to see right side up.

TRANSPORTATION

We need a variety of vehicles for preparedness.

- Small economical, gasoline vehicles for when fuel is expensive or being rationed
- Diesel vehicles to have another fuel option
- 4 Wheel Drive, off-road vehicles for getting around road blockages and rough terrain
- Trucks or large vans for hauling things
- Some form of alternate energy vehicle (pedal power, electric, bio-fuel) when fossil fuels are totally unavailable or too expensive.

We could even add to this list aircraft, motorcycles, and boats for various needs. Naturally, not everyone will need all of these vehicle types. However, I will discuss their uses and criteria below. First, automobiles will be grouped into two types: (1) hardy, economical, low maintenance vehicles that will keep you in transportation for a long time, and (2) all-wheel drive vehicles for bad weather and occasional off-road problems.

Group One Criteria – Automobiles for Street Endurance:

1. High efficiency engines with high reliability
2. Moderate power with good fuel economy
3. Rack and pinion steering (with hydraulic assist)
4. Disc brakes (at least on front)
5. Manual 4 or 5 speed transmission
6. Durable suspension
7. Orthopedic designed seats

8. Quality interior, exterior materials
9. Factory undercoating
10. High visibility seating height and glass
11. Small to medium size (relative to the type of vehicle)
12. High velocity natural ventilation system
13. Good parts availability
14. 20+ mpg city and 27+ mpg highway mileage

My best recommendation goes to the TOYOTA and HONDA line of cars. They have the best performance and maintenance records of all cars in the moderate price range. The Toyota Lexus has the best overall record, but it is too high a profile to match our preparedness criteria. For the best economy, the new engines by Honda will top everything on the market. Honda's new ZLEV engine burns fuel so clean, it is considered zero emissions. Installed in the new Civic, it will get 70 mpg. Look for Toyota to follow suit with a similarly performing vehicle as well.

Group Two Criteria – 4 Wheel Drive Automobiles:

Same criteria as above with the following added:

1. Full time 4 wheel drive with locking differentials
2. At least 8" of ground clearance
3. Turbo charged engine for power at altitude
4. Room for hauling limited amounts of people and equipment

The two best all-around 4WD road cars are the Audi Turbo Quattro Avant (station wagon) in the high price range and the Subaru Outback in the medium price range. The Audi Turbo Quattro is by far the best 4WD system on the market – rugged, reliable, and will go 300,000 miles with proper maintenance. The Subaru Outback has only 2/3 the performance of the Audi but it is about half the price. Both these cars will satisfy the Group 1 criteria as well.

In the larger sized 4WD vehicles (SUVs and vans), I recommend either the Chevy/GMC SUBURBAN or any of the 4WD extended length minivans from Ford, Chevy, or Chrysler. They all build good vehicles and will haul about twice what the Subaru or Audi Avant will handle. The reason I recommend the large and ponderous Suburbans is that they are the only ones with sufficient room to haul any sizable cargo. Get the long range tank option. They are also the strongest vehicle on the conventional market – can even push other cars out of the road to get by – don't try that with any of the minivans. The other SUVs are OK if you don't need to haul anything. Another downside of the shorter, smaller SUVs (excluding Suburban) is that they are top-heavy and tend to roll easily. All SUVs get relatively poor gas mileage.

Used Vehicles

Some of the best cars on the market are high quality older cars that have gone out of fashion, but that still have good reliability. Often they were not high volume sellers so there may be a lack of

spare parts – especially in some foreign models. Pick a used car that is highly reliable and which has been around long enough to ensure good availability of parts in auto junk yards. What my friends and I do is buy our own supply of parts by getting a partially wrecked car (same model) for parts. Certain luxury cars like all-wheel drive Audi Quattros are ideal for this method. Audi's 5000 model line of turbo-quattro vehicles from 1986-1989 were some of the best performing cars in the world during the eighties. They got a bad rap in the press due to phony charges about auto-acceleration, which was proven totally false. But it gave the car an undeserved bad name. The bottom line is that you can pick up these highly engineered cars for less than $3,000 in good running condition, which is less than any other used luxury car of this caliber. The drive train on the Audi will take you well over 200,000 miles and often above 300,000 miles before an overhaul.

Try to find the **5000 Turbo Quattros** for the optimum vehicle. The 5 cylinder Audi turbos are built like a tank, and will last and last. The down side is that Audi, like all German cars charge very high prices for parts, so these cars are best for the person who can learn to fix them and has the room to buy and store a couple of spare cars for parts. Bet sure and get on the Audi Quattro Internet list (**www.audifans.com**) so you can get how-to fix-it advise from over 1500 other Audi owners in the world. It's a great resource. Only the European cars which don't change much for 3 or 4 years at a time can offer the advantage of several years of parts compatibility. I firmly believe that the only safe resolution to the parts problem lies not in buying American necessarily, but by buying parts in advance or a spare car of the same model, whether European or American. Buying a spare, identical used car is not only a real parts bargain, but may provide you with additional gas purchasing power in the case of rationing (if you keep the vehicle licensed).

Another great used survival vehicle is the **Volkswagen Vanagon Syncros**. They are not in production anymore, but you can't find a more economical large van anywhere that has all wheel drive capability. The Vanagon waterboxer engine does have a problem with leaking head gaskets. But this is easily prevented by changing the anti-freeze every two years and by keeping a high quality radiator aluminum stop leak solution in the anti-freeze at all times. When a leak begins it won't get very far. Like the Audi Quattros, these are fantastic vehicles, but you don't want to have to go through the dealers for repairs or parts. Learn to fix them yourselves and buy spare vehicles for parts. There is also a website for Vanagon owners (www.vanagon.com). Everyone should plan on buying a good mechanics manual for the vehicles you have. Even if you don't know how to fix cars, you will have the book to help someone who may have the tools – but doesn't know your car.

Electric and Hybrid Vehicles

I feel that there is a high potential of serious fuel shortages in the future due to war. If this is the case, it would be a good strategic move to have an electric vehicle (EV) for short runs into town, so that you could save your stored fuel for long trips or emergencies. Electric cars and trucks have come a long way and are finally in production. Several car manufacturers are producing efficient commuter vehicles. Range is still the biggest drawback due to battery technology limitations. For the foreseeable future, I don't see any major breakthroughs that will significantly allow EV to move out of the commuter category to long range transportation.

Thus for current strategic planning, if an EV fits into your plans, I recommend you buy one of the numerous conversion kits on the market for existing vehicles. My preference is for one of

the VW Vanagon buses. These vehicles are large and rugged, but not heavy. They will haul a full ton of cargo, so they can handle large loads of batteries. But the real reason I prefer a van is so that you can mount as many square feet of solar panels on the sides and top as possible. This allows your vehicle to be recharging (partially) as you drive and when you are out parked in the sun. This addition of solar panels can sometimes make the difference between getting stranded and getting home those few extra miles. See the Recommended Equipment and Sources section for details. Also check the bibliography for books and magazines for EV enthusiasts. The Internet also has chat forums where EV owners share their experiences.

In 1999 the first of the hybrid vehicles are coming into production. These are a combination of the new super high efficiency diesel engines combined with an electric motor for cruising. The fuel engine only comes on for rapid acceleration and recharging of batteries. Thus, with a hybrid you have the best of both worlds. These hybrid vehicles have achieved over 80 mpg. If you have a choice, always buy the diesel engine for a hybrid vehicle. Diesel engines can burn biodiesel fuel and even soybean oil from the grocery store if you are really out of fuel. Toyota will probably be the first one on the market with a hybrid vehicle.

The big news in Germany is that Mercedes has an operational hydrogen fuel cell vehicle. This "engine" has the benefit of having hardly any moving parts. But the down side is low efficiency (both in the production of hydrogen from gasoline and in the fuel cell itself). We may see a working prototype soon, but I don't think it will be able to compare in cost to the proven hybrid technology.

Trucks

In pick-up trucks, I don't recommend any of the new bulbous designed modern trucks – they are all looks and too much money. Get used trucks that were built between 1990 and 1996. If you want older trucks without computerized ignitions, look for 4x4 Fords with the older FE V-8 engines. They are powerful, built tough and have efficient engines. For those with higher hauling needs, consider one of the 4WD, 2 ton Ford or Chevy trucks that have special custom dump beds built onto the rear. These can be outfitted with a small crane, ramps, and winches to make a terrific overland transport and getaway vehicle. They don't get good gas mileage, but you can haul a ton of fuel in the rear.

Snowmobiles

If your retreat is in high snow country, then you will undoubtedly need some snowmobiles, snowshoes, and a four-wheel drive pick-up truck and trailer to haul them around in. There are also a number of expensive tracked vehicles available as well. There are too many fine snowmobiles for me to mention, but look for ones that have moderate power, good mileage, long-range tanks and a short turning radius.

Motorcycles and Motorbikes

I expect that if gasoline becomes extremely expensive or unavailable (or both) the motorcycle and motorbike will become the standard transportation of the commuter. There is a lot of quality in the motorcycle market, so I will not make recommendations, other than to mention a few design points to watch out for. If you plan on traveling any distance regularly, vibration will

become your worst irritation as well as wind. I highly recommend the lower RPM, 4-cycle machines with drive shafts for road use (BMW or Motoguzzij for example). Two cycle machines have more vibration and are usually lower geared, which equates to high RPM and engine wear at highway speeds. I highly recommend the use of a windshield and protective head and footgear for highway use of a motorcycle. For mountainous travel, the lightweight, lower geared 2-cycle machines are better, but be sure to specify a low noise muffling system and spark arrestor.

Bicycles

Regardless of how many motorized vehicles you acquire, I recommend you have at least one mountain bicycle for each member of the family. A fast, high quality, lightweight, 10-speed road bicycle is excellent transportation for modern touring on good roads, but it won't be worth 10 miles of travel when roads become rough and broken up. Mountain bikes can be equipped with road tires and can haul a lot more weight than lightweight racing bikes. Make sure you have plenty of spare tires, inner tubes, and even spare rims in case one gets bent. Parents who may wish to ride a child in back should purchase a good bike seat for over the rear wheel or a bike trailer. The trailers are also useful for hauling groceries.

Electric Bikes

The newest and most promising form of economical and rugged transportation are the new breed of electric bikes. The best ones allow you to peddle or coast with the battery powering an electric motor which drives the wheel. Most manufacturers use a separate motor driving the rear wheel, but other more sophisticated types have electric motors built into the front wheel hub so that coasting downhill, the motor can act as a generator and help recharge the battery. See the Recommended Equipment and Sources section for recommendations.

Motor Homes

There are many self-sufficiency buffs who have chosen the motor home as their answer to a retreat. I have some reservations about this concept, though it is certainly a good concept for some families – at least while the road system is intact. One advantage is that they are totally self-contained and can take you long distances in home-like comfort. You can even pull off the road and have all the comforts of home – but not without a price. First, they are real fuel guzzlers. Get extra long range fuel tanks to compensate. Second, they aren't very maneuverable, and I don't know of any that have all-wheel drive. It would be pretty difficult to take one of these off-road. Third, for the price, most families could buy a lot of survival facilities, not to mention equipment. Fourth, they lack security under threat or attack, so it is important to get the vehicle to a safe and private location as expeditiously as possible. On the plus side, there will be several foreseeable circumstances in a less than total crisis when a large trailer or motor home could be very useful and fulfill a definite short-term survival purpose. If you can justify one from a regular vacation use standpoint, then it may serve you well in getting out of town quickly in better than average comfort. However, care should be taken in developing a strategy to avoid traffic problems. Having it stored in a rural location out of town, and using a motorcycle to get to it may be worth consideration. Be sure to mount a motorbike bumper on the rear so that you can take secondary transportation with you in case of break-down or a blocked roadway. Like any other vehicle, always bring tools and spare parts.

Other variations on the motor home theme are 5th-wheel trailers, mobile homes, and campers on the back of pick-ups. The options that don't involve towing a trailer will have the most maneuverability.

Airplanes

While definitely not a useful item for most people, I feel that for those who have the extra money, aircraft are a great piece of survival gear, as long as they are coupled with a series of secure fuel supplies and private landing strips. Those who would need an aircraft most are those who must live in the East and who must get far to the West for retreat. For most, the potential of mass clogging of roadways will make such a journey impossible. With an airplane taking off from a small private strip, coupled with prepositioned fuel supplies at other small strips along the way, this flight from danger could be achieved without confrontation. For others, an aircraft may allow you to relocate into a totally isolated region without roads, offering near perfect site selection as to security. Aircraft would allow an added surveillance ability for early warning of intrusion. Private air travel from unregulated airports or fields is also the least affected by traffic jams and improper law enforcement. There are many other advantages as well, but remember also, that small aircraft travel is far more affected by weather and terrain than land travel.

My general criteria for airplanes are: Long range tanks; short field take-off capability, high lift modified; beefed-up retractable landing gear; IFR, radar equipped; and a flexible passenger-cargo arrangement. Become a qualified mechanic of your aircraft (even if you lack a special license to do the work), and get lots of spare parts. I recommend the Robertson modified Cessna 206 as an all-around workhorse, even though it has fixed landing gear.

Helicopters

Small helicopters are not meant for long-range travel, but are superior to the airplane for landing in small areas and for slow-speed maneuverability. I prefer jet engines for helos, both for maintenance and for better performance. The preferred small jet helo is the Hughes 500. The best turbocharged, piston-driven helos are the Enstrom and the Robertson. The small "Rotorway" helicopters are an interesting low priced alternative for emergency transportation. Their big liabilities are limited range, tiny cargo capacity, and short engine longevity. But for a quick personal escape machine for the least price of any helicopter, this is the one.

Experimental Jets

Small business jets are normally out of the question for small survival operations due to their high landing speeds and long landing roll-outs that require long, paved runways. They also normally cost anywhere from $2 to $4 a mile to fly just for gas. However, there may be hope with the new engines coming out of Williams Research. These very small jet engines could provide the capability of producing a small, fast 2 or 4-place jet. One new design is using a normal-sized jet engine for cruise and adding a small Williams Research engine underneath it for taxiing and take-off power, and to act as a reserve engine. If it were not for the FAA multi-million dollar certification procedures, we could probably have one on the market for half the money in half the time.

Boats

Boats offer numerous possibilities for special survival situations. There are many people who live in cities or counties that are criss-crossed with rivers and lakes. A person living in St. Louis, Missouri, for example, is surrounded on all sides by rivers. If one has to get further west in a crisis and the roads are blocked, a small boat would be invaluable. Sometimes, it is enough simply to have a small 2-person inflatable raft in the trunk of a car of van. If you have a small, portable 12-volt trolling motor, you can use the car battery to power it back and forth across the river.

People who select an island for a retreat must have a boat not only to ensure that they can get to the island, but also to get off in case it becomes occupied. This is the prime liability of any island. The water barrier can either work for you or against you depending upon where you are relative to the threat and the water. If you ever have to take to a large open stretch of water to escape or evade some type of piracy or patrol, keep the following strategies in mind. If it is a short distance that can be crossed in a night, use a small, low profile boat and go at night. A motorized rubber dingy is almost invisible to radar. If it cannot be crossed in a night, try to use a fast speed boat. Cigarette boats, or their smaller brothers, will out-race and out-maneuver all large vessels except in heavy seas. If neither of these is an available option, try using a ruse, such as a special purpose fishing or exploration small craft. Sometimes in a coastal area, using a shallow draft boat and staying close to shore can keep you out of harm's way.

Ocean cruising or sailing boats make interesting survival platforms. The ocean is so large that it is easy to make oneself invisible for months at a time, especially if you avoid the major shipping lanes. An experienced crew, with a desalinator, alternate wind and solar power, and good fishing skills can live almost indefinitely on the sea. There are literally thousands of small islands and ports that can provide temporary havens from time to time. However, once discovered in a slow boat, the game is over – with the exception of those brave and hardy souls who can create ways to "disappear" temporarily until the danger is past.

For ultimate survival, you may someday find that you have to construct a boat. To cross a river, a log raft may do, but if you have to cross a fair distance across open water, consider a rudimentary ferro cement sailboat or large rowboat. The heavy weight of ferro cement is hardly noticeable in the water. Building the hull requires only chicken wire, sand and a few bags of cement. Sounds incredible but it is true. The technique is much easier than trying to carve out a dugout canoe, and is the easiest technique to use if you have to build a fairly large boat with hardly any wood, to accommodate several people or a lot of cargo. Keep a book on this subject in your library in case you need it – especially for you islanders. See bibliography.

TOOLS

Tools are absolutely indispensable in the residential survival context. I like to consider them as ways to increase your physical "leverage" against the myriad of do-it-yourself situations you will encounter in a crisis. The basic purpose of tools is to provide you with the ability to accomplish the following survival related operations:

- REPAIRS: Appliance, electronics, auto, machine, home, and furniture.

- CONSTRUCTION: Wood and metal fabrication (cutting, drilling, milling, grinding).
- TOOL-MAKING: Future moments will arise when you find you do not have a special tool required to do a technical repair. If you can't borrow one, most of these can be fabricated with modest tool making machinery – like grinders, drills and files.
- WELDING: Torch, arc, and spot.
- LIMITED PRODUCTION: When friends or clients need items that you can supply on a limited basis; you may find potential earning power through use of your tools.

I cannot emphasize enough how important it is to acquire high quality tools now while they are still available. Even if you are presently so busy with your profession or work that you do not have time to learn to use them, acquire them now so that they will be available when priorities change toward increased manual endeavors. Be sure to include the appropriate "how-to" books associated with wood, metal, and electrical tools so that you can gain the skills necessary to use them, even in isolation. In most cases, the basic machine is not enough to enable its use. There are literally thousands of jigs, parts, and attachments to wood and metal-working machinery that permit them to perform their various operations. The total cost of the hand tools, accessories, and small attachments will sometimes be as much as the main machinery itself. It is in this area of purchases that some knowledge of the use of equipment is necessary, with one exception. Perhaps the best way to ensure that you have the majority of equipment and accessories, as well as auxiliary hand tools, is to purchase a shop full of equipment "in total." If the shop is going out of business or is being sold due to an owner/operator's death, you can usually pick up the entire package at a mere fraction of its retail value.

A caution in this regard is to avoid a "heavy production" shop which would contain mostly 3-phase power machinery. It is nearly impossible to get 3-phase power in a residence without unacceptable expense. Additionally, you most likely will never need that size of machinery for residential use. Normally most of the machinery you will be looking for should be single phase 220 volt machines. These will fall into the 1-3 horsepower motor variety and provide all the power you will ever need in a residential survival situation.

For a general listing of tools you should have for preparedness, get a copy of my booklet, *Ten Packs For Survival*. In has storage lists for the 10 major aspects of preparedness.

The first rule of buying tools separately at retail or discount prices is *never buy a cheap tool*, if you can help it – especially hand tools. Sometimes there are exceptions. If you really can't afford quality and your primary use will be for emergencies only, then most often the cheaper tools will work just fine. You won't be worrying about longevity if you simply need to keep a tool in reserve. However, for any tool that must rely upon quality steel, like a screwdriver, a file or a set of drill bits, buy quality. A soft steel drill bit is like no bit at all when you need it. Besides, these small, high quality steel tools will not cost you a lot in total quantity anyway. If you really are low on cash, then save by buying the cheaper electric tools. They won't last forever, but if you don't use them much, you'll never notice. If you need a heavy duty tool that requires lots of power, like an electric rotary hammer drill, make sure the one you buy has the power to do the job. Most often the smaller, cheaper ones simply will not drill through the tough job you bought them for.

There are three primary grades of tools: homeowner's, professional, and industrial grades. I am disappointed at the low quality of the homeowner's grade. Even the "professional" or "contractor's" grade is being downgraded by the indiscriminate and purposeful deception of calling cheap tools by those names. A good catalog to obtain to give you an idea of what really qualifies as professional and industrial is the ROCKWELL catalog of "industrial machinery." Most of this equipment is applicable for home use. Obviously there are many manufacturers of sophisticated and specialized industrial machinery for mass-production purposes that are beyond the scope of this book. Five companies which offer a complete line of stationary wood and metal-working machinery in the professional and industrial line are MAKITA, ROCKWELL, DEWALT, MILWAUKEE and POWERMATIC. Each of these makes a cheaper line of tools also, which I do not recommend. Manufacturers of professional and industrial portable power tools are BOSCH, DAYTON, MILWAUKEE, ROCKWELL, CHICAGO PNEUMATIC, MAKITA, etc.

Price and Quality

In no other area is price such a reflection of quality as in tools, simply because there are few real shortcuts to making quality tools and machinery that are not already being employed by the best manufacturers. Aside from price, there are a few other details to look for in judging tools.

1. WEIGHT: Quality tools are built heavier, having more steel and less plastic or aluminum.
2. METAL FINISH: No cheap chrome facade, no rough, unmachined edges.
3. STEEL HARDNESS: Screwdrivers should be hard enough to dull a hacksaw blade. Avoid soft metal wrenches that are chrome plated. Hard metals and alloys will be forged and machined, not cast to get their final product. Stainless is great on areas that need to resist corrosion, but it doesn't make the best cutting edge.
4. ELECTRICAL QUALITY: Long, thick cords with three-pronged plugs and high amperage ratings on the motor. Scrutinize the words "heavy duty" or "commercial grade." Unless they meet the above criteria, they probably are falsely labeled. True commercial tools are not purchased at the hardware store or discount store anyway, and their quality and price obviously makes them a commercial grade.
5. BALL BEARINGS: Not plastic or alloy bushings.

Hand tool quality has seriously deteriorated within the past decade with the influx of Chinese tools. All of these are sold under American labels, so unless you look at the trademark ("made in China"), you can be deceived. Sears CRAFTSMAN wrenches are an excellent brand of hand tool, especially with their lifetime automatic replacement guarantee. Most tool manufacturers offer such lifetime warrantees, but it is still better to work with quality tools. They fit better and grab the nut or bolt better. Mechanic's tools require very high resistance to torsion pressures. Only the highest grade American or German tools should be purchased if you do serious mechanic's work. CRAFTSMAN, PROTO and SNAP-ON are the most respected names.

If you do decide to do any tool-making, you should look for some of the miniaturized milling machines and engine lathes. More and more brands are coming on the hobby market that have some serious capabilities, but that don't cost multiple thousands of dollars. Some are very

limited, however. Make sure the one you buy has the capability to do a full range of threads – SAE, NC, NF, and all the metric threads as well.

Storage Shipping Containers

Shipping containers are strong, weatherproof, lockable structures that can be used for long or short term storage, as long as you have a place to put them. They are not pretty, and would not fit into any suburban situation. They are 8 ft. wide by 8 ft. high by either 20 or 40 ft. long. The common steel units have 1-1/2 inch marine grade flooring. They will support about 55,000 pounds of weight. To get one that is weathertight is about $1,600 plus shipping (runs about $1.75/loaded mile delivery). Refrigerated containers are used to haul food and have air conditioning units on them (usually run by diesel fuel). They are lined with stainless steel and insulated to R-30 in the walls, floor, and ceiling and have a ribbed aluminum floor. They cost about $2,400 each (2000).

Chapter

18

Systems Integration

We have discussed numerous individual systems and types of equipment thus far. Now it is time to discuss how to integrate all the various functions and where to best locate them in the home structure.

MULTIPLE POWER SOURCES

One of the most perplexing things about contingency planning for a crisis is that it is no longer enough to prognosticate the future availability of energy sources. Many shortages are now caused by international intervention in supplies, bureaucratic bungling and regulation, or counterproductive taxation policies. Bureaucrats are nearly unpredictable as to their timing, which adds further complexity to the energy guessing game. One year a tax credit exists to promote one form of energy and another year they take it away. When capriciousness and pork-barrel politics rule rather than the consistency of free market law, you had better prepare for every conceivable contingency that your finances can afford. In the long term, we have a much bigger problem – that of a world of instability and government intrigue which will induce war and international depressions that will certainly affect energy supplies for many years to come. Only stockpiling and alternating renewable sources of energy will keep us from being victims of these destructive forces. The primary energy sources that your preparedness home ought to be able to adapt to or utilize are:

- SOLAR (passive for heating, active for electricity, and thermosiphon for water heating) and/or wind and water power if available.
- PUBLIC POWER: Whenever it is available and close to your house, it is worth hooking up to. It will save wear and tear on your alternative system.
- SOLID FUELS (wood, wood pellets, coal, dry waste material) for heating mostly and water heating when coupled with a water jacket on your furnace or wood stove.
- LIQUID FOSSIL FUEL (diesel oil, kerosene, gasoline) and gaseous fossil fuels (natural gas, propane) for space heating, water heating, and for vehicles and generators.

Other more-or-less exotic or scarce types are not practical except for the adept do-it-yourselfer:

- WASTE OIL (heaters have to have access to large quantities of waste oil).
- WASTE VEGETABLE OIL: With a small amount of petroleum-based additives, waste fry oil from fast food places can be turned into diesel fuel to run a vehicle. Home Power Magazine has the details on the experimental "Veggie Van."
- GEOTHERMAL is location-critical/dependent and is expensive to harness in most cases except for those having access to a hot spring for hydronic heating.
- SAWDUST furnaces are excellent but are dependent on a significant supply chain of sawdust which in turn is dependent upon the saw mills operating close to your area, truckers to haul the material, and large chutes and bins with automatic conveying equipment to get it to feed automatically to the furnace. For some who meet this criteria, it is an excellent, smokeless burning process, but for most it is out of the question.
- METHANE GENERATION from farm waste products is a high production operation not suited for suburban applications. Numerous animals and their waste products must be readily available for the benefits to outweigh the costs (including labor).
- ALCOHOL GENERATION is becoming more practicable. Small distillers are now coming on the market that offer excellent efficiency and production. You do have to have a cheap source of heat to make it cost effective.
- PRIVATE GAS WELLS: There are many private parcels of land in the US and Canada that have private natural gas wells on them. These are found in areas where oil and gas production are common and sometimes in areas where the commercial value of the wells has already been extracted. For example, in the old Pennsylvania oil fields, not a few residences have old wells on the property which still produce a few barrels of oil a day or have gas production. Arkansas, Texas, Oklahoma, and Colorado are among the many states that have land with private gas wells. This is a nice to have feature which can provide you with years of free energy – but don't let it be the driving factor in site selection. Keep in mind that it is only one component of the entire preparedness picture.

MASTER DESIGN LAYOUT

(See Systems Masterplan drawing.) This illustration depicts a sample implementation of almost all survival and self-sufficiency systems under one roof. The actual use of these systems would depend on your particular climates and needs, but the integration of all the suggested systems should give you a better idea of the total preparation concept. This is a conceptual house, not an actual planned structure.

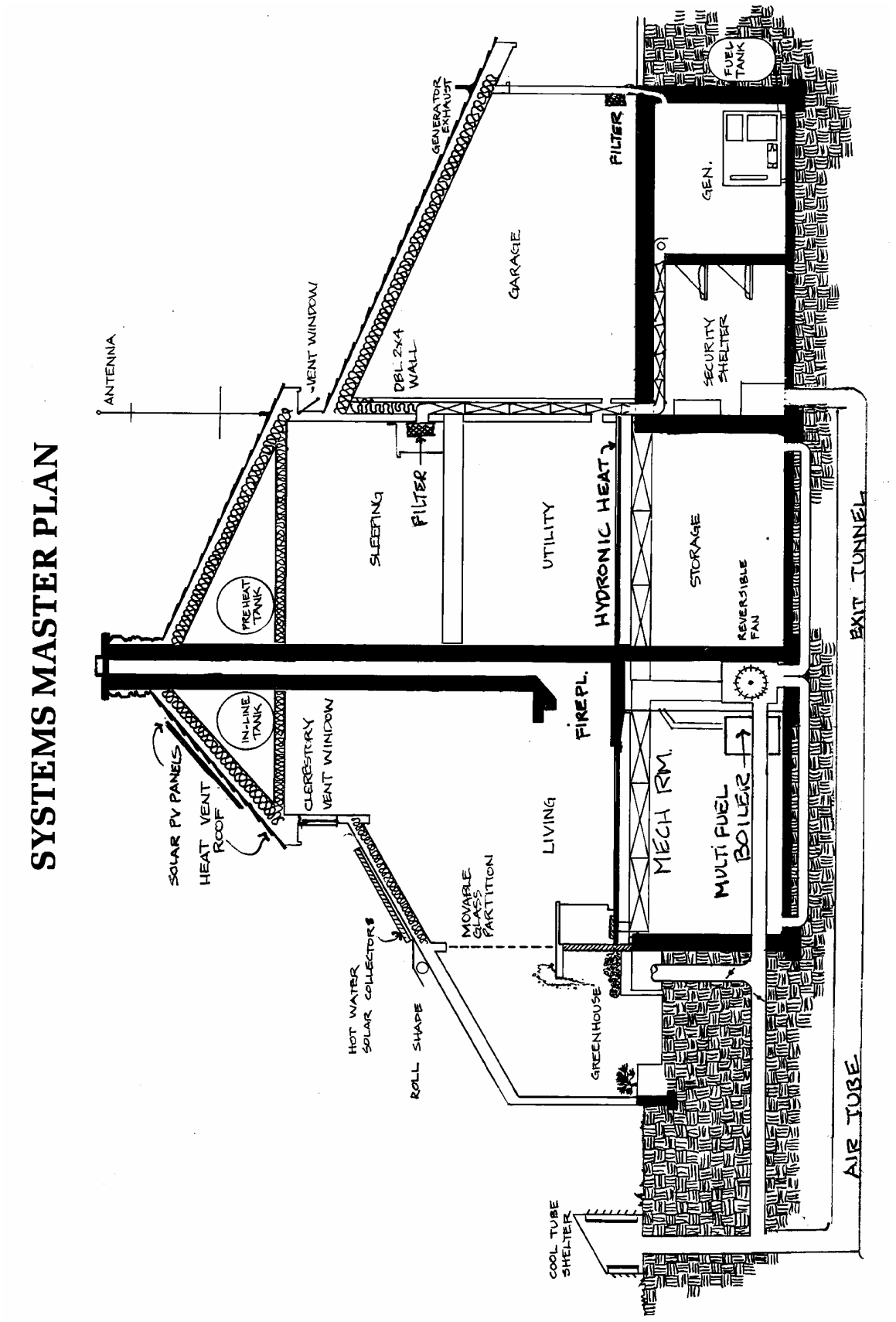
Vertical Integration

One of the most important features I look for when I consult on a plan is the ability of the home to provide vertical integration of connections, wiring, plumbing, chimneys, and private escape passages. Most people only look at floor plans and one room's relationship to another. Just as important are the vertical paths. Try to get **plumbing walls** to be stacked vertically to avoid complexity and expense. In most houses this involves two major plumbing stacks. This doesn't mean that one has to physically stack bathrooms on top of one another – only one wall of each bath is sufficient to be over another to link up the major plumbing drains. Even though this is an efficiency measure, don't make a design awkward just to align plumbing walls either. Plastic plumbing pipes are not very expensive, so if you can't stack the plumbing walls, it's not the end of the world.

I also like to integrate all the plumbing lines into one of the **new manifold systems**. These are limited to areas that allow polypropylene pipe (a special flexible gray pipe that doesn't break when it freezes). Like electric circuit breaker panels, the plumbing manifold allows you to shut off various plumbing lines from one central location – usually in the basement or laundry.

Look for the possibility of **stacking children's closet areas** over a master bedroom closet so as to be able to provide alternate escape routes when there might be intruders in the house. If your children are upstairs and you need everyone to get into the basement shelter, it is sometimes preferable to not have them use the main stairway or hallway. Use a trap door in the floor/ceiling of stacked closets that allows the children to get down to the parents' bedroom and then down into the basement from another trap door in the parents' room without having to transit the open parts of the house. These exits must be built so that they are fire-resistant.

In larger homes with multiple levels it is sometimes wise to install a **residential elevator**. They are not nearly as expensive as commercial elevators that have massive safety regulations and yearly inspections. Do check to make sure you don't live in a city that requires inspections of home elevators. There are significant fire codes involved since an elevator breaches the fire stops between one floor to another--but it's no different than a stairwell. Make sure you use a plain-looking closet door for the elevator door so that it is not conspicuous. These doors should be heavy duty with good electric locks so that no one can intercept your travel from upstairs down to the basement. In high security situations, it is even advisable to conceal the elevator completely. When you select one, check for those that operate silently.


SYSTEMS MASTER PLAN
ANTENNA
VENT WINDOW
GENERATOR EXHAUST
DBL. 2x4 WALL
GARAGE
FILTER
FUEL TANK
GEN.
SECURITY SHELTER
SLEEPING
FILTER
UTILITY
HYDRONIC HEAT
STORAGE
REVERSIBLE FAN
EXIT TUNNEL
PRE HEAT TANK
IN-LINE TANK
SOLAR PV PANELS
HEAT VENT ROOF
CLERESTORY VENT WINDOW
FIREPL.
LIVING
MECH RM.
MULTI FUEL BOILER
MOVABLE GLASS PARTITION
HOT WATER SOLAR COLLECTORS
ROLL SHADE
GREENHOUSE
AIR TUBE
COOL TUBE SHELTER

As we can also see from the Systems Master Plan, there are antennas, solar piping, solar wiring, shelter filter ducts, and chimneys that must all penetrate one or more floors. When you do your own design work, use tracing paper to lay one floor plan over another so that you can see and plan for these **vertical penetrations**, or "chases" as they are sometimes called. There are many inexpensive house design and planning computer programs to help you draw plans as well. These are called CAD systems (computer aided drafting). You won't want to buy an expensive engineering CAD program, which will take you months to learn how to use, but rather one of the residential design programs that are easier to learn.

When integrating vertical spaces for aesthetic reasons, try to envision the main living areas in 3 dimensions. If you can work out vertical spaces for light and ventilation through the use of vaulted ceilings, rooms tend to come alive and lose that boxed-in rigid look. Unique vertical spaces always add interest to living areas, especially when a great room is planned.

The Design Concept

The section drawing through the home (see "Systems Master Plan") demonstrates a couple of design goals. First, it is desirable to provide "buffer" rooms around the perimeter of much of the house to protect the core living areas from severe temperature differentials. I have accomplished this by designing a greenhouse and solar atrium on the south, and a garage on the north. Naturally, there are other factors that would influence the placement of the garage, but it is an ideal unheated buffer for shielding either a north wall from the cold, or a west wall from excessive heat in the summer. Second, you will note that the house is a multiple level design to utilize what would normally be wasted attic space and to facilitate the natural cooling airflow upward to eliminate heat buildup. Additionally, the added height allows for the placement of gravity flow water storage facilities in the attic areas.

The inner "sanctum" of the home (excluding buffer rooms such as greenhouses and garages) is built with superinsulated construction on three walls (all except the south solar wall). This insulation design will match most underground designs for energy conservation. However, this type of superinsulated construction should be used with caution. Using superinsulated designs is insulation overkill when used next to high-loss glass window units, or an uninsulated garage door, for example. For superinsulation wall systems to be cost effective, you must have windows no larger than 10-15% of wall area and/or be using insulating window coverings or low-E glazing.

Solar Design

The sample home is a passive solar design utilizing the greenhouse and solar atriums on the front for maximum heat gain during cold weather. The high clerestory windows have roof eaves designed to only allow sunlight entrance during late fall, winter, and early spring. The greenhouse has an external rolling sun shade to cut all heat gain during the summer, as well as sliding double glass partitions to block heat convection from entering the home directly. Excess heat is vented out the side walls. The short roof line further up from the greenhouse is an ideal placement for the solar hot water collectors to heat the

solar floors, which have hydronic heating coils in a 1-1/2 or 2 inch layer of cement. One or two domestic hot water solar collectors are also on this roof area. Since these collectors are lower than the raised storage tanks in the attic, thermosiphon techniques can be applied for circulation and storage of the heated water. The roof over the attic portion is built as a heat-venting, double-insulated structure to prevent excess heat gain in the summer and to prevent freezing of the tanks in the winter. The area between rafter insulation and sheathing is vented to the roof vent (obscured from view by the chimney), and the attic itself is separately vented at the side walls for the small amount of heat gain that would occur. This design ensures full temperature control in the upper bedrooms of the home. Excess heat can always be supplied from the greenhouse collector, if needed, and cool air from the passive air cooling system.

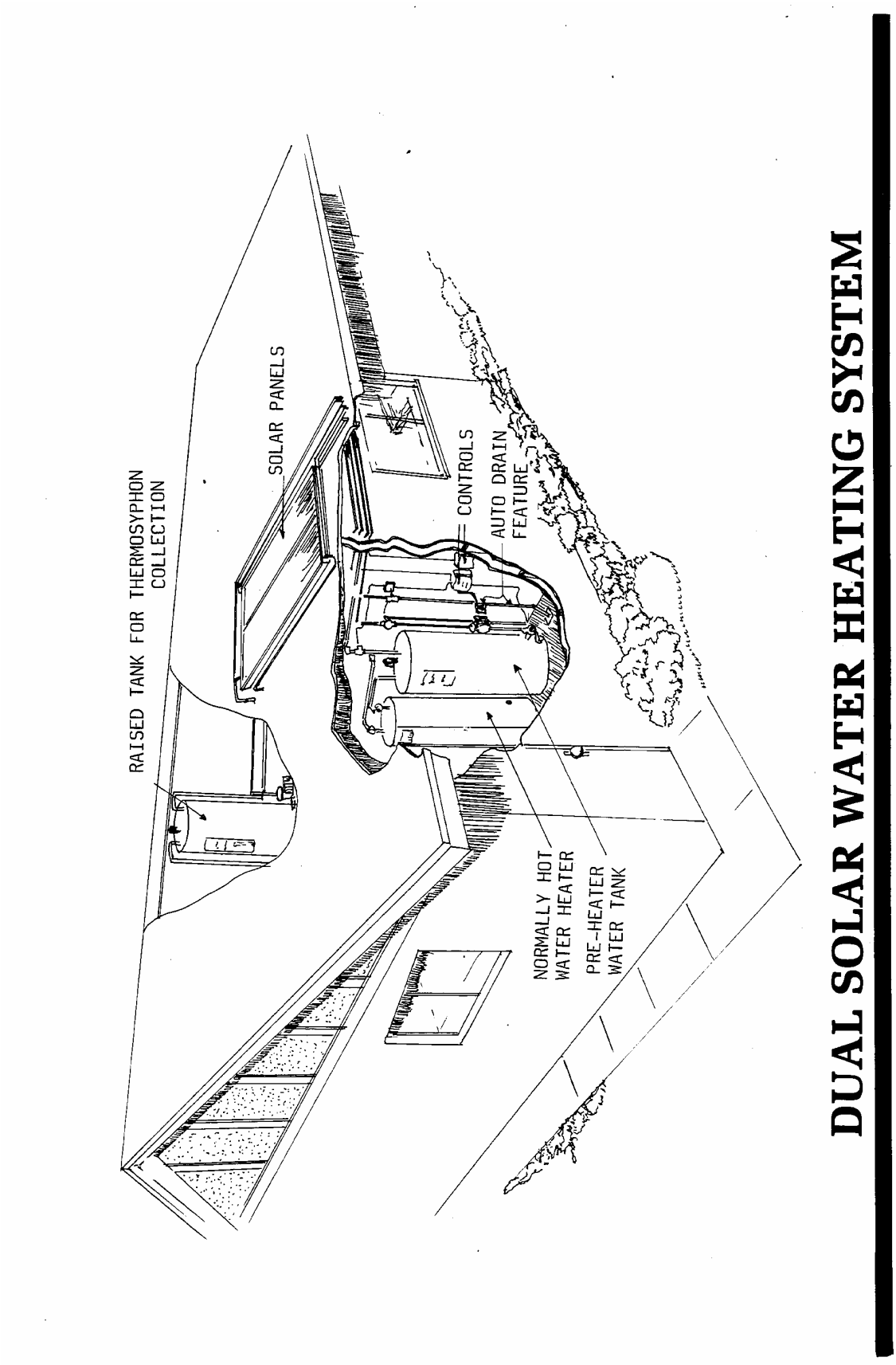
Domestic Hot Water

Some homes may or may not have attic space for a thermosiphon pre-heating tank in conjunction with a solar domestic hot water system. The following illustration shows a couple of ways to install domestic solar hot water in a low, truss roofed house. If there is enough room in the attic for a heater, the solar collector must be placed as low on the roof as possible. If the preheat goes in the house proper, install it side-by-side with the final water heater and provide a solar electric-driven pump to circulate the heat from collector to preheat tank or heat exchanger, whichever is used. Modern solar controls are very reliable. So, if powered by solar panels, they should be nearly as maintenance-free as a thermosiphon system.

Passive Cooling

The passive cooling system consists primarily of masses of thermal storage concrete in the fireplace and the basement foundation, and a series of cooling tubes to extract what excess heat may occur that is not dissipated by the heat sink connection to the subsoil. If we were to extend the masonry walls above the basement level, with heavy exterior insulation, the heat sink effect would cool the home completely except in tropical or desert climates where the nights never cool off. I prefer the use of thermal mass over the cool tube installations since concrete masses offer security protection as well. However, in climates where the ground surface never cools, one must resort to the utilization of subterranean coolness to obtain passive cooling effects. A labyrinth of cool tubes, or even a deep “cool room” to cool incoming air, is very effective. Make sure cool tubes are perforated, lie below the level of the basement floor, and slope away from the house to ensure that moisture condensing on the cool tube walls does not enter the home. Cool tubes and rooms in contact with a water table of cold spring water offer an inexhaustible heat sink. Some cellar constructions are purposely done over springs of flowing water to make use of the added moisture and coolness. Make sure cool tubes can be cleaned in case mildew or mold build-up.

The basement 3-speed air handler in this design can channel air from various sources, using its dampers and/or reversing the air flow. A duct leads to and from the greenhouse to either extract heated air for distribution to the back reaches of the home, or to add heat



DUAL SOLAR WATER HEATING SYSTEM

to the greenhouse in the winter. It has a damper to close off the air flow when we want to pull outside air into the cool tubes. Outside air inlet boxes should have furnace-type filters and screens inside to prevent insect and vermin entrance. They should be located in the shade of a tree, or in a small shaded stream bed where they can draw in a natural flow of stream conditioned air. Note that the air handler can pump air down into the rock storage under the slab for heat or cooling storage. These storage beds are much more economical than rock storage rooms since they perform a foundation function for the basement slab as well.

There is a new technology in semi-passive cooling that may be of interest. A new company has placed a water-absorbing coating on a fan system, called "Heat Wheels." When placed inside an air-to-air heat exchanger, the spinning wheels extract moisture from the incoming humid air and transfer it to the outgoing stale air. This has a drying effect in humid climates, and could provide some relief if combined with a cool tube system.

Multi-Fuel Heating

The multi-fuel boiler is next to the air handler and has a flue connected to the chimney system. The boiler provides final heat if necessary after the solar system has provided initial floor warming. Depending upon your fuel availability, I recommend a unit that burns wood or coal, and at least one fossil fuel such as natural gas, propane, or oil. Additional heat potential could be drawn from the generator in the shelter area. The easiest way to do this would be to tie the radiator system in with the hydronic floor system, so that generator heat could be distributed to the floors.

Shelter Systems

The shelter in this design is located under the garage slab. This maximizes the use of concrete, which serves as a radiation shield for the shelter and as a floor surface for the garage. Its wall surfaces align with one or more of the main floor walls for channeling security wiring (and antenna wiring up to the roof) with a minimum of bends. This is a very important design item. Often, since you may not be able to afford to install all this equipment when you first build, it is essential to install the wiring within this common vertical wall before covering it with sheetrock or paneling. Just for good measure, I always recommend that people install a couple of 2" electrical PVC conduits in this wall from attic to basement so as to make it easy to add wires later on. This is especially important on an insulated wall (such as the one between garage and house) where it would be very difficult to install wiring after the home was complete.

I have made several provisions for shelter filters in this concept. There is one filter system drawing air from the garage and another drawing air from inside the house. Filters should always be mounted inside a cabinet for concealment, unless placed in the attic where not visible. Even the cool tube duct, which acts as an air source of last resort for the shelter, should have some type of filter over the large hole. There are large commercial filters that can suit the purpose, or you can use several layers of furnace filters stacked together.

In this design I have integrated the shelter secondary exit to go out through the cool tube system. Using a cool tube system is one of the best ways to justify putting tunnels in the ground – especially if you can't do the work yourself in private. The cool tube vent housing above ground should look like a normal outdoor air conditioning unit (only hollow inside). It is hinged internally on a slab that has a large hole in the center. Thus, one can exit the cool tube, unlock the mechanical vent housing and tilt it back on the ground to exit.

Generator stacks are ideally hidden within the masonry of the chimney which we could do if the mechanical room had a sound-insulated portion for the generator. In this case a double-lined, metal tube conducts the exhaust through the garage wall to the roof, since the genset is under the garage. Special muffler silencing is needed for this type of exhaust design. I usually put the muffler down in the basement close to the generator.

FUEL STORAGE PLACEMENT

Fuel handling in a safe and private manner can be a problem, especially as scarcities arrive along with the natural resentment between the "have nots" versus the "haves." For longevity, security, and privacy, fuels of all types should be stored in covered or underground conditions where practical. Fossil fuels such as gasoline, fuel oil, diesel, and propane should be stored underground. Propane tanks should also be buried since they are extremely dangerous if someone decides to put a bullet into your tank. Most tanks are rented and are therefore controlled by the tank supplier. You should purchase your own tank when possible. Placing propane underground is advantageous in a very cold climate where propane tends to lose some of its delivery pressure due to the cold. Butane is even more sensitive to cold and is not recommended at all in really cold climates. Auxiliary heating units must then employed to boost the delivery temperature and pressure.

Going underground with gasoline and diesel storage tanks is normal and helps to preserve the fuel's octane value significantly, not being subjected to high heat. One may point to the disadvantage of having to pump the fuel from an underground tank. But in one sense, this is actually safer than gravity feed since a leaky or broken valve can otherwise cause a tank to empty itself onto the ground or into your basement. Special drains, leading to an outside collection area (not to the sewer), should be provided to prevent such flooding of a generator room should a major leak occur. The risk of a broken feedline from any underground tank can have dangerous legal consequences. I know one owner who had a whole tank of diesel leak out under his house due to a broken feed line leading to the oil furnace. His biggest problem was the EPA threatening to remove his house in order to make him clean up the spill. He made the mistake of calling his oil company about the problem, not realizing that they were required by the EPA to report any and all spills. Finally, in a rare moment of reasonableness, the EPA realized there was no way to recover the lost oil, so they spared the very expensive home. Make sure you have a 12 volt fuel pump with a good battery supply of power to extract the fuel from an underground tank.

Placement of tanks should be such that they can be filled by the bulk fuel supplier from a location within 40 feet of your access road or driveway. The tank also needs to be close enough to where you are going to fuel a vehicle so that the fuel can be drawn out without undue effort. Because of the potential of envy surrounding those who may have fuel and those who do not, you must not be seen fueling your vehicle from a tank out in the open. Provide for a fueling station inside a building.

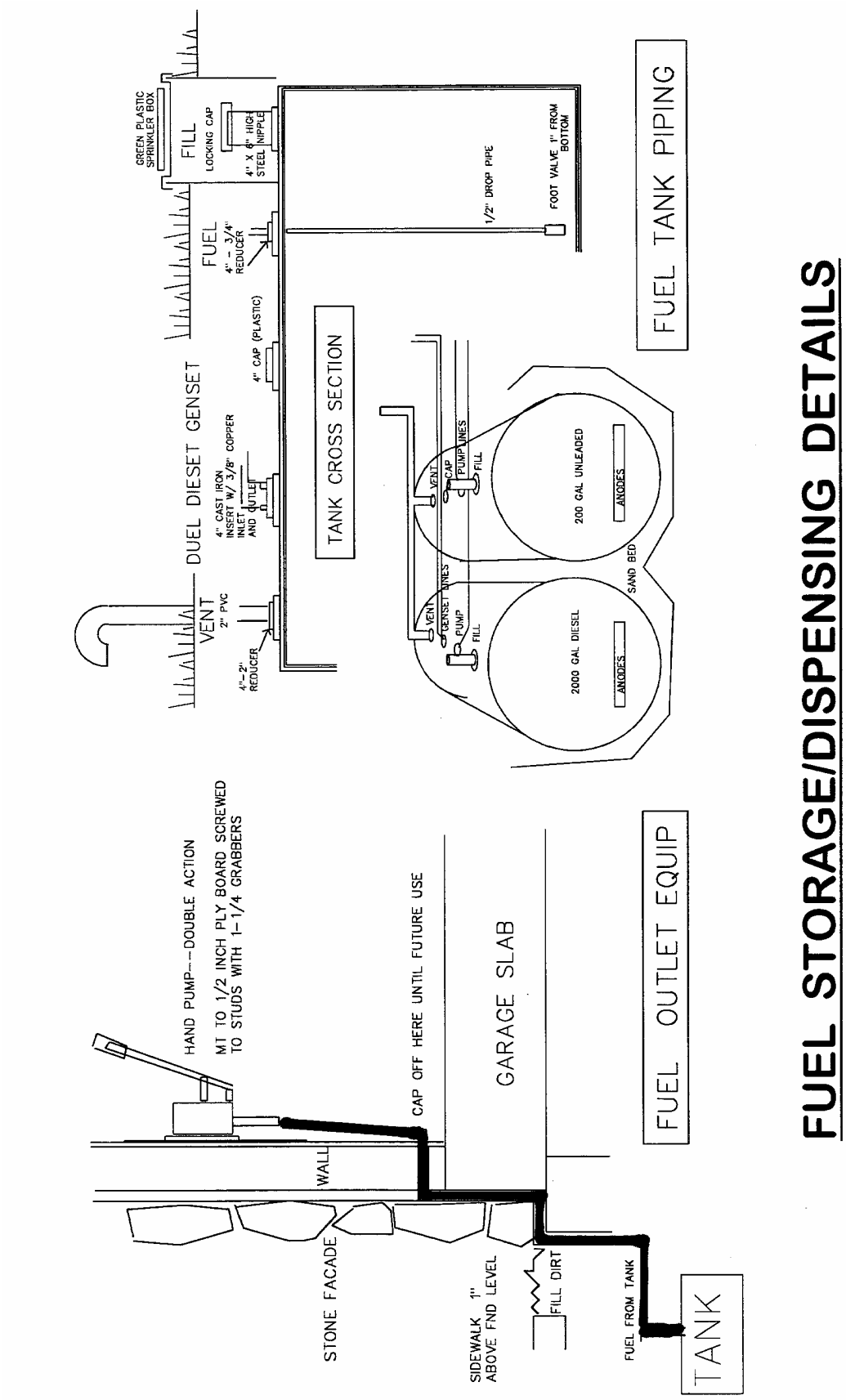
Our long-term problem relative to privacy of fuel storage is government regulation of fuel suppliers. Even now all fuel suppliers are required to keep records relative to EPA compliance on every tank they fill. Privacy is only as good as its weakest link, which will be the fuel company and its various drivers. One way to insulate your fuel supply from the fuel company is to have an above ground tank behind a shed. Privately install an EPA-approved underground tank nearby and fill it from the smaller above ground, farm-type tank. It may take several refills over several months to do this without suspicion, but at least you won't be on anyone's list. And if you have an EPA-approved underground tank, you won't be breaking any laws, either.

Make sure fuel filler necks on top of the tanks are heavy duty and have strong, lockable caps. For underground tanks, make sure vents are concealed by exiting through a building wall into the roof so they appear as plumbing vents. They should have "mushroom" type vent caps so that water and other substances cannot be introduced by vandals.

Installing Underground Fuel Tanks

In the following illustrations I show some details of underground tank installations. The 3-dimensional portion of the drawing (in the center) shows how to put two tanks together underground and interconnect the vent lines. One tank is for diesel fuel and the other for gasoline. They will each have a few different outlet fittings depending on use. The cutaway or section drawing above it shows some of these fittings. The two basic fittings for any commercial underground tanks are a filler pipe and a vent pipe. The basic holes in most tanks are huge – usually 4 inch round threaded pipe fittings. So the first thing you must do is get some reducing bushings from your tank supplier. The maximum-sized pipe you will use for fill and vent are 2-inch pipe, so for these openings you will want a 4x2 reducing bushing – which means you will reduce the threaded opening from 4 inch to 2 inches. Normal tanks have anywhere from 4 to 6 of these big 4 inch openings, so you will have to buy a few threaded plugs for the ones you don't use.

Other fittings will also include a drop pipe for extracting the fuel. Underground tanks don't have any openings at the bottom of the tank, only at the top. Thus, we have to send a pipe to the bottom of the tank to extract the fuels. Once you have your top bushings screwed into the holes, send a tape measure to the bottom of the tank and take a careful measurement. Take an inch off that measurement and now you know how long a pipe to cut and thread for this drop tube. You will also have to take off a little more length so that a foot valve can be threaded on the bottom. A foot valve is a one-way valve to keep fuel from draining back into the tank once pumped upward with your pump. This makes it easier for your hand or electric pump to start the pumping process each time (not having


FUEL STORAGE/DISPENSING DETAILS
FUEL TANK PIPING
TANK CROSS SECTION
FUEL OUTLET EQUIP
GARAGE SLAB
TANK
GREEN PLASTIC SPRINKLER BOX
FILL
LOCKING CAP
4" X 6" HIGH STEEL NIPPLE
FUEL
4" - 3/4" REDUCER
1/2" DROP PIPE
FOOT VALVE 1" FROM BOTTOM
DUEL DIESET GENSET
4" CAP (PLASTIC)
4" CAST IRON INSERT W/ 3/8" COPPER INLET AND OUTLET
VENT
2" PVC
4"-2" REDUCER
GENSET LINES
PUMP
FILL
VENT
CAP
PUMP LINES
FILL
200 GAL UNLEADED
ANODES
2000 GAL DIESEL
ANODES
SAND BED
HAND PUMP---DOUBLE ACTION
MT TO 1/2 INCH PLY BOARD SCREWED TO STUDS WITH 1-1/4 GRABBERS
CAP OFF HERE UNTIL FUTURE USE
WALL
STONE FACADE
SIDEWALK 1" ABOVE FND LEVEL
FILL DIRT
FUEL FROM TANK

to pump the fuel all the way from the bottom of the tank). Another fitting would be a dual-line generator connection. Diesel generators have fuel pumps which return unused fuel to the tank and so you must provide not only a withdrawal line but a return line. Your tank supplier will have these special fittings to accommodate the two lines. The fitting has two 1/2" threaded holes in it (side by side) instead of one.

The drawing shows how to pipe the fuel supply into a fueling location, staying close and tight to foundation and walls so that the pipe will not be visible from the outside. This is important so that you can refuel your vehicle within the safety and privacy of an enclosed shed or detached garage rather than out in the open.

In the following portions of this book section, I will go through all of the major systems and equipment that operate the secure home. Remember, that the names and addresses of recommended suppliers and sources for products are listed in the Recommended Equipment and Sources section. Only some of the names listed in the equipment recommendations will be mentioned in the text.

ALTERNATE ENERGY AND BIOLOGICAL WASTES

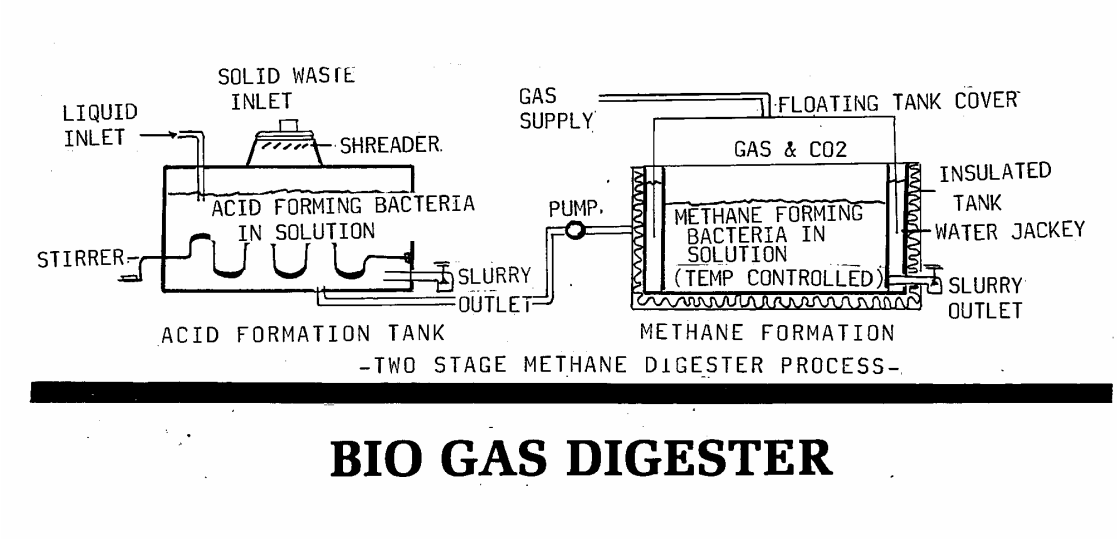
Methane Digesters

My only purpose in briefly discussing methane digesters is to give you a feeling for their potential utility in your particular situation. The design and construction of digesters is fairly technical and would not be sufficiently useful to the majority of my clients to justify the space to cover it properly. The two major limiting factors when utilizing digesters are first, the need to produce large amounts of bacteria-laden waste (such as vegetable or animal waste) and second, the delicate chemical bacterial balance which must be maintained at some expense in time for the owner/operator.

Unless you are a full-time homesteader, farmer, or rancher (or feed-lot operator) it is my opinion that you could not produce a quantity of gas sufficient to justify the time and expense. It takes a minimum of approximately 100 chickens, 5 cows or horses, 20 pigs, or a small herd of goats or sheep kept in near confinement to supply enough waste to operate a digester capable of supplying even 25% of your gas needs.

The basic process of methane generation is as follows (see illustration). Production of methane gas is essentially a dual-stage process occurring in an anaerobic (meaning without oxygen) environment. In the first stage, complex organic matter (manure, feces, compost, etc.) is broken down by a group of bacteria known as the "acid formers" into volatile acids and simple compounds – for the most part, fatty acids. The second stage can not occur until the first stage is complete. A single tank digester can do double duty, but all organic matter has to be processed before new material is ingested. Double tank systems can develop a "continuous process" since both stages can go on simultaneously in their separated compartments. This adds a lot to the expense and complexity of the system. The second stage of digestion actually produces the methane and is the most sensitive to imbalance and mismanagement. It is here that the major volatile acids (acetic acid and propionic acid) are converted by the "methane forming" bacteria into gaseous

carbon dioxide and methane. The bacteria types involved are very sensitive to even small amounts of oxygen, and will not function properly except in a strict anaerobic atmosphere. To further complicate things, several different types of bacteria are needed to break down different organic matter from whatever type of waste you have put in the digester. Careless errors of management can shut down your digester for days.



BIO GAS DIGESTER

Alcohol Distillation

This technology is mentioned as a private means to produce limited quantities of vehicle fuel. Alcohol distillation is most easily done by the fermentation of grains. The grains are cooked and then enzymes are added to break down the carbohydrates into sugars, which then ferment with the assistance of alcohol-producing bacteria. The end result is a concentration of 5-10% ethyl alcohol. The hard part is separating out the alcohol by distillation. There are 4 or 5 different processes and all are fairly sophisticated and take considerable heat energy. The basic problem is that it takes multiple trips through a distillation process to get pure alcohol. It is a well-established commercial process controlled mostly by the giant agricultural companies (subsidized by the taxpayers) who sell it for fuel to be mixed with gasoline. But it is a difficult process to miniaturize and make economical for the small farmer or homeowner. There are numerous inventors working on producing a reasonably-priced small still. If you have access to a lot of excess silage or grain for alcohol distillation, this could provide you with a small income in a *fuel-starved* world. Naturally, if the world is *food-starved,* as well, it would hardly pay to change grain into alcohol.

Chapter

19

The Master Electrical System

Now that we have discussed the essential equipment necessary to operate a preparedness home, we need to know how to integrate these into the electrical system. Let me first give you an overview of the integration problem we are looking at. These are the system's possibilities:

1. Normal 110 volt household wiring, 20-40 of the 20 amp branch circuits.
2. Five to six of the 220 volt utility circuits for high-draw shop, laundry, and kitchen items.
3. Low voltage controls for lights, master shutter controls, and master door locking system.
4. Low voltage security, intercom, and fire warning system.
5. Exterior floodlight control system.
6. Generator interconnect through a transfer switch or through the inverter.
7. Inverter tie-in with main electrical panel, essential panel, and battery bank.
8. Solar panel tie-in with the DC control Panel.
9. Separate 12 or 24 volt system for emergency lighting.
10. EMP/lightning protection for the entire electrical system.

In all frankness, the preparedness home electrical system will cost three times what a normal house wiring system will cost, if we install all these options. I'm sure you can imagine why. You do not, however, have to implement all these options to have some alternative energy. There are many lesser options that are not as convenient, but will do the job if you supply the connections and operate the units manually.

For example we can have several small stand-alone systems that are not all interconnected. A small portable generator, a small solar system and battery bank, etc. These can be connected to different appliances with extension cords or temporary surface wiring. This is not ideal, but in short-term emergencies, they will do the job and get you through.

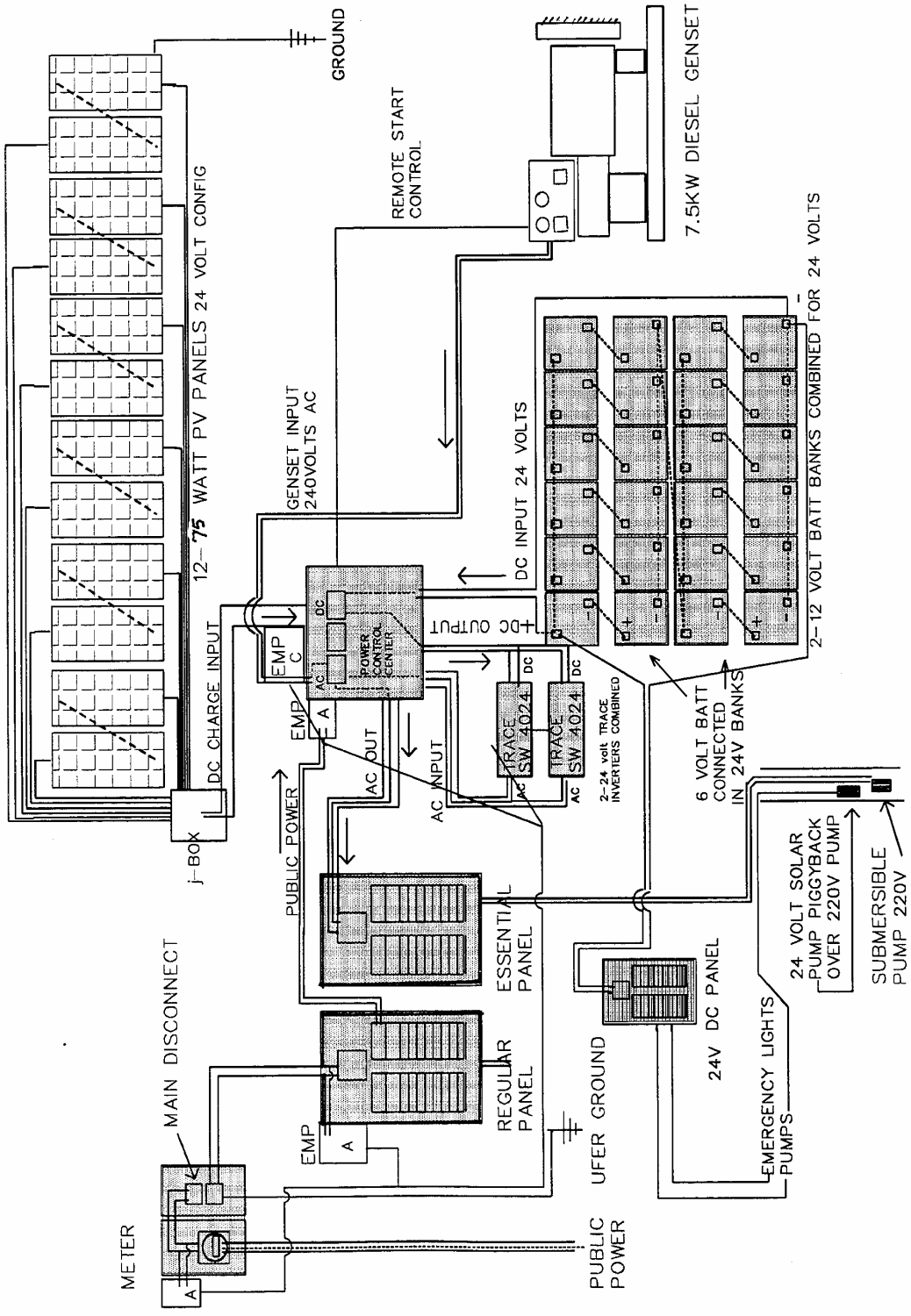
However, what I will concentrate on here is the fully integrated systems approach. Since it is cheaper to wire the house for some or all of these options while we still have access to the open framing during construction, I prefer to do so. The equipment can be installed later on when you can afford it. But trying to add these systems after the home is closed up and completed is more costly and intrusive. Almost always, you will have to tear into the walls to install the wiring.

The type of integrated home we are talking about is a true "working" home. You don't just *live* in its shelter, you *monitor and operate* the home like a machine – which is rather enjoyable. Most clients who can afford the full set of options and equipment enjoy the low voltage controls best. With one button they can raise or lower all shutters. With another, lock or unlock all doors. Closing and locking the house for the night is not an arduous chore. When ready for bed, or when leaving, all lights can be turned off with a single switch. Even without any expensive computer controls, low voltage systems can be programmed to open all shutters and unlock all doors when the fire alarm goes off, or they can shut everything down when an intrusion alarm occurs. Frankly, I don't like much of what I see in home automation. I like lots of electronic control, but I prefer to use my own mental "computer" to make the actual choices. The human mind is very reliable and isn't subject to power outages and EMP.

SYSTEM OVERVIEW OF ALTERNATE ELECTRICAL COMPONENTS

Refer to the illustration entitled, *Alternate Energy Electrical Schematic.*

This is a composite block diagram of a fully integrated alternate energy system with several different sources of power (including public utilities) all interconnected. The Solar/Battery/Inverter system is wired for 24 volts to match the more powerful Trace inverters available as well as to keep voltage losses down to a minimum. Thus, the 12 volt **PV solar panels** at the top of the drawing are wired together in groups of two to double the voltage. Rather than lead all the numerous wires from each panel down to the basement, we will combine them all together in the attic with a combiner box – an approved electrical box with multiple connections for joining the positive and negative leads into two terminals. From there we will only need two larger wires to go down to the main DC power control panel. For most homes a set of #2 awg stranded copper wires will be sufficient to carry the load of twelve 75 watt solar panels at 24 volts.


ALTERNATE ENERGY ELECTRICAL SCHEMATIC
GROUND
REMOTE START CONTROL
7.5KW DIESEL GENSET
12-75 WATT PV PANELS 24 VOLT CONFIG
GENSET INPUT 240VOLTS AC
DC INPUT 24 VOLTS
2-12 VOLT BATT BANKS COMBINED FOR 24 VOLTS
DC CHARGE INPUT
j-BOX
EMP C
EMP A
POWER CONTROL CENTER
+DC OUTPUT
AC OUT
AC INPUT
TRACE SW 4024
TRACE SW 4024
2-24 volt TRACE INVERTERS COMBINED
6 VOLT BATT CONNECTED IN 24V BANKS
PUBLIC POWER
ESSENTIAL PANEL
REGULAR PANEL
MAIN DISCONNECT
METER
UFER GROUND
24V DC PANEL
EMERGENCY LIGHTS
PUMPS
24 VOLT SOLAR PUMP PIGGYBACK OVER 220V PUMP
SUBMERSIBLE PUMP 220V
PUBLIC POWER

The **DC control panel** ("Power Control Center") in the upper center of the drawing is the main interface between the 110 volt and 24 volt components. This control panel will not actually do any switching between the public utility power and the alternate power systems – that is the inverter's job. But it will provide several key safety and monitoring provisions:

- Safety and fuse disconnects (to keep short circuits from causing a fire)
- Meters to monitor solar input, and battery output voltage and current
- Charge controlling of the solar energy to the battery bank
- Circuit breakers for AC inputs to the inverter

To the left and right of this control panel are the two main sources of input power: **Public Utility Power** and the **Engine Driven Generator** (7.5 KW diesel). Both feed power through EMP protectors and regular circuit breakers and finally connect to the dual Trace brand **inverters** below. Let's discuss each as a separate element first.
illustration: Alternate Electrical Schematic

Public Power

Public power enters at 220 volts from the utility meter on the outside of your home. I have added a shunt type of **EMP protector** on the incoming power line. In case of a high voltage or current surge, the surge will be shunted to ground and not go into the home electrical system. Once inside the house, the electrical circuits must be divided into two different circuit breaker panels. Most homes have only one panel. The problem with alternate energy systems is that we don't usually have enough power from alternative sources to operate all normal house appliances or equipment. If we had a huge generator, capable of putting out 200 amps, we could keep everything in one panel, though that would be very uneconomical in terms of fuel usage. With a battery bank and inverter system, we are limited to a total output (as of this writing) of 60 amps from a dual inverter system and 30 amps from a single inverter systems. In order to accommodate this limitation, we pull off what we consider the *essential electrical circuits* and put them in a separate "**Essential Panel**" that we can power up with the alternative system.

In general, we put all the high-draw 220 volt circuits on the regular electric panel, as well as some heavy-draw 110 volt appliances like conventional refrigerators. Large refrigerators often run for six hours at a time, which puts a heavy load or drain on a battery system. If we put a refrigerator on the essential panel, it must be one of the high efficiency models that use much less electricity, and which are much smaller in total storage capacity. When the electrician designs the wiring layout of the house, he normally does so solely to keep wiring runs as short and efficient as possible. But in this case, we need to instruct him to do it differently. We want to make sure essential and non-essential electrical items are <u>not</u> interconnected.

110 Volt Wiring

Instead of mixing wall plugs and lights on the same circuits, I prefer that all 110 volt plugs, except the refrigerator, freezer, and outdoor GFI plugs, be on the essential panel.

Even though this could allow much more than 60 amps to flow through the essential circuits, we will use our human computer to limit how much we plug into the system. I prefer the convenience of knowing that I can get alternate 110 volt power from almost every wall plug in the house. I can even run some 110 volt lights by plugging them into wall plugs, if desired. Thus, all the 110 volt permanent light fixtures are wired separately from the plugs and go on the regular non-essential panel. For emergency lights, I always prefer 12 or 24 volt fluorescent lights hooked directly to the battery bank via a small DC subpanel with DC circuit breakers (regular Square D brand AC circuit breakers are also rated for DC). I have designed homes where all the lights operate through the inverter. These houses use much much more stored energy from the battery – not only because running AC incandescent lights through an inverter is less efficient, but also because there is no incentive to conserve – every normal light in the house is available for use during a crisis. With DC fluorescents, the household uses a different type of lighting, which reminds everyone that they are on alternative power. The lighting is minimal and area specific rather than generalized and bright.

If we have a low voltage control system for lighting, we have to decide how to separate which low voltage control modules go on which panel. The goal is to keep as many loads off the essential panel as possible to keep from exceeding the 60 amp limit. That's one reason why I prefer to wire DC lights separately even with a low voltage control system for 110 volt lights. Low voltage control is not an energy conservation system, but a means of controlling large numbers of lights remotely.

The 60 amp limit is really a problem if we aren't careful. The only 110 volt lights we really want to power from the inverter/battery bank are the external security lights. If we have low voltage control of electric door locks and electric rolling shutters, I definitely want them on the essential panel. We want to be sure to be able to actuate these in an emergency. However, depending on how many shutters you have, running all the shutter motors simultaneously may exceed the 60 amp capacity, so you may have to wire only the main level shutters for actuation on emergency power as a group (with a master switch). Then the upper floor shutters could be activated manually. In terms of wiring the low voltage panels, it means powering up only some of the modules by the essential panel. Each module handles 6-8 lighting circuits. Thus, we can place all essential lighting and shutter/door locking circuits on one or two modules. The rest of the lighting modules will be powered off the regular panel, and will not have power except when utility power is available or the generator is running. Here is a sample list of recommended circuits for each of the two AC panels:

Regular Circuit Breaker Panel: (Always located outside the shelter, preferably nearby in the basement)

- All 220 volt circuits such as dryers, water heaters, electric range.
- Refrigerators, freezers.
- Shop equipment like welders, motors over 1.5 hp.
- Air conditioning.
- Heat pumps and electric resistant heaters.

- All 110 volt light fixtures, except outdoor security lighting.
- 60 amp 220 volt breaker to interconnect to the inverter

Essential Circuit Breaker Panel: (located next to main panel just outside of shelter)

- 220 volt well pump (requires dual inverters for feed and transfer switch).
- 110 volt well pump (requires only one inverter for feed and transfer switch).
- All house wall plugs except for refrigerators, freezers, and outdoor GFI plugs.
- Security system and intercom.
- Furnace fan (if conventional furnace).
- Wood stove fan (if any).
- Circulation pumps on a boiler system (if installed).
- Low voltage control modules (if any) for shutters, door locks, and outside security lights.

12 or 24 Volt DC Circuit Breaker Panel: (always locate inside shelter – occupants must have absolute control of these circuit breakers)

- All 12 or 24 volt emergency lighting, six fixtures per circuit
- All shelter lighting, six fixtures per circuit
- All shelter 12 or 24 volt fans
- Any other direct 12 or 24 volt wiring to specialty appliances

Engine-Driven Generator

For high security houses, I like to place the generator in a basement security room that is soundproofed and ventilated as needed. If outside and above ground, put it in a concrete block house building with a steel door to protect it from tampering. This unit will be a permanent stand-by unit, hard wired into the house electrical system. It will be circuit breaker-protected through the main DC/AC control panel and then connected to the inverter. For most homes this generator should be sized between 8 and 12 KW. This will allow it to charge batteries and run all items on the essential panel as well. If you do not have an inverter system, use a manual or automatic transfer switch to connect the generator power directly to the essential panel. You can still have a 12 or 24 volt battery bank without an inverter. Just connect a 110 volt charger to the batteries and energize it through the essential panel. Whenever the generator is running, the battery charger will charge up the batteries so that your DC emergency lighting system will operate.

Inverters

The inverter should always be inside the shelter so that it is given a high level of protection when you need it. The modern sine wave inverters do much more than convert DC current to 110 volt AC power. They also act as battery chargers with sophisticated sensors that can maintain batteries at a perfect float charge (13.36 volts for a 12 volt battery and double that voltage for a 24 volt system). They also act as high speed automatic transfer switches. The Trace system will even keep a computer from

dropping off-line during the transfer – saving you the expense of buying a separate computer UPS (Uninterrupted Power Supply). The inverter is powered full-time from the battery bank – not from utility power. This allows it to operate independently of 110 volt power. When it senses 110 volt power on its *input* terminals (from either the utility or the generator), it closes a relay and passes the power directly to the *output* side which is connected to your essential panel. The output is limited to 30 amps for a single inverter and 60 amps for two installed in tandem. There are small red circuit breaker buttons on the side which will pop out if you exceed this draw either when operating the inverter as a pass-through for regular power or when operating on battery power. They can be reset by waiting a minute and pushing the buttons in again.

Most inverters also have sensing circuits that will start a generator and then automatically transfer power to the essential panel when it is warmed up and energized. The best inverters also go into a "sleep" mode when not drawing power so that they do not waste battery power on stand-by. The inverters are the heart of the automatic system. They are highly efficient when running resistive electrical loads (like heaters or lights – which we should not operate with an inverter). The items we most need to run on inverters, like motors and 110 volt fluorescent lights, do not run as efficiently. Also, anything that puts only a small load on the inverter is not efficient. This is because the inverter takes a certain amount of energy just to run its own electronic circuits when in the "on" mode. Thus when a small load is sensed and the inverter turns on, the total load on the inverter, counting the both the inverter internal load and the small external load (a single light bulb, for example) is at least twice what the light bulb would draw alone. For this reason, I like to take lighting off of the inverter and put it directly on the battery bank. Not only are the DC fluorescents stingy on the power consumption, but they are long-lasting as well. 110 volt lighting on an inverter almost always runs in the lower power consumption band – making the inverter fairly inefficient. So save the inverter for things like moderate water pumping and running motors. Each of these types of equipment can run directly off 12 or 24 volts, but they do so with less strain in 110 volts. If you do run 110 volt lights from an inverter, switch to AC fluorescent bulbs to save on battery drain.

Battery Bank

Large 1 or 2-ton battery banks cannot easily be located in the shelter system due to the problem of getting them up and down stairs. Locate them on the main level in a separate, ventilated secure room near the garage or in the garage. Then, add a smaller set of portable batteries to the shelter so that your lighting of last resort cannot be cut off while you are in the shelter. This is very important. It's no picnic being in a shelter for two weeks without light. The battery bank is the last essential link in the alternate energy system, and provides the reserve power for times when no other power source is available. As explained previously, I like to use the batteries sparingly. The electricity leaves them much faster than you can recharge them. If using a generator to recharge the batteries, this can cost a lot in fuel. That is why adding a solar system for daytime recharging is cost effective in all sunny locations. Remember that the cables from the battery bank to the inverter must be very large and have lots of strands of copper wire. The best cable is welding cable in the big sizes like "double ought" (written 00 or 2/0 awg). Batteries can put out more than 600 amps for short periods, so the cabling must

handle those loads without overheating. The best inverters will shut down, in fact, if they sense the cables from the batteries are giving them too much resistance. Have the battery bank located within 10 or 15 feet of the inverter.

ELECTRICAL GROUNDING SYSTEM

I have covered equipment grounding previously, so I will address only the main electrical power ground system, to which all small equipment grounds will be connected. It is important to remember to tie all grounding cables and rods together so they all maintain the same electrical potential. Most conventional homes only have one standard 8 foot copper or galvanized ground rod driven into the ground somewhere near and below the electrical meter. This is rarely sufficient, especially in dry weather when the ground may dry out and not conduct electricity from a surge rapidly enough to the earth. A UFER ground is a better system. It involves surrounding the house with a continuous ground loop, down deep at the footing level. If the ground wire is laid under a french drain system, the drain will keep the wire wet and highly conductive. You can bury a continuous, long wire of 1/4-inch solid copper outside of the footing, or you can tie into the continuous R-bar within the spread footing at the base of the house. The R-bar in the footings almost always stays damp so that it maintains good conductivity. If you use the steel R-bar in the footings, make sure all the R-bars are clamped together securely at every joint and covered with a corrosion resistant paste so that the electrical integrity is maintained within the concrete. At the point in the loop below where the meter is going to go, have a heavy gauge copper wire lead out of the footing so it is available to clamp onto the normal ground rod that will be set at that location. The ground rod is connected to the lower grounding loop prior to backfilling around the basement or foundation. Don't forget to provide a ground lead to this loop directly into the shelter so your equipment can have a short path to ground. If you have an existing ground rod, soak the soil around it once every dry season with several gallons of water mixed with a cup of Epsom salts. This increases ground conductivity around the rod.

LIGHTNING ROD SYSTEMS

There are lots of good lightning rod systems on the conventional market. I suggest they be installed in any area that is subject to numerous summer electrical and thunderstorms. Make sure the rods are at least 6 feet from any of your solar panels and that the cable leading down to the grounding system does not come close to any portion of the alternate energy system or even normal house wiring on the interior. Side flashes can even penetrate wood exterior walls and knock out portions of house wiring. Run the copper grounding wires down along the outside edge of eaves so they are as far away from house wiring as possible. The better systems mount the wire on stand-offs so that the wire isn't directly contacting any portion of the house, which may catch on fire when the cable takes a white-hot lightning strike.

EMP PROTECTION

EMP stands for "ElectroMagnetic Pulse." Technically, we are referring here to NEMP (Nuclear EMP) – the kind that is induced by high altitude nuclear blasts specifically designed to knock out all electrical power in the target country. You will notice several boxes on the drawing labeled EMP, which indicates where protective devices need to be placed. A "power mains" protector is the first line of defense. Most EMP surges will come down the power lines where they have miles of wire to pick up the induced current and voltage surges. There are two types of power mains protectors. One is a *shunt type* which reroutes the surge to ground. It has the advantage of being able to take multiple hits and still restore power. But it has the disadvantage of being slower acting and may not give total protection. Some of the surge may slip by before the unit activates. The other type is an *In-Line* protector – a more expensive single use element that works like a fast acting fuse. It is only good for one hit, and then it must be replaced. But it does give total protection – one time.

All of the other EMP protectors are variations on these two types. The more of them you have along your wiring path, the better the chance of clamping the surge and routing it to ground. But they aren't cheap so put one on the main service entrance by the meter and then install a few portable type units into which you plug in your sensitive equipment. It is very important to have a large grounding network to facilitate getting these high powered surges to dissipate. If your ground wire is too tiny, it will have a high resistance and the strike will likely side-flash to the nearest piece of electronic equipment. Normal house wiring ground wires are not sufficient to protect important electronic equipment. All important equipment needs a separate grounding wire leading from the EMP protector directly to the perimeter grounding system. I have bought a few of the Polyphaser units for the more important equipment, like an expensive TV and computer. These units have standard wall plug outlets on them. I still use the house wiring ground for most normal household appliances that aren't critical.

I plug noncritical household appliances into EMP-rated plug strip protectors that are commercially available. Check the back label for the clamping time. Get the ones that clamp down in less than 2 nanoseconds if you want them to be effective against EMP. For radio and TV antenna lines, you need EMP protectors that are frequency sensitive – that will allow the radio frequency to pass but divert the high voltage and current spikes of lightning or EMP. See the Recommended Equipment and Sources section for specific recommendations.

12/24 VOLT EMERGENCY LIGHTING WIRING

Have your electrician run regular 12/2 Romex wiring to a position 6" above the regular light switch in each room. No electrical box is necessary – just stick the wire out from the wall about 5 inches and double back and go to the next light switch. The Thinlite fluorescent lights I recommend (model #197 for 12V and #297 for 24V) are 36 inch long vertical fluorescent tube lights with a diffuser cover that blend easily with the door trim. These fixtures have a built-in switch, so all an installer has to do is insert the wires through the rear of the fixture, attach the unit to the wall surface, and then make the

connections inside the fixture. Having the DC light fixture just above the regular wall switch is the most convenient placement. When utility power is off, you simply raise your hand up to the alternative fixture and turn it on – no hunting to find the fixture elsewhere in the dark. Only in larger rooms like living and kitchen areas will it be necessary to put additional fixtures, such as next to sinks and other work areas. In closet areas that are seldom used, you will probably not need to install these emergency lights. The electrician must not put more than 6 DC fluorescent lights on a circuit for a 12 volt system, and 12 lights on a circuit for a 24 volt system. DC low voltage current has a higher amperage for a given amount of wattage than the corresponding 110 volt variety, so when we use standard 12/2 Romex, we cannot put on the same number of fixtures as in 110 volt house wiring.

LOW VOLTAGE LIGHTING AND SWITCHING

I have primarily worked with a solid state low voltage system called LITE TOUCH, by Electro Controls of Salt Lake City, UT. It is a mature system and very reliable. With a low voltage control system, all lights and actuating switches are low voltage touch pads connected to a series of relay modules mounted near your electrical panel. The modules (located near the main electric panels) have 110 volt power coming in and then going out to each light in the house. The low voltage switch and relay inside these modules determines when power is turned on or off to the appliance. A regular high voltage switch on the wall does this same switching function by interrupting the 110 volt power going to each light the switch controls. The advantage of the low voltage relays is that you can control multiple lights from many different locations simply by running inexpensive low voltage wiring to various *master switch locations*. You can program the master switches to turn off or on all outside or interior lights, lock the doors, or even close and open all the shutters. This would be every expensive to do if you had to connect all these fixtures into a series of interconnected high voltage switches.

MASTER SWITCHING

I recommend the following control sequences in a well-operated home. These master switching operations should be able to be performed from 3 primary locations in the house (master bedroom, kitchen administrative center, and the high security shelter):

1. Turn on and off all house lighting (as a group) from the 3 prime locations mentioned as well as from the main exits from the home where you come and go most often.
2. Lock and unlock all outside doors electronically.
3. Turn on partial banks of exterior flood lights from each exterior door and the 3 prime locations. The automatic perimeter lighting system also turns on each floodlight with infrared detection sensors upon the approach of a person or animal.

4. Open and close all shutters.
5. Listening in (monitor) of all rooms via intercom (this is part of the normal intercom wiring – not part of the low voltage control system).
6. Monitor and actuate all fire and security functions (part of the security system, not the low voltage wiring).

DOCUMENTATION

Have complete documentation of all systems compiled in at least two copies – one for the electrical room for troubleshooting, and the other for safekeeping. Documentation should include:

1. Complete schematics of all electrical equipment, including security and intercom, etc.
2. All relay locations and interconnects.
3. Main power distribution lines, connections, and where the wires run inside the walls. During construction, take pictures of the wires leading in and out of both panels so you will know where they are after being covered up.
4. All individual wires should be marked with matching labels or numerical tags at each end of the wire run, so that bad wires or future connections can be repaired or installed without extensive testing. Sometimes you may want to move a circuit from the essential panel to the regular panel and vise versa. Labels make it easy.
5. All electrical panels and circuits should be marked in detail with circuit breakers listed in easy to read, indelible pen.

OPERATIONS MANUAL

The most effective thing you can do to help troubleshoot your system is to create an Operations Manual for the entire home. Put it in a large loose-leaf folder with lots of side pockets for individual equipment manuals. Best of all, when you don't have access to the professionals who installed your system (which you won't in a crisis) you will have all the essential data at your finger tips. Your wife will appreciate it, too, if you are gone. Include the following and keep one copy of this manual in the security shelter:

- The electrical manuals and diagrams as previously explained.
- Plumbing diagrams showing all shut-off valves and routing diagrams. Also list procedures to change valves at water heaters and pre-heat tanks when switching from the solar system to the wood-heating system, for example.
- Security system functions and manuals on how to reprogram the system.
- A listing of special access codes and combinations necessary to open and operate coded systems.
- Instructions on how to access key information from your computer systems.
- Instructions on how to operate the radios and how to tune or turn the rotating antennas.
- Instructions on how to switch over to other fuel sources for heating systems.
- Generator instructions and troubleshooting.
- How to maintain essential equipment and battery banks.
- Quick reaction drills and procedures for emergencies (fire, nuclear, smoke, escape, etc.)

Section

IV

Construction and Implementation

Chapter

20

Building The House

There are hundreds of roadblocks between the fun of designing and planning a home and the actual construction and finishing of the project. Almost all these roadblocks have to do with government regulations, building codes, and environmental controls. Sadly, there are precious few places in this once land of liberty where you can build without a building permit. These islands of freedom are almost always very rural, and are slowly disappearing as state governments are being pushed to enforce uniformity of lawmaking throughout every corner of their jurisdiction. Federal mandates are behind much of this uniformity of control. Bureaucrats and lawyers can't stand the thought of certain people being beyond the reach of the law. Interestingly enough, there are more counties in the East than in the West where freedom to build still abounds. I think this is because the western states did not come into the union in the same manner as the original eastern states. The western territories were never sovereign states – but territories run by federal mandate. When they did become states, the federal government required that, as a condition of becoming a state, all lands not already privately owned, were to be held as federal lands. Thus, many western states have over 60 or 70 percent of the land in federal hands.

It is important that you take the control factor (zoning and building code regulations) into consideration before you buy your land. I have seen many a preparedness home plan rendered "unbuildable" by county codes so onerous and costly that the owners could not proceed. Sometimes even the planning, architectural, engineering, and special consulting fees exceeded $50,000. Even if the special engineering fees were reasonable, the typical engineer, in attempting to ensure his liability against error, will over-design the structure in such a manner as to increase building costs by $10,000 to 50,000. Obviously, many projects are sunk before they start. Sadly, the number of counties that have no building permits or that allow homeowner exemptions are shrinking each year as over-zealous building officials and legislators push for uniformity of enforcement. Here are some hints for avoiding tragedy.

First, avoid building in areas that require that everything be certified or stamped by an architect or engineer. This happens most often, believe it or not, when the building department has a certified engineer on staff. He has no sympathy for your desire to avoid excess engineering costs. Some of the best plan inspectors are those who are the practical old timers who know what is good practice and what is outrageous. Shop for

freedom. If you can't find it, many times you are better off buying an existing home rather than building new. You have to pass fewer requirements, normally, in a remodel than for new construction.

FINDING A GOOD CONTRACTOR

You should feel a great deal of exhilaration and relief when the building department finally puts their stamp of approval on your plans. You are now ready for the headaches of the building process. I know of no way to avoid the many hassles and difficulties you will experience, unless you can somehow pick up some vicarious experience and know-how from those that have gone before.

If you have the time (be honest about that) and are not afraid to give strong direction to your builders and subcontractors, then I highly suggest you serve as your own contractor. You will save thousands and learn a lot about your house and construction. However, there are many advantages to having your own general contractor, if he is honest and not desirous of making a "killing" off your house. He can take a lot of the pressure off of you, which can mean a lot to busy, self-employed individuals. If you are building during a building boom, it may be nearly impossible to find any subcontractors to work for you. They owe their primary allegiance to the general contractors who supply them most of their work. The only ones you will get to work for you are those just starting out, or those who have quality problems. There are exceptions, but they are few and far between. Perhaps you'll find a subcontractor who will be sensitive enough to feel your need and want to help.

Here are some important character traits to watch for:

HONESTY: Every builder will tell you he is honest, if you ask him, but let me describe to you what I think honesty is in relation to employment. Honesty is not just sticking to the letter of the contract. It is not just "doing my best." It is delivering the full performance and quality that a worker knows he *should* deliver, for a *fair price*, and that "fair price" is not only determined by what the free market would allow under true competition, but what both parties feel as a *matter of conscience* is fair. While it is true that a builder may have high earning expectations, the building of non-luxury custom homes should not be a vehicle for high wealth. Make sure the builder you choose does not have unreal expectations about how much money he wants to make off you.

One of the most important aspects of honesty is to find a contractor who will be *true to his word*. I'd like to have a dollar every time a contractor or subcontractor has said he will be on the job and then he doesn't show up until days later. Worse yet, most will never even have the courtesy to call you to let you know why they can't be there. Make an iron-clad commitment in your contract that the contractor will always be there when he says he will, or that he will *call in advance* to explain why he can't. This is very important and leads to many frustrations if this commitment breaks down. Believe me, a contractor that is a chronic liar, and too sleazy to own up to those fibs, will never give you satisfactory work.

TOUGHNESS: Whatever you do, don't hire a "nice guy" who doesn't have the mental toughness to hire, fire, and demand performance from his workers. I have seen the soft

type operate – always smooth talking, commanding a high wage, and making the owner pay dearly for their sense of "perfection" (which is often way too costly for the owner – especially when the builder doesn't have the experience to get perfection without agonizing slowness). The dishonest subs can spot a soft general contractor, and you will pay dearly for the contractor's "compassion" in letting things ride. Shoddy workmanship will abound, and he will never seem to understand why everyone is so sloppy and "dishonest" with him. People tend to give service only when service is really demanded. This is not to say you should hire a "screamer" who alienates all the help. You want someone who is both fair and firm. It is important that he have good attention to detail and is present to catch errors. If it isn't done right the first time, you will end up paying for a lot of those mistakes in excess labor charges when it has to be redone.

COOPERATIVE: Some of the worst situations between owners and workers arise when the builder despises the owner and does not understand the employer/employee relationship. A builder who is always arguing and fighting over every issue (when he gets paid the same regardless of the outcome) has not got your best interests at heart. Even if he has good reason for disagreeing, his real job is to simply make sure you understand the alternatives (the price you will pay in terms of money, aesthetics, function, or longevity for what you are asking), and then leave the final decision up to you, and forget about it. A man who wears his ego on his sleeve or who has a big chip on the shoulder should be avoided. This goes for design professionals as well. Don't hire an architect or designer who wants to build monuments to their own reputations. You want someone who is sincerely interested in helping you get what *you* really want – as long as those desires are not flawed or unrealistic.

You don't want a yes-man either. If this is your first home, a savvy builder can really help out with some good suggestions. Listen to them, but don't make major changes without checking with your designer to make sure it won't change some unseen but important aspect. Some builders are particularly hostile about the wife showing up and checking up on them, or making changes. I will agree that many a wife has made herself a pest to those trying to do their job. Do the builder a favor and set down some ground rules for keeping the petty criticisms down, and having a firm chain of command for making changes so that husband and wife are not constantly contradicting each other in front of workers. Make sure all disagreements are settled on the basis of what is true, rather than blood relationship or money. If you run a tight, but fair ship, all will work more willingly for you, unless they are dishonest, and in that case, better to dissolve the relationship sooner rather than later.

RESPONSIBILITY: Don't try and pin all house problems on the builder, but you should expect him to be willing to quickly accept and make financial or labor restitution for errors, including ruined construction material by mistaken procedures. Tell him at the beginning that you don't want to have to spy, but that you will be making general oversight visits. Make sure the builder understands that you always want him to be the first to tell you about one of his mistakes, that you don't want to have to find out after the fact and confront him with it.

MORALITY AND VICES: All manual laborers don't have to be vice-ridden (even though that is the rule rather than the exception), and all moral people do not have to be

soft either. People with a lot of self-control problems and vices are simply not trustworthy over the long haul, even though they often will bend over backwards to perform well on the job – like the alcoholic who always makes it to work on time, just to prove to you that he isn't an alcoholic. Unless you are the owner-contractor, you really won't have much control over the vices of the workers. But I do think it is good moral leadership to let your contractor know that when you are around, you want clean language, and the normal acid rock music turned off. You might be surprised how one person's objection to chronic bad crew habits can give a new worker on the crew the courage to set a new standard. If no one objects to low moral conduct, many weak young workers will prey to peer pressure and coercion.

Bidding

Due to the special features of your preparedness home, you can expect your bids to vary as much as two or three times what is expected. They can easily vary by 100% even with conventional construction. I have seen $40,000 basement projects (by Utah standards – where they build basements under almost every house) cost over $100,000 in California where basements are rare. Start to worry, when you hear a contractor say "we don't do basements here!"

The construction industry is highly competitive, and a tradesman may go for months working for "peanuts" just to "hang in there" waiting for the right customer to come along who he thinks can be more profitable. How you present yourself will determine, in part, how much he figures he can charge you. What you wear and what you drive will tell him the most. When you are discussing the project, make several references on how important it is to you to keep costs as low as possible. Don't make detailed explanations of your ultimate plans. This tells him they are so complicated that they require a lot of explanation. If your plans are done right and you have a complete list of all equipment and specifications, there will be less guesswork for the contractor.

When you first meet the person, do a quick sizing up. A person who definitely gives you a bad impression should not be given a set of plans. No use making him go to all the trouble of bidding a job you aren't going to give him. Watch out for people who talk too much. This is a danger sign in many regards. A contractor needs to keep information about your plans confidential and financial situation private. Look for someone who is careful and discrete. Look for signs of excess worldliness. A person with lots of fancy new cars and trucks is probably overcharging or deep into debt, and will be looking for your project to help make those payments. I prefer contractors with clean living habits and no personal vises. This is almost impossible to do with ordinary workers, but is not too much to ask of you builder who should be smart enough to stay away from vices. Make sure you check out your builder's financial situation.

When you do find an honest man, he will usually not be the wealthy builder-type. Under normal competitive circumstances, there just isn't a lot of profit in home building. There are too many people who can compete in this endeavor for it to be highly profitable. So make up your mind now to treat him right. Don't put the old "squeeze" on an honest man by forcing him to bid as low as the guy who knows how to slip in extra costs after the bid. That doesn't mean you aren't careful in requiring a good careful bid. But realize

that you have a custom home to build which will involve construction and installation techniques that are unfamiliar to the man and his crew. It is very easy to underestimate the time and delays in ordering specialty equipment and controls to complete the job. When I find one of these highly skilled, honest builders with a small reliable crew, I prefer to hire them on an hourly wage basis. I have the most control over the costs of the project and can judge his performance against how much he is pulling on his wage each week. You will have to pay a set fee on top of that to cover the cost of his equipment that he uses on the job, depending upon how well equipped he is. I don't like percentage fees for a contractor mark-up unless it is a bare bones house. It really isn't fair for the contractor to be adding a 15% fee to an expensive bathtub you special order. In fact, you can count on this one fact – the easiest way for a contractor to make big money off the owner is to have the contract stacked with lots of set percentage fees, that accrue to the contractor regardless of the amount of work it takes to supervise the job.

Let's take a house that is going to cost $500,000 and take 9 months to build. A typical contractor wants to be paid at least $20-$30 an hour when he is physically on the job or working for you on the telephone, *plus* 15% of the total cost of the house to cover his "overhead." Keeping track of a contractor's hours is almost impossible if he is running multiple jobs – chances are good every job is going to get billed for nearly a full day, which means he is getting paid for being in two places at one time. Let's crank in a few numbers and see how this figures relative to an honest wage. If the job takes nine months and his hourly fees average $4,000 a month, that's $36,000. His 15% fee of $500,000 will be $75,000 totaling $111,000. Divided up into a straight salary, that comes out to be a whopping $12,333 a month or about $75/hour if he worked full time for you – which he isn't. Take into consideration what he is getting from other jobs he is working on. So, when your contractor throws those kinds of fees out, show him the figures and ask him if he thinks that is fair compensation. If he thinks that is fair, with a straight face, look elsewhere.

Once again, the facts of life in a busy building season mean you won't have much choice. Now, if you end up having to pay those kinds of fees, I would demand that he devote full-time to your house. He certainly can't claim he isn't making enough money. The best way to work with an honest contractor is to make a deal on a fixed fee for him to contract and build the home – plus his actual costs (hired labor and materials) for everything else – without any mark up. Then set a reasonable time for completion and offer a bonus for on-time completion and an equal penalty for going over time, allowing for any changes you make in the project during construction. You must have a schedule if you are paying his men's wages, otherwise there is no incentive to work fast.

I don't like to hire a builder for one of my homes who is building other houses simultaneously. The houses I design are different enough that they cannot be done properly without full-time supervision. I really prefer to hire a builder who will participate in all phases of the actual construction and be on site at all times, except when ordering and running down materials. When doing the actual construction, it is most efficient to only have a small crew of 3 or 4 well-rounded workers (not counting subcontractors). There are too many times when the crew is waiting for the delivery of materials and a big crew can eat up a lot of time waiting around.

You must ascertain what the present and future commitments of the builder are before you contract with him. He can really hurt you if he plans on trying to oversee three or four homes while he is working on yours. Make sure that he completes all other major commitments to other homes in process prior to beginning work on yours, and commit him not to accept other work until your home is completed. Delays of several months can cost you many hundreds of dollars if prices climb. And, in fairness to the builder, make sure you have enough money to complete the project on schedule. Of course, in the real world, it will be rare when you can hire a contractor committed to the above terms. But no harm in trying for the optimal situation before settling on what you can get.

Check with the builder's most recent clients and his major suppliers to make sure he is not in arrears. If he is, there is a good chance he will be using your first payments to pay off other jobs. Remember, in most states, the supplier can legally put a lien against your house if the contractor doesn't pay his bill – even if you have paid the contractor. You could end up paying twice for your home. Above all, check your inner feelings. If you feel nervous about someone, don't hire them, no matter how good a story they tell. If your spouse feels nervous and you don't, follow the spouse's lead. Better to error on the safe side than depend on verbal assurances. Often your conscience will know what you can't know through human perception.

When you request the bid, be sure to request a minimal breakdown of materials and labor separately, and then a sum total. Don't let contractors get away with lumping everything all together. When you want to shave costs, you have no way to check how he came to his figures if he didn't itemize them properly. This way, if he charges you $1,000 extra, you can force him to submit all his material receipts and time cards for his workers and compare them with his bid. If he had some legitimate overruns, then pay them. I believe that legitimate overruns, not due to the fault of the contractor, ought to be paid, even if it wasn't in the contract. But above all, never accept a verbal bid. Have him itemize what is included in the bid *plus* a general clause that covers anything else in the plans and specifications not herein covered. I believe that contracts are important, but I also think they ought to be fair and drawn up in plain language so that there are no loopholes either way. The most important thing you can get from a contractor in a contract is the stipulation that he doesn't get paid until you see the paid receipts of the subcontractors – which constitute a lien release. If the contractor doesn't have the money to pay the subs in advance, then you agree to pay the subs directly. And be prepared to scrutinize the bills and compare them to the bid, or the time on the job. You have to make sure a subcontractor isn't padding the bill and kicking back a percentage to the contractor.

SELECTING PEOPLE TO WORK WITH

Prior to going out for individual bids, whether with general contractors or the individual subcontractors, it is best to get some recommendations other than the yellow pages advertising section of the phone book. In a large city, making a choice from the yellow pages can get very exasperating. Even if you plan on being your own general contractor, it is good to establish a relationship with an honest general contractor to help you select subcontractors and find the best sources of building materials. If you can't get such a recommendation, the best bet is to find someone in the area who has recently had a

custom house built. He or she will certainly have some strong opinions on the conduct and performance of plumbers, electricians, etc. The worst problems come from the highly unionized trades or professions protected by licensing from competition. They are mostly competent, but the government license is a license to charge higher than free market prices – especially if they get used to higher commercial building prices. Commercial contracts provide high profit margins and tradesmen gets used to these fat contracts. When they see some specialty design work in your preparedness home, they are liable to charge you double just because it looks expensive and is different than what they are used to. That is why "custom" almost always means more money. We still recommend staying with the competent small contractor who will really put out for you.

This matter of selecting the right people is so critical, in view of the security systems and living quarters we have designed, that it may be worthwhile moving into an area and renting for a few months just to know your way around with people prior to the big project. A proposed retreat site may be so far removed from your normal living area that you may not have any way of making a suitable selection. If at all possible, I recommend that a retreat be built by the owner himself with the assistance of a few trusted workers. If this is not possible, in total, the conventional portion of the retreat can be built from contracted labor with provisions for security additions later. This is also the recommended way of getting a permit and having the required inspections without revealing secret facilities that will be constructed later on in private – as is your right.

Selecting Workers for the Private Work

Finding someone to do this private work is difficult. Obviously, it is best if you do it yourself. But hopefully, among the workers, you might find one that you like and trust and can hire him to do some private work with you later on. Technically, your exercising of your right to privacy will involve installing some things that may normally demand a permit. It is best to hire someone who is unlicensed to work directly under your supervision, so that he isn't putting his license on the line if the work should be discovered. The bureaucrats don't have as much leverage over the owner as they do over state licensed individuals. It's no easy job fighting for your rights to install private vault rooms or shelter living quarters, so above all, you want to make sure it remains private so that you don't have to make a big legal issue out of it.

If you can't find anyone locally to do the work – who is absolutely trustworthy – then it is often feasible to hire someone to come in from out of town. In this way, if word leaks out to his friends or relatives, they won't know where your place is. The worst thing you can do is hire someone local who goes to the bar every night and talks about his work. It is even worse if he talks to his wife and she has lots of gossipy friends. Normally, you would think that you could trust someone in your church to keep things private, but I have seen things go wrong there as well. Often religious people assume that because someone shares the same church with them, they will also keep their mouth closed. Not so. Often people of the same religion assume that it's OK to tell everyone else in church about your business – because it's "among friends."

If people do find out, don't make a big fuss. Just let things die. People do forget – at least they forget enough specifics that you can keep them from finding their way into your shelter with appropriate concealed entrances and strong room doors.

FINANCING

In regards to financing, there are some difficulties in being your own contractor if you are not in the business full-time. Many loaning institutions fear getting stuck with a half-baked experimental house that they cannot sell if you default on the mortgage. Many, therefore, will simply refuse to grant a construction loan unless you have a licensed general contractor. Sometimes you can get around this by getting a licensed contractor to sign on as your nominal contractor and let you do the work. But he knows that his signature makes him liable, so unless he really trusts your ability, he may not be eager to help. Those companies who will loan to owner-contractors usually require that you get written bids on every aspect of the home – a process that would undoubtedly take you more than a month. The banks want to be sure that the loan they give you will, in fact, cover the entire cost of the construction, to keep them from ending up with a half-finished house on their hands. Perhaps you can see why I am reluctant to recommend building with traditional financing. You lose a lot of privacy and control over your project – not to mention freedom.

Above all, a true preparedness home should be *debt-free*. It is better to build a smaller home you can afford than go into debt. I think we are going to face some severe financial circumstances in the first decade of the new millennium, as a prelude to war. All of this means that those who are completely out of debt will have the best chance of survival.

LABELING THE PLANS FOR PRIVACY

After the conventional part of the home is complete and inspected, you can begin to outfit the private parts of the home. When you have plans drawn, great care should be taken not to reveal the private and sensitive areas of the basement that will serve as your ultimate security. No matter what laws government passes, everyone should have the right to build private hiding places and security rooms that are not privy to government inspectors. Government may well be the problem someday, I can assure you. You have a right to secure your valuables in places which are not on the plans. You cannot, in most areas, get away with building a structure without a permit. They want to be sure it isn't going to fall down on you. So be it. But don't label your fallout shelter as a shelter. Always label these concrete ceiling areas as cellars or storage rooms. When you build them under the garage, you already have an excuse to have concrete over head, as well as ventilation. Sure, 12" thick may be overkill, but you can always talk about needing "cool mass" to keep heat from penetrating the basement cellar. When you need an escape opening in the side wall, build it as a "wood chute" opening in the wall, with an appropriate metal window well around it. Then after the inspections are over, you can attach your tunnel to that opening, install the security door, or make a sand trap exit out of the window well.

SEQUENCING THE WORK

If you are serving as your own general contractor, you will have the major task of planning and sequencing the entire operation. This is extremely important, as your decisions and timing will affect all other subcontractors. Many operations by subcontractors cannot begin until other tradesmen have completed their work: plumbers and electricians must rough-in their work before insulation installers can go do their work. Insulation has to go in before interior sheetrock can be applied; sheetrock has to be installed and finished before finish flooring and finish casing can be done, and so on. You can only estimate within a week or two when some of these men can start work, hoping there will be no delays. Don't expect every subcontractor to be able to jump right on your job when you want him. Most have to schedule a month in advance in order to ensure they keep busy.

Materials can be very critical. The general contractor has to be on the job each day to find out how things are progressing and to ensure the next day's or next week's materials are present and available. It is somewhat disconcerting to have your roofers ready to start next week and your lumber supplier tells you that it will take him a month to make delivery of the beams and decking you ordered. To avoid all this, let me suggest a possible sequencing checklist for a nearly conventional house. Depending on your particular design and the materials you choose, your sequencing might be different. This list will assume you are acting as your own general contractor.

1. MAKE LISTS and CHECK PRICES. Look through the plans and make a list of all the wood you will need to frame the house. List also doors, windows, and fixtures-including sizes, colors, and styles. Make another list of all built-in specialty equipment (fireplace liners, furnaces, security switches, relays, wiring, etc.).

2. ORDER MATERIALS. Start checking with suppliers as to the availability and cost of all these items. Order them now, but specifically tell them NOT to deliver them to the building site until you call for them, and have him give you an estimated arrival date for special order items and arrange to have them call you when they arrive, or if any delays come up. Order, on the spot, items which are in short supply or which may take a long time in shipment. The more leeway you give yourself, the less affected you may be by a sudden trucking or shipping strike. It is best if you arrange for some secure temporary storage trailer or building on the property so that you have a place to keep them safe until used.

3. EXCAVATION. Line up your excavator. Don't always pick the man who charges the least per hour (man and machine). Check what type of machinery he will be using. A huge tracked hydraulic excavator for $100/hr. can dig a basement in one-fourth the time as a $50/hr. backhoe. Obviously, the big machine is often cheaper. Don't let the excavator leave the premises until you have checked the level of the excavation with his transit (they all have them). He should be within 2 or 3 inches of level all around. Any greater error makes added difficulties for the man putting in footings. Also, if you have trees and shrubs on the property which you do not want disturbed, mark them with bright tags and tell the excavator that means stay well clear. Save your topsoil and instruct him to scrape it all off and stockpile it to one

side before he starts digging the basement. After the home is completed and rough grading is complete, this top soil can be spread on top for final grading. It can also be used for a garden plot. If the excavator has used any amount of fill dirt to make the level pad for the home, it must be carefully compacted, both by his heavy machinery and by compaction equipment.

4. ROUGH-IN SEWER, DRAINS, and SUMPS. Anything that is to be laid in the ground under the basement can most easily be installed prior to the footings and foundation, provided the house is all laid out perfectly. When a backhoe is required, the job is facilitated greatly if no obstructions are present. Be sure to mark all existing water and gas lines so that the backhoe operator doesn't cut them during the trenching process.

5. FOOTINGS and FOUNDATION/BASEMENT. Your masonry contractor should have been lined up about the same time as the excavator so he can be on the job the next day after the basement is dug. The footings must be level within 1/4 inch and you should check them before he pours the cement. The general dimensions of the house were probably obliterated by the excavator, and the house should be precisely laid out again by the footing contractor. Check his measurements after he sets his footing forms, especially to see that the corners are perfectly square. I have seen foundations poured that are too far out of level or out of square to fix. Few subcontractors will have the money to foot the bill to tear out an entire basement and pour it again for you. So check before he pours , just to save yourself a lot of grief. Don't take chances with cement. See that he puts in all the steel reinforcing that is specified in the plan, and don't let him skimp on the size of the footings. When the basement wall forms go in, have all window "bucks" (the metal forms that will allow windows to be inserted in the basement walls) and door forms ready in advance, as well as wooden rods or metal pipes to set in the forms as pass-throughs for wiring, water pipes or gas mains. This simple procedure will save a lot of masonry drilling later. These should be done by your head carpenter, who should be in charge of the framing crew. A major building code inspection occurs prior to pouring any concrete. You must notify the inspectors when you will be ready to pour – usually at least a day in advance.

6. BASEMENT FLOOR and SHELTER SUPPORT WALLS. Sometime prior to the framing of the house the plumber can lay any additional plumbing in the basement floor so that the concrete floor surface can be poured. After the basement floor is poured, the framers can come in and frame up for the support floor that is going to allow the 12" thick concrete ceiling for the shelter. Make sure they follow the general guidelines given in the fallout shelter portion of the book. This floor weighs about 80 lbs per square foot and must be able to withstand the weight.

7. ROUGH HOUSE FRAMING, WALLS, WINDOW OPENINGS, and ROOF. This is the fun part where the house begins to take shape. Don't panic at how small the house seems when only the floor is in place. You cannot get a true perspective of room size until the walls are up. Make sure the contractor securely braces all walls to guard against high winds. I have seen several partially-framed houses blown down after the crew quit for the day because walls were not braced correctly.

8. FIREPLACE CONSTRUCTION can take place simultaneously with rough-in PLUMBING, ELECTRICAL, HEATING DUCTWORK, and ROOFING. Make sure you supervise the fireplace building if following my special design. Windows and doors are also installed after the walls and sheathing are in place. After the rough-in work is done, there is another major inspection, sometimes called the 4-way inspection, prior to insulation. The inspectors inspect *framing, electrical, plumbing, and heating* systems and, if all is in order, you are given a permission to "cover" – meaning to place insulation in the walls.
9. WALL INSULATION. Another inspection follows and then you are free to put up sheetrock. Usually no further inspections occur until the final one.
10. SHEETROCK and EXTERIOR SIDING.
11. INTERIOR TRIM and PAINTING.
12. FLOORING, then CABINETRY and APPLIANCES.

SUMMARY

Of course, now you have the conventional portion of your home complete. Move in, get settled, and then begin planning for the private installation of the high security features. Some of the core elements may already be in the shelter area. For persons not capable of doing their own electrical and security wiring, it is best to have those portions of the master electrical system pre-installed in the shelter. This will include:

- Alternate energy control panel, inverters, and minimal battery bank for 12 or 24 volt system
- A remote master control panel for your security system
- A remote master intercom panel with a small video monitor built in
- the DC circuit breaker panel

These things will be mounted on a wall near the main shelter door. Once you get your shelter finished, there is a possibility workmen may have to return to repair or work on these systems. You may want to consider, in light of this, walling off this area and turning it into a small ante-room so that repairmen do not see what else is in your shelter when they come in. Admittedly there are a lot of little tactical decision you will have to make in finishing out these sensitive areas. Hopefully I have given you enough hints and examples to help you through most of them. If you need additional personal consultation from me on these or other issues, see my consultation rates and contact information.

Section

V

Recommended Equipment and Sources

This section of the book should be the most helpful. Finding the actual products and resources to build a home is often difficult. I have not included many conventional products for building here, but rather have concentrated on those less conventional items that I have commented about during the text. I have used many of the products mentioned here. However, there are many items that I have not had personal experience with. I have attempted to judge these within the limitations of written claims, but you should use your own judgment as well in evaluating their suitability to your needs. I make no guarantees about the performance or reliability of these products or services. Surely, there are other similar products to the ones I have mentioned that may be available and yet unknown to me. Because they are not mentioned does not mean that they are not acceptable. If they follow the general criteria given, feel free to consider them. If I have time, I can try to check out a product of interest to you, if you will provide me some relevant sources or descriptive information. Any feedback you have, negative or positive, about any of these products will be appreciated.

This page also provides the source information for those who have the booklet *10 Packs for Survival*. If you find errors here or see web addresses (URL) that do not function, please inform me by Email at joels@joelskousen.com

PRODUCT SUPPLIERS

Here is a list of suppliers who carry a variety of items mentioned in this list. To save space, I will only mention their name as a source within the list, instead of giving out their address and telephone numbers each time they are mentioned. Check here for contact information if it isn't listed in the body of the list. In most cases I will try and give an Internet website URL (URL means an Internet address, usually preceded by a www). Going to a company website will allow you to view the product and read important information. This will save you much time and effort.

ABRAHAM SOLAR EQUIPMENT: This is my top recommended source for all your solar and alternate energy products. Mick has low prices and he knows all the equipment personally, including how to install it. Above everything, I can personally vouch for Mick Abraham's honesty and integrity. This is a source you can completely trust. Order line: 1-800-222-7242, Consultation (970) 731-4675; address: 124 Creekside Place, Pagosa Springs, Co. 81147. Website: www.abrahamsolar.com

BE SELF RELIANT.COM: This is company with a lot of practical experience in designing and installing self-sufficient and multi-fuel systems within homes. They are based out of Idaho and are quickly developing into a comprehensive one-stop resource for self-sufficiency products and information. This includes: alternative energy, heating, home production, self-reliant skills development, consulting, and installation. They have developed a unique home heating boiler system that uses any available fuel, simply by changing out the burner. It also uses coal and wood. I don't know of any other system

that matches this one. All of their systems come with extensive "How To" documentation for the do-it-yourselfer. **Phone: (208) 624-3135 or (888) 624-0040 website:** www.beselfreliant.com **Email:** info@beselfreliant.com

EMERGENCY ESSENTIALS: Largest of the Utah-based full service preparedness products stores. Website www.beprepared.com : 653 North 1500 West, Orem, Utah 84057 Phone contact numbers: 1-801-222-9596-Corporate offices, 1-801-222-9598 Fax 1-800-999-1863 Customer order line. Email: sales@beprepared.com

PROVIDENT LIVING: Excellent online shopping for 72 hour kits and specialty preparedness equipment. They also sell a full range of storage foods. Website: https://www.providentlivingcenter.com/

MAJOR SURPLUS AND SURVIVAL: Biggest of the California survival food and products stores. Website URL: http://www.majorsurplusnsurvival.com/ . Address: 435 W. Alondra Blvd.; Gardena, Ca 90248 Tel: (800)441-8855 or (310)324-8855 email: sales@MajorSurplusNSurvival.com

NITRO-PAK: Carries a full line of survival foods and products. Website: http://www.nitro-pak.com/

WALTON FEED: Largest of the survival food suppliers. Website: http://waltonfeed.com Location: 135 North 10th (PO Box 307) Montpelier ID 83254 Phone: 800-847-0465

LEHMAN'S CATALOG: The largest of the self-sufficient/back-to-the-land suppliers. Website: www.lehmans.com . Address: Lehman's Non-Electric Catalog Listing ID 575. Phone: 1-877 438-5346 Email: info@lehmans.com Mail: Lehman's, 289 Kurzen Road North Dalton, Ohio 44618

REAL GOODS: California and Colorado outlets for full range of back-to-the-land and self-sufficiency products. Website: http://www.gaiam.com/realgoods/default.htm

AMATEUR ELECTRONIC SUPPLY (AES): Biggest of the mail order Ham radio and antenna stores. Website: http://www.aesham.com/ Order their catalog: 1-800-558-0411.

HAM RADIO OUTLET: 1-800-644-4476 (east) or 1-800-854-6046 (west). Major competitor or AES. Website: www.**hamradio**.com Order their catalog 1-**800-444-0047**

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RADIO SHACK: website www.radioshack.com . Nationwide electronics parts, radios, telephones, and security systems. Order line: 1-800-843-7422 (get a catalog at local store or see it online).

WW GRAINGER: Nationwide wholesalers of almost every type of equipment. You must have some type of business in order to establish a wholesale account with them, but it is worth it. Check their website for the warehouse nearest you: www.grainger.com .

NORTHERN TOOL AND EQUIPMENT: Major discount mail-order catalog company for generators and major tools and equipment. Website: http://www.northerntool.com/ or 1-800-221-0516

HOME IMPROVEMENT STORES TO PURCHASE ITEMS AT A DISCOUNT

COSTCO WHOLESALE: See website for location of stores nearest you: www.costco.com . They are in most states East and West (but only a few in the Midwest (Illinois, Indiana, Iowa, and Kansas). Chain discount bulk supplies of household products and services. Very high quality and cheap prices.

SAM'S CLUB (WALMART CHAIN): Nationwide chain carrying bulk supplies at discount prices.

HOME DEPOT: Largest national home improvement store chain. Website URL: www.homedepot.com .

LOWES: Nationwide home improvement discount store; second largest in the nation.They are better than Home Depot for specialty tools and hardware. Website: www.lowes.com

LISTINGS

CONSTRUCTION MATERIALS AND EQUIPMENT

GROUND SOURCE HEAT PUMPS

International Ground Source Heat Pump Association:
http://www.igshpa.okstate.edu/ Has a listing of many approved installers.

WaterFurnace International, Inc. 9000 Conservation Way, Fort Wayne, IN 46809 USA
Website: http://www.waterfurnace.com Tel: 800-436-7283.

PLASTIC LUMBER DECKING Now available all all home building stores.

STEEL DECKING FOR FORMING UP SHELTER CEILINGS: Many brands of steel decking are available at local steel suppliers in most large cities. Deal locally to avoid shipping costs.

FormDeck Comes 36" wide in variety of lengths. Contact Structures of USA, P.O. Box 639 Johnstown, PA 15907 Tel: 814-536-8371 URL: http://www.structuresofusa.com /

SHATTERPROOF WINDOWS AND SKYLIGHTS

Roto Frank (German made) high strength skylights. Website: www.**roto**hardware.com/ Available in US at skylight distributors.

Andersen Windows makes a triple laminate glass with polymer layers in between. These windows are intrusion-proof, and will not scratch like Shattergard film. This is the glass system they use on their high strength (hurricane-proof) skylites. You can order this glass in their regular window line as well. Cost is about 30% higher than standard glass/wood windows. Andersen Windows (available at window suppliers everywhere).

STAIR-STEPPED MODULAR WINDOW WELL (for fire escape)

Scapewell by The Bilco Company: URL: www.bilco.com. The Bilco Company, P.O. Box 1203, New Haven, Connecticut 06505 Tel: 203-934-6363.

INSULATING WINDOW FILMS/INSULATION

Gila Films have a full range of energy saving films to apply to windows. Website: http://www.gilafilms.com /

QUILTED DECORATIVE INSULATING CURTAINS FOR SOLAR WINDOWS

See the Website of 1WindowQuilts.com: http://www.1windowquilts.com They sell a rolling shutter type installation that is easy to install.

FOIL INSULATION

One of the latest innovations is bubble Poly blankets with foil on front and back. It's great for molding into window jambs or stapling to attic rafters, or cover existing attic insulation to reflect summer heat and keep winter heat inside. Website: http://www.reflectixinc.com But it is sold in stores everywhere no—even on Amazon.com.

SOUND INSULATION

Insul-Tek and O.E.M. Sound Deadener, self adhesive automotive stype sound-proofing. This is very compact, effective material. Call **Juliano's** to order. Orders: 800-300-1932 Technical Assistance: 860-872-1932. Insul-Tek 1/4" thick core of polyethylene foam with aluminum foil bonded to both sides. Will not absorb moisture. Reduces noise level by 40%. Website: http://www.julianos.com/insultek.html

SONEX Professional quality deep finger foam for shooting ranges. **Ilbruck Inc**, 3800 Washington Ave North Minneapolis, Mn 55412. Tel (612) 521-3555. website: http://www.illbruck-sonex.com /

ADD-ON PROTECTIVE FILMS

Shattergard Protective Film (unbreakable backing to standard glass). Itcan be applied to existing house and car windows. Makes windows bullet-proof to small caliber (.22) weapons and makes windows inpenetrable to intruders. www.shattergard.com .

FIREPROOF SHEETROCK

In the 1980's a woman invented real fireproof plaster that was vastly superior to type XX sheetrock (which merely sloughs off during a fire. The product is called **GEOBOND,** and comes in panels as well as a stucco-like exterior coating. It can be used in combination with many other materials. Website: www.geobond.net (inactive site) This is a truly amazing family of products, but it looks like it was not a commercial success and may not be available now.

FIREPROOF PLYWOOD

Plycem. This is a recycled material which has higher densities than all other sheathings. It is marketed by **Castleblock** P.O. Box 1893, Ventura, CA USA 93002 Tel: 800-672-7872 Website: http://www.castleblock.com/ .

STRUCTURAL BUILDING PANELS

R-Control Structural Building Panels. factory-made wall systems that replace wall framing. Also **R-Control Speclam** (insulation foam attached to particle board) **AFM Corp**24000 West Highway 7, P.O. Box 246 Excelsior, MN 55331 Tel: 1-800-255-0176. (612) 474-0809 or 1-800-255-0176 Fax: 612-474-2074. Website: http://www.afmcorp-epsfoam.com

EIFS (EXTERIOR INSULATED FINISH SYSTEMS)

Exterior insulated finish systems (EIFS) consist of synthetic stucco applied over insulation board, which is then installed over sheathing. These systems have been used commercially for years, but they received some bad press recently when homeowners complained that these systems were failing. Moisture penetrated the wall and the sheathing and structural members rotted. While manufacturers, contractors, and homeowners swap complaints, drainable siding is entering the picture. Manufacturers say that this system allows moisture that gets behind the stucco to drain harmlessly to the outside.

Dryvit: website: dryvit.com. Tel: 800-556-7752. Dryvit Systems, Inc. One Energy Way, P.O. Box 1014 West Warwick, RI 02893.

Pleko See website at www.pleko.com/ (Dryvit substitute; more competitive in price.)

CHEAPER ALTERNATIVE TO EIFS

The **QUIKRETE**® Hardcoat Stucco System provides builders and contractors with unparalleled durability and moisture protection that is lacking in Exterior Insulation and Finish Systems (EIFS). The Hardcoat Stucco System is comprised of QUIKRETE Liquid Stucco decorative coating over a base coat of QUIKRETE Fiberglass-Reinforced Stucco. Unlike EIFS, where water may become trapped between a synthetic finish coat and the interior drywall, Fiberglass-Reinforced Stucco acts as a drainage medium. If water

penetrates the top coat of Liquid Stucco, it will migrate down the base coat and out through a flashing at the concrete footing. The Hardcoat Stucco System combines the design versatility and energy efficiency of EIFS with the durability and water drainage benefits of cement-based systems. Fiberglass-Reinforced Stucco is reinforced with alkali-resistant glass fibers. It provides a high impact, crack-resistant shell and can be trowel or spray-applied at a 3/8-inch thickness using wire mesh over insulation board or sheathing. Fiberglass-Reinforced Stucco also provides the ideal base for the Liquid Stucco decorative coating, which is a moisture-resistant color and texture coating designed for use over concrete and stucco surfaces. This ready-to-use and trowel-applied product is a 100 percent acrylic co-polymer-based coating. It is available in swirl, coarse sand, and fine sand textures and can be pigmented to any desired color, thus offering unlimited design options. This system can also be used over the concrete stack-block method. URL: www.quickcrete.com .

ELECTRICAL, MISC

GFCI (Ground Fault Circuit Interrupter). Installing a GFCI outlet for your washing machine for shock protection is worthwhile. However, some GFCIs might trip every time the motor is activated. To prevent this type of nuisance tripping, the **Leviton** Manufacturing Co. indicated that you should get the **Hospital Grade GFCI outlet** rather than the regular commercial grade. The catalog number of this part is 6598-HG, and it's available at commercial electrical supply stores.

GREENHOUSE MANUFACTURERS AND COMPONENTS

Conley's Mfg. & Sales 4344 E. Mission Blvd., Montclair, CA 91763 Tel: 909-627-0981 URL: www.conley.com (a commercial greenhouse manufacturer. Will send components to you as well as twinwall glazing at wholesale rates).

Nexus Corp. 10983 Leroy Drive Northglenn, CO 80233 Tel: 303-457-9199 URL: www.nexus.com/ (A commercial greenhouse manufacturer. Will sell components to you as well as twinwall glazing at wholesale rates).

PLASTIC GREENHOUSE FILM

Armin Plastics Corp. 18901 East Railroad Street City of Industry, CA 91748 Tel: 800-654-8119 URL: www.armin.com (supplies a full range of single layer plastic, UV protected greenhouse coverings – suitable for warmer climates.

STRUCTURAL METAL COMPONENTS (aluminum square tubing, round tubing etc)

Allied Tube & Conduit 16100 S. Lathrop Ave. Harvey, IL 60426 Tel: 800-882-5543 URL: www.allied.com. Also available at steel/metal supply houses in all major cities.

DEHUMIDIFYING AIR TO AIR HEAT EXCHANGERS

HEAT WHEELS by XeteX, Inc. 3530 E. 28th St.. Minneapolis, MN 55406 Tel: (888) 899-9991 Toll Free. (These unique spinning wheels have water absorbing media on the blades which transfers humidity from incoming fresh air to the outgoing stream of exhaust air.)

WATERPROOFING MATERIALS FOR BASEMENTS, UNDERGROUND HOMES

FIXING BASEMENT CRACKS

Most use hydraulic cement (rigid). For a better job, fill the crack on the inside using a tough, but flexible professional-grade sealant such as **SIKAFLEX 1A**. Prepare the crack according to the manufacturer's instructions, then coat it with Sikaflex primer 429 and apply the Sikaflex-1a. Finish up by covering the repair with SikaTop Seal 107, a polymer-modified, cement-based coating. A 10.3-ounce cartridge of Sikaflex-1a costs about $5, a pint of primer about $12.50 and the SikaTop Seal about $40. Bear in mind that these products are not sold at home centers or hardware stores. They are sold through construction supply houses, some of which are reluctant to sell less than case-size quantities to a homeowner. So the prices of individual cartridges or cans may vary from what we show here. For more information, contact **SIKA CORP**. 201 Polito Ave., Lyndhurst, NJ 07071; 800-933-7452.

WATERPROOFING WALLS, UNDERGROUND ROOFS:

Black Hills Bentonite Box 9, Mills, Wyoming 82644 URL www.bhbentonite.com/ Email: bhbentonite@doccee.com/ . You can also find bentonite pellets at almost any well drilling outfit.

Paraseal (HDPE) Waterproofing Membrane (from **W.R. Grace Co**, and national firm. Local construction firms can get this product). Paraseal is a dual combination of two of the most effective waterproofing materials, high density polyethylene (HDPE) and bentonite clay, laminated together to form a tough, single sheet membrane. It is easily installed and typically applied on backfilled wall conditions, under floors, decks, or as a pond liner. The Paraseal dual membrane system is also available in a lagging grade, Paraseal LG, which is designed for blindside installations or where shotcrete is to be blown directly into the face of the membrane.

Bituthene Heavy duty waterproof membranes that can literally surround the outside of a basement (even under slabs and footings) to make a basement waterproof in a high water table area. Bituthene 1000x by **W.R. Grace Co**. (available through local concrete contractors).

Vulkem 201/222 are also ideal for waterproofing foundation walls. By Tremco Incorporated 3735 Green Rd., Beachwood, OH 44122 Tel: 216-292-5000 or 800-321-7906.

Underground roofs: Apply 30 or 45 mil EPDM rubber pond liner material over Polyurathane foam sprayed on insulation. Pond liners widely available at rural farm stores.

WATERPROOFING FOR DECKS

Vulkem #350/351 Pedestrian Deck Coating System. **Tremco** Incorporated 3735 Green Rd. Beachwood, OH 44122 Tel: 216-292-5000 or 800-321-7906.

CUPOLAS (special decorative vent housings that go on top of traditional styled roofs and barns)

Stephenson Cupolas and Weathervanes. **Nashvilled Sash and Door**, Tel: (615) 254-1371

Edon Fiberglass Cupolas. 1-800-255-0176, URL www.edon.com/ (These are indestructable vents and never need maintenance).

CONSTRUCTION TYPES: ALTERNATIVE

INFORMATION ON CONCRETE HOMES

www.concretehomes.com

PRECAST CONCRETE

Thermomass Residential Building Systems. (The best residential system in the world – uses a thermal sandwich of foam in between two concrete precast surfaces. Has heat mass characteristics, rodents cannot get into the foam layer, bullet-proof, and the best sound-proofing available) 1999 Highview Rd. Coralville, IA 52241 Tel: (319) 351-4232 Fax (319) 351-0993 Website: www.t-mass.com .

Kistner Concrete Products, Inc. (Prefab security buildings, precast basement foundation systems) They also have very innovative retaining wall systems with planting areas. 8713 Read Road East Pembroke, NY 14056 Tel: 716-762-8216 Fax: 716-762-8315 Website: www.kistner.com .

Tierra Concrete Homes P.O. Box 1924, Pueblo, CO Tel: 719-947-3040 Fax: 719-947-3050. Website: http://www.tierraconcretehomes.com/service.html

Oldcastle Precast Custom precast water-proof concrete tanks. **Can combine these to make drop-in-the-ground shelter systems**. Contact: Oldcastle Products, 2820 A Street, SE Auburn, WA 98071-0608 Tel: 253-833-2777 Fax: 253-939-9126 or 888-232-6274. Website: www.oldcastle-precast.com/ They have local manufacturers all over the USA.

PRECAST CONCRETE SLABS (AIR CORE CONCRETE)

For use as flooring systems or roofing systems. Duct heat or cooling air into the floor tubes. **FLEXICORE** brand slabs are available in all states. Check with commercial concrete contractors in every major city. Example: http://www.flexicoreoftexas.com/

THERMAL MASS CONCRETE BLOCK CONSTRUCTION

The Natural Home Source: These designers and builders have the most experience in heat mass – passive solar homes. Their system is applicable to most areas of the country, but especially the West. I don't agree with all their techniques or their pricing commissions, but you can learn a lot from their information and implement what you want on your own. They cover waste treatment systems, earth sheltered homes and buildings, solar air heating systems, composting system components, indoor gardening/attached greenhouses. Silverthorne, CO 80498 Tel: 970-262-6727 Website: http://www.thenaturalhome.com/ .

DOME UNDERGROUND HOMES

All of the following companies have been in business over 20 years, so they know what they are doing.

Nest Egg Homes (an underground system using concrete dome or tunnel type structures) Formworks Building, Inc. P.O. Box 1509, Durango, CO 81302 Tel: 970-247-2100 URL: www.formworksbuilding.com/ .

The Terra-Dome Corp. Underground or bermed buildings. They have tremendous experience in the field. http://www.terra-dome.com Hdq: 8908 S. Shrout Rd. Grain Valley, MO 64029 Tel: 1-800.481.3663 toll-free

Davis Caves Construction, Inc. P.O. Box 69, Armington, IL 61721 Website: www.daviscaves.com Tel: 309-392-2574.

CEDAR HOMES

International Homes of Cedar (Laminated Cedar Homes) P.O. Box 886, Woodinville, Wa 98072 Tel: 360-668-8511 or toll free 800-767-7674. Website: http://www.ihoc.com/

LOG HOMES

There are hundreds of log home companies. However, it has been my experience that log home suppliers in the Eastern US are almost double the price of western log home suppliers. Call for price comparason with the company below to see how your local dealer compares. Often it is much cheaper to ship log kits from the west than buy in the east.

Real Log Homes Hartland, VT and throughout the Eastern States (800) 732-5564 Compare prices with the West. Website: http://www.realloghomes.com/

Timberline Log Homes 915 N. State St. Orem, Ut 84058, (801) 226-8786. website: http://www.timberlineloghomes.net/ This is the company I use as a reference for a fair price. I have consistently found this outfit to be very competitive and fairly priced. Check your prices locally and then give the same specs to this company to see how they compare. In many cases, it has been more economical to buy from Timberline, and ship to the East coast than to buy in the East.

ICF (INSULATED CONCRETE FORMS)

The Portland Cement Association has introduced both a book on building with insulated concrete forms (known as ICF construction), and a 5-part video series on the topic. The 326-page book, *Insulating Concrete Forms*, ($60 postpaid) is a highly detailed look at these systems, from design through installation to completion. Numerous section and perspective views of various ICFs are given. If you're considering building with an ICF system, the book is necessary reading. The video series ($65 postpaid) doesn't provide detailed information, but it gives a realistic overview of ICFs, since much of its 80 minutes was filmed at construction sites. The five videos are design, planning, setting forms, placing concrete, and utilities/interior finish. Contact the Portland Cement Association, 5420 Old Orchard Rd., Skokie, IL 60077.

THERMALITE: 1-800-500-4898. website: http://www.thermaliteforms.com . Flat foam forming system tied together with plastic ties. One of few systems that can accommodate concrete walls up to 14 inches wide. One has to put together the forms – do not come as blocks, thus allowing much wider variety of wall widths. Bracing system must be rented or purchased from them – highly recommended.

BLUE MAX: One of the only foam block systems that allows an 8" wide, full-width concrete wall. Now under the name ARXX: website: http://www.arxx.net/

AAB Building System, Inc. http://oikos.com/esb/40/AAB-icf.html Address: 840 Division St., Cobourg, Ontario K9A-4J9 Canada Tel: 800-293-3210 Fax: 905-373-0002.

SMARTBLOCK Use variable width form only – gives solid wall thickness up to 8." Pre formed blocks with integral ties. Plastic ties are built into foam, recessed 3/4" from outside (makes them a little harder to reach for attachment purposes). CONFORM website: http://www.smartblock.com/ Call 1-800-CONFORM for distributor nearest you.

LITEFORM: (Flat foam – have to build it up yourself, so it takes longer) But, you can buy wholesale direct from the factory and save money. **Lite-Form** International is headquartered at 1210 Steuben St., Sioux City, IA 51105 Tel: 712-252-3704 Fax: 712-252-3259 Toll Free in North America 1-800-551-3313 website: http://www.liteform.com/ . Email: general@liteform.com

QUADLOCK (Flat Foam forms – install ties yourself) They also have insulated decking for floors and ceilings. Website: www.quadlock.com . Address: QUAD-LOCK Building Systems Ltd. 7398 132nd Street Surrey, B.C. V3W 4M7 Canada Tel: (888) 711-LOCK (604) 590-3111 Fax: (604) 590-8412.

CUSTOM MODULAR HOMES

Avis Homes, Avis, Pa. http://www.avisamerica.com/ Probably the most advance type of modular homes available—with a great deal of customization possible. These are not your normal type of tract home.

STORAGE SHIPPING CONTAINERS (Insulated Reefers) about $2200 plus shipping. Equipment Service Storage 7226 North Loop East Houston, Tx 77028 Tel: 713-674-1082 Dallas Office 214-374-3995. Check locally as well. There are many outlets across the nation for these containers.

DC OR AC ELECTRICAL EQUIPMENT

LOW VOLTAGE LIGHTING SYSTEMS

Lite Touch, Inc One of the premier remote control lighting systems. Great for activating lights and shutters systems remotely—or anything electrical. Tel: 801-268-8668. http://www.litetouch.com/

LINEAR CURRENT BOOSTER (for using solar panels to run a water pump or motor directly)

Sun Selector LCB 20 (about $400) **Abraham Solar Equipment**

DC LOAD CENTER

Alternate Energy Engineering http://www.aeesolar.com/index.htm or talk to **Abraham Solar Equip.**

AC-DC POWER CONTROL CENTER

Trace Power Center Combines all meters, fuses, circuitbreakers, and connections into one unit – code approved. Custom built for each application. Buy from **Abraham Solar or Beselfreliant.com**

DC-AC SOLID STATE INVERTER

TRACE CORPORATION is NOW XANTREX. They are considered by many to be "top of the Line" but energy guru Mick Abraham says they have now become way too complex. So, now he also sells

VICTRON ENERGY BLUE inverters: Check out the differences. Contact Mick at www.abrahamsolar.com

BATTERY EQUALIZER SYSTEM (for combining 12 volt batteries and a 24 volt battery system)

Vanner model 60-50A **Abraham Solar.**

BATTERY MAINTAINERS and DESULFATION

BATTERY WEB **http://www.batteryweb.com/batterymindercomparison.cfm** see this webpage for a run down on all the new battery maintenance technology. Never use a "trickle charger." Trickle chargers do not turn off and on to keep a float charge – they will overcharge the battery and ruin it eventually. Sulphation of the lead plates occurs on all batteries over time. There is one technology that keeps batteries from sulphating and one that can remove sulphation once it occurs.

SCHUMACHER SE-1125 Automatic Battery Charger/Maintainer (keeps battery at a perfect float charge without overcharging) about $25 from Walmart and other auto parts stores.

DEEP DISCHARGE STORAGE BATTERIES

6-volt **Golf Cart Batteries** (about $49 each) cheap source (Costco Wholesale or Sam's Clubs).

Heavy Duty Deep Cycle Batteries for Solar Systems: Go to www.beselfreliant.com

DEKA BATTERS, see: **Abraham Solar** Tel: 800-222-7242.

TROJAN L-16 and L-16HC from Abraham Solar Tel: 800-222-7242.

AGM (absorbed Glass Matt) batteries. Heavy duty, high amperage delivery capacities without ruining battery. **Optima** or **Lifeline** batteries are 2 prominent brands. Check with Abraham Solar or an internet site like http://www.dcbattery.com.

USED SOLAR EQUIPMENT: www.abrahamsolar.com deals in lots of used solar equipment:

HYDROCAPS

These units condense the water vapor out of battery gassing so you don't have to water as often. Get them from **Abraham Solar** 1-800-222-7242.

JUNCTION BOX

For solar array connections – contains SOV lightning arrestor. Model 53-911 from Abraham Solar.

WIRING SIZES (these will varying according to specific installation, but this should give you a general idea for a small to medium installation)

Solar Panels to J-Box #6 stranded copper.

J-Box to APT Power Center or Charge controller: (2) #2 stranded copper, 1 #6 stranded copper for external ground connection.

Battery interconnect cables #2 stranded copper (Abraham Solar) or auto supply stores.

Battery bank (last connection) to Inverter: #2/0 stranded copper, preferrably welding wire.

Grounding cable: 1" wide braided copper.

12/24 VOLT FLUORESCENT LIGHTING

THINLITE Corp For 12 volt systems: use #197 (36" long) or #139 (48"long) fluorescent. For 24 volt systems use model numbers #297 or #239, same cost – about $65) from **Abraham Solar** or local RV supply stores carry Thinlite Products.

WHITE LED LIGHTS

WHITE LED FLASHLITE. Numerous brands available everywhere now.

18 **LED SURFACE MOUNTING LIGHT** "Super Nova" available in 12,24, 36, 48 volts. Abraham Solar at 1-800-222-7242.

12v LIGHT BULBS local RV suppliers)

12 VOLT BATTERY CHARGER

Radio Shack, model 23-139

12 VOLT VENTILATION FANS

Best all-around choice is the DAYTON brand 12 volt fan from WW Grainger Stock # 2C646. About $46, 175 CFM and fairly quiet. A noisier, high rpm fan is by ITT JABSCO BRAND, also sold by **W. W. GRAINGER**, Stock # 4C814 (not for continuous duty – do not run more than 60 minutes at a time. This is an acceptable restriction as this fan will replace all the air in your shelter in less than 10-15 minutes). What makes these fans convenient is their 3" flange which allows you to easily attach it to the vent pipe

shown in my shelter designs. The quieter DAYON fans need to have a flange adapter attached, which you can adapt from sheet metal duct parts available at most home improvement stores.

FUEL STORAGE EQUIPMENT

GASOLINE STABILIZER

Stabil, found at Pep Boys and other Auto Parts stores.

PRI: Proven #1 For Stability. This is the best stuff available. Use PRI-D & G to stabilize stored fuels. PRI-D & G can keep diesel fuel, kerosene, and gasoline fresh in storage. PRI-D & G can actually restore old fuels to refinery specifications. **Yellowstone Trading**: (800) 585-5077 URL: www.yellowstonetrading.com/ .

OCTANE BOOSTER: Gives much better mileage on cars where timing is computer controlled to create maximum compression just short of knocking (most modern cars). It can be found at auto parts stores (helps rejuvenate old gasoline, so keep several bottles on hand for use with old stored fuel. Also keep fuel injector cleaners on hand to eliminate residues from old fuel) Cheapest at Walmart.

DIESEL FUEL STORAGE ADDITIVE

Racor Biocide 1-800-344-3286. An insecticide plus additives to keep diesel fuel from growing algae and other solid organic matter. Call the 800 number to find distributor nearest you. http://www.dieselpage.com/filter.htm

FUEL TANKS (Available in all major cities. See Yellow Pages or check with local Petroleum distributor)

FUEL PUMPS (Check under **Petroleum Equipment** in Yellow pages)

FOOT VALVES Used at the bottom of a suction line. These are available at petroleum equipment dealers or at large plumbing outlets. Here are some sample brands of foot valves.

Simmons model 1402

Merril Series 810, model FV75

Water Ace model RFV75

Brady model SFV75 (plastic)

FOOD STORAGE

NOTES: Best buys in food storage are in bulk dried grains: Wheat, rice, and beans. Due to the shipping weight of bulk foods for storage, it best to buy these items close to home. (Shipping will cost you nearly $40/50 lb bucket, whereas if you can pick it up locally, you save those costs.) You can buy large bags of beans and rice at Cosco and at Sam's

Clubs nationwide. You can buy bulk wheat in many locations in the West, as indicated below. However, in the Midwest few grain growers bag any wheat for consumers. The best bet for people in the Midwest is to join together with a few other families and buy grain in bulk from the grower. Load up your pickup truck with grain, and then package it yourself plastic 6 gallon buckets. Many farmers in the Midwest and Canada have small grain cleaners that can take out the dust and other particles from field grain. Use a spoonful of diatomacious earth per bucket of grain to kill any bugs.

DIATOMACIOUS EARTH

Sprinkle a tablespoon over and into a bucket of grain to kill all weavil. Harmless to humans. Available at any swimming pool supply house. It is used as a filter medium. It is also available at many garden stores since it is an effective pest control item (sprinkled on cabbage or lettuce, etc).

SOURCES OF DEHYDRATED FOODS AND PACKAGED GRAINS

Emergency Essentials Emergency Essentials 165 South Mountain Way Drive, Orem, UT 84058. Website: http://beprepared.com/ . Tel: 1-800-999-1863.

Provident Living: www.Providentliving.com

Montana Chemical Free Wheat Website: http://www.mtmarketplace.com

Lehi Roller Mills Tripple-cleaned hard or soft wheat. Reasonable prices. Contact: (801) 768-4401, Address: 833 E. Main St., Lehi, Ut 84043. Website: https://www.lehirollermill.com/comersus/estore/default.asp?

Walton Wheat Full service chemical free supply outlet for all types of survival foods and equipment. Very reputable. Contact: **Walton Feed** 135 North 10th, P.O. Box 307, Montpelier, ID 83254 Tel: 800-269-8563. Website: http://waltonfeed.com/

NON-HYBRID SEEDS

Territorial Seed Company P.O. Box 27, Lorane, Ore 97451 Tel: 541-942-9547.

Harris Seeds 1-800-514-4441.

Internet sources for hybrid seeds:

http://www.heirloomseeds.com

http://www.organicseed.com

WATER BARRELS

New 55 Gallon Polyethylene http://beprepared.com

MOISTURE AND OXYGEN ABSORBERS (FOR DRY PACKING)

http://www.multisorb.com/

STORAGE BUCKETS

ROPAK WEST Tel 1-800-547-2347 (call to find distributor closest to you).

GENERATORS

SOURCES: Because of shipping weight, the heavier generators are sometimes best purchased from local generator dealers (see Yellow pages). However, always compare price with one of the major mail order generator supply houses. WW Grainger and Northern Tools will supply a wide variety of the cheaper or discontinued generator lines. For the best prices on the high quality units, call **Norwall Power Systems** Lake Havasu City, Az Tel: (520) 453-4494. Website: http://norwall.com/ These people ship all over the world and are experts – very good prices, too. They don't sell any junk, and service all major brands (so they know which ones are best for maintenance, too).

MINI PORTABLES

Small suitcase type gensets, less than 2000 watts, that are super quiet and super fuel-efficient:

Coleman Pulse 1850 (1.8kw) . Best buy of the quiet, small gensets that will run 7 hours day on 1.5 gal of fuel.

Yamaha EF1000 It is only 1kw but it is very fuel efficient and quiet and runs all day on a gallon of gas. Costs double the larger Coleman brand.

Honda EU1000i This is the newest high tech wonder from Honda, but it runs its current through a new high tech inverter – giving excellent sine wave power (but may be a high tech problem in maintenance – and also the most costly).

PORTABLES

There are two classes of generators here: the cheap group with flat-head, side valve, lawnmower type engines, and the more expensive group with longer life overhead cam and valve engines. Starting from the best and most expensive to the cheapest, lowest quality here is how I would rank them (from top to bottom):

Kawasaki GE Series Best maintenance history, rugged engines, pressurized oil system, great bearing surfaces – most expensive.

Honda Delux Series Honda is one of those companies with a high quality line, and a medium quality line (the ECON models – don't confuse them).

Generac EXL Series Generac also has a high and low line. The XL or EXL lines have the pressurized oil system “vanguard” engine or the Honda engine.

Kubota AV Series – excellent machines (Kubota always builds nice engines).

Kubota Diesel Gensets Model GL6500 (6.5kw) about $4500 (Kubota Tractor Dealers).

Generac (cheaper lines)

Winco (cheaper lines)

Coleman Powermate 5kw gas generator – about $500 (cheapest, moderate quality, but most generator for the money).

STAND-BY GENERATORS

Top to bottom in price and quality:

Kohler simply the best in all regards, and most expensive. Rock solid engines and electronics. Kohler transfer switches rarely fail. Available in Gasoline, LP, NG (or all three) or Diesel.

Onan – second best overall, but some problems with electronic reliability in past) all fuels avail.

Hawk Power (Lester Petter diesel engines – English and Mitsubishi gas/lp/ng engines).

Generac II (8K and above are top quality engines) Best Buy for very good quality.

China Diesel Cheapest of the diesel gensets (buy a spare rebuild kit) and very noisy, but has a good reliability record. Recommend the 8000 Watt S195 Engine, 1800 RPM Brushless Alternator, Continuous Duty, Includes Radiator. This company now sells a full line of other standby and marine generators. Call 800-341-7027 or website: www.chinadiesel.com .

SPECIALTY STAND-BY

TRI-FUEL GENERATOR: For the ultimate in multi-fuel use, you can pay more and get a generator set up for three fuels: Gasoline, LP and NG. Onan or Kohler both have these units perfected. Call Norwall Power Systems, Lake Havasu City, Az Tel: (520) 453-4494.

STEAM ENGINES

TINY POWER: http://www.tinypower.com/

5 HP Liberty http://www.thesustainablevillage.com/servlet/display/product/detail/32104

12 HP Steam GENSET
http://www.thesustainablevillage.com/servlet/display/product/detail/30748

Mike Brown Steam
http://www.thesustainablevillage.com/servlet/display/product/detail/29811

BATTERY MAINTAINER

http://www.batteryweb.com/

Schaumacher Battery Maintainer, $25 from Walmart stores, nationwide.

SPECIAL ACCESSORIES FOR GENERATORS

Manual and Auto Transfer Switches for Portable Generators:

Most Generator manufacturers offer a wide variety of these transfer switches. Abraham Solar is an expert on these.

Master Sales Website: http://www.mastersalesonline.com/ Call Toll Free 1-888-917-2244

SILENCING MUFFLERS FOR GENERATORS

HARCO, Inc Portland Oregon. (503) 244-7571. Website: www.**harco**mfg.com Harco has 2 levels of silencers: *Super Critical* (attenuates down to nearly silent) about $175, and *Critical* which is about $140. They also have the same two levels in a "low Profile" unit for small, tight locations. These cost about 25-30% more. All these mufflers are stat-of-the-art silencers, and are very resonably priced. You can afford to stack two mufflers together for super critical needs inside a home. Email at harco1@teleport.com .

HEATING EQUIPMENT

KEROSENE HEATERS

Kerosun DC 100 1-888-537-6786 Most fuel efficient and cleanest burn.

PROPANE WALL HEATERS (VENTLESS)

There are a variety of manufacturers of ventless heaters now. Most home improvement stores carry them. Vanguard is one brand. Another is:

Martin Industries, Florence Al website: www.martinindustries.com. model MIR12 (1-2 burner) MIR18 (1-3 burners) or MIR30 (1-6 burners) I prefer multiple small units spaced around the house for emergency LP gas heat. Also available in natural gas a "BEST BUY."

MULTI-FUEL FURNACES

TURBO HEAT MULTI-FUEL BOILER: Burns almost anything, can change burners http://www.beselfreliant.com/heating/index.cfm

YUKON Multifuel Furnace (www.yukon-eagle.com) Alpha American Co.1000 Ag Science Drive, P.O. Box 20, Palisade, MN 56469 Tel: 1-800-358-0060.

CHARMASTER Products, Inc. http://www.charmaster.com 2307 No. 2 West Grand Rapids, Mn 55744 Tel: (218) 326-6768 (Makes combination wood/oil or gas furnaces and even a furnace with a fireplace front on the side.)

WOODSTOVES

Travis Industries, Inc. 10850 117th Place NE, Kirkland, WA 98033 Tel: (425) 827-9505 Makers of the **LOPI** high efficiency woodstoves, **Avalon** Pellet Stoves & Fireplace Xtrordinair lines of Wood, Pellet & Gas hearth heating stoves.

Avalon Wood stoves and Pellet Stoves Website: Eastcoast: http://www.stoveworksnj.com/

Regency Wood Stoves and Gas Fireplaces. website: www.regency-fire.com . A highly recommended clean-burn stove without catalytic converter.

DIRECT VENT GAS/WOOD FIREPLACES

Heat-N-Glo Website: www.heatnglo.com . 20802 Kensington Blvd. Lakeville, MN 55044 Tel: 888-743-2887. Local dealers almost everywhere.

Regency Wood Stoves and Gas Fireplaces. website: www.regency-fire.com .

DEDICATED WOOD WATER HEATER

AquaHeater, LEHMAN'S item; #59-841; or Domestic Growers Supply (541) 592-3615.

COAL STOKER STOVES

Alaska Coal Stoker Pennwood Stoves, Fireplaces, Etc. West College Avenue, Pleasant Gap, Pa. 16823 Tel: 1-800-598-3995.

AIR TO AIR HEAT EXCHANGERS

XeteX, Inc. 3530 E. 28th St. Minneapolis, MN 55406 Tel: (888) 899-9991 Toll Free or (612) 724-3101 voice mail. URL: www.xetexinc.com (This company has some of the best and most cost effective heat exchangers.)

HOUSEHOLD PREPAREDNESS EQUIPMENT

GENERAL INTERNET ORDER SOURCE

APPLIANCES ONLINE Website: www.appliances.com E-Mail: zupanci@ibm.net Voice & Fax: 440-543-8345. Good, one stop shopping for most small household appliances.

JUICERS

Champion Juicer: (about $215) from most health food stores.

Vita-Mix: About $360. Call 1-800-848-2649 for info.

KEROSENE STOVE

ALPACA (about $79) from Emergency Essentials.

WHOLE HOUSE HYPO-ALLERGENIC FILTERS SYSTEM

http://www.casadavida.com The CVI-series EnviroConditioner controls every parameter of indoor air quality. As an integrated part of the HVAC (heating, ventilation, air conditioning) system, the air in the entire house is processed and distributed through the central air conditioning ductwork. Nothing on the market can compare to the effectiveness of the CVI EnviroConditioner at any price. Very Pricey.

- Pressurizes the house with fresh outside air, exhausts stale air, and utilizes the structure of the building to create a hyberbaric chamber
- Advanced filtration remove overs 99.7% of particulate matter from the air, eliminating dust in the house

- Sterilizes the airstream of virtually all biologicals, destroying viruses, bacteria, molds, mycobacteria, mildew, pollen, animal dander, dust mites, etc.
- Independent laboratory tests confirm the destruction of over 99.996% of viruses and over 99.999% of bacteria
- Eliminates environmental toxicants
- Eliminates odors- gives house a clean, fresh smell
- Eliminates smoke
- Destroys toxic mold

WHEAT/GRAIN GRINDERS-ELECTRIC/MANUAL

EVERYTHING KITCHENS: Online shopping of a full range of all the newest equipment: http://www.everythingkitchens.com/grainmills.html

Grain Master "Whisper Mill" from Emergency Essentials or Waltons.

Magic Mill or **K-Tec** "Kitchen Mill" Same machine Same principle as Whisper mill but mill sits over cannister – holds more flour, less complicated, a little less expensive. Same milling mechanism.

Golden Grain Grinder (conventional type of stone mill motorized grinder) Emergency Essentials.

MANUAL GRINDERS

Country Living Grain Mill http://www.countrylivinggrainmills.com V-groove wheel for quick and easy conversion to electric motor. Cast-iron flywheel for easy turning and smooth flow of flour. Large hopper holds 2 lb. of wheat easy-Dial, self-locking adjustment. Double sealed industrial ball bearings. 30% less torque or energy required to turn than any comparable hand mill on the market. This grain mill is designed to be easily motorized. The fly wheel is grooved for use with a standard V Belt. We recommend using at least a 1/3 HP motor rated at 1150 RPM and equipped with a 1 1/2" pulley. This ratio will produce about 115 to 120 RPM at the flywheel. Other motors may be used, but they will need to be geared so that the RPM at the flywheel does not exceed 140 RPM.

The **Family Grain Mill** is unique in that it offers both a grain mill and a roller mill, as well as a choice of hand-powered or electric, or both. You can mix and match the components any way you want. Grain Mill with hand base or motorized base, Roller Mill with hand base or motorized base . Buy both on the hand base for about $196 from Homestead Products website http://www.homestead-products.com , phone in Oregon: 541-688-9263.

KITCHEN MIXERS

BOSCH Unviersal Kitchen System

K-TEC "Champ" Delux model with all attachments www.everythingkitchens.com/**k-tec**blender.html . The Champ Mixer is the most versatile multi-function home food preparation machine available today. The Champ combines the features of a strong 1400 watt, 1.8 peak horsepower motor with a sophisticated, keypad-controlled computer "Bread Brain." The Champ computer assists the cook by measuring the resistance of the developing gluten in the bread and turns off the machine once it has developed perfectly. The Champ is also the strongest blender on the market. Our blender jar is made of GE Lexan plastic, the same material used in bullet-proof glass. The most popular attachment is the pasta maker/meat grinder combination.

PRESSURE CANNERS

All American is now producing the model 941 (41 quart) pressure canner. **Smithfield Implement** in Smithfield, UT has them in stock. If you need another source on home canning see http://www.home-canning.com. **http://www.pressurecooker-outlet.com/americancans.htm**

PEELER

Apple, Potato Peeler (about $30, plus $12 for potato attachments) Emergency Essentials.

SMALL CONVENTIONAL REFRIGERATOR (most energy-efficient)

Magic Chef ct-1511AE (15 cubic ft) uses 1.2 kw/day $37/year.

LARGE CONVENTIONAL REFRIGERATOR (most energy-efficienty)

Kitchen Aid, Whirpool, Kenmore 25 cu. ft. side-by-side use 1.75 kw/day or $54/year.

ALTERNATE ENERGY REFRIGERATORS

SUN FROST: www.abrahamsolar.com

SOLARFRIDGE: 19 cu. ft. (12 volt fridge) Better alternative to SunFrost but same high price. ($2,700) **Simpler Solar** 3118 W. Tharpe St.Tallahassee, FL 32303, website: www.simplersolar.com or call 1-800-248-9786. Two models of fridges use .5 and .7 kw/h for the 6 and 12 cu ft models.

KOOLATRON – small non compresser technology – about 2 cu. ft., 4 amp 12Vdc icebox. Available at outdoor stores.

Kool Mate 40 by **Igloo.** Another thermoelectric cooler like the Koolatron – sits upright or on its side so as to operate like a small fridge.

PROPANE OR KEROSENE REFRIGERATORS

NORCOLD: 2 way and 3-way 7.5 cu. ft. Propane fridge model 1082,

DOMETIC 7.5 cu. ft. propane fridge (same as Servel brand from Sweden) – about $1,200. Can also buy these with 120volt backup power, or in natural gas or kerosene. Most RV suppliers are Dometic distributors.

FOOD DEHYDRATORS

Magic Aire II On-Line Health Products 387 Yellowstone Ave., Pocatello, Idaho 83201 (800) 789-1577 or (208) 234-9352 http://www.dhi.com/ .

Air Preserve II On-Line Health Products 387 Yellowstone Ave., Pocatello, Idaho 83201 (800) 789-1577 or (208) 234-9352.

Harvest Maid (Available at many preparedness stores listed at the beginning.)

WATER DISTILLERS

Genesis 20-G3000 (about $250). This is a portable model, counter-top. **Optimal Health Concepts** 355 N. Lantana Street, Suite 730, Camarillo, CA 93010-9030. 24 hour Orders: 888-390-4676 http://intohealth.com/ This company sells a lot of excellent health products.

PORTABLE WATER FILTERS

PUREFLOW 2000 will remove bacteria, giardia, cryptosporidium, chlorine, chlorine byproducts, volatile organic compounds (VOCs), trihalomethanes, pesticides, herbicides, tastes, odors, and more. PureFlow 2000 purification starts with our highly efficient clean able ceramic microfilter which provides genuine sub-micron filtration. After all signs of bacteria and ultrafine sediment are removed, the PureFlow 2000 passes the water through a highly dense solid block of extruded activated carbon. Chlorine removal for 20,000 gallons (76,000 liters) of water at 1ppm chlorine. The PureFlow2000 “Plus” is the same System with a 3rd Filter for heavy debris URL: www.**Supplies4Y2K.com** Tel: (406) 375-9282 Mail: 610 N. 1st Street, Suite #5-150, Hamilton, MT 59840 USA.

BREAD MAKERS

Zojirushi V-20: order online from Costco for the best price about $145 www.costco.com . See a product review of all the breadmakers at http://www.sonic.net/webpub/bread-machine/breadmachine.html

BREAD MIXERS

BOSCH mixer: This unit is the Cadillac of all combination units. There is no higher quality unit around. The unit with all the attachments, including everything imaginable, will run you several hundred dollars. Available at hundreds of online stores.

HIGH EFFICIENCY APPLIANCES WASHING MACHINES

Staber 2300 washing machine uses 1 oz., of soap, 21 gallons of water (saves 25 gallons/load), less than 200 watts per load. Spins faster, most of the water is removed. It is a toploader and the clothes go through a door in the rotating drum – not as convenient to load or unload because of the small opening. See **Abraham Solar** 1-800-222-7242.

ASKO The best of the current models http://www.askousa.com / Swedish import—top of the line Euro appliances. Also very high priced

MAYTAG Neptune Mod #MAH3000A. The matching Neptune dryer model MD3000A. Model number for Neptune Super Stack washer/dryer combo is MUE for electric dryer,

and MUG for gas. Neptune washer uses 22 gallons of water per cycle instead of the old average amount of 38 gallons per cycle. Spin speed is 800 rpms on the old and 850 on the new. Because of the larger tub size on the Maytag Neptune, less rpms are required to extract the same amount of water as other brands. Use HE (high efficiency detergents) about $1,100.

FRIGIDAIRE (also Gibson) Front Loading Washer FT449GFS – spins up to 850 rpm dryer FSE748GF (matching front load). Low Price: $800 (best buy) also is a true under-counter model. Floor models can be stacked for convenience and without buying any extra cabinet.

MANUAL WRINGER WASHERS

The James Hand Washer is the washer of choice among those who wash by hand as a way of life. Its unique lever action makes agitating the clothes so easy a child can do it. It has a stainless steel tub and a wringer so efficient that it gets out twice as much moisture as spin drying. Very well-made and durable. Wringer can be bought separately for $130.00 The company that makes these will sell directly to you. Contact **S & H Metal Products Inc**., 122 Redman Dr, Topeka, IN (219) 593-2565. Or you can buy through Lehman's catalog,

MANUAL CLOTHES WRINGER

Buy a Chamois [chammy] wringer at auto supply stores for about $160 [Champ Catalogue item #J9-213] and mount on a 30 gal barrel. This is too high a price in my opinion. I would get the James washer wringer, instead. You can buy it directly from several other small outfits that carry them. Call the manufacturer, **Lake City Industries** at (814) 774-9616 to get a list of the nearest local source to you. It is called the #76-3 Hand Wringer.

PORTABLE COOK STOVES – KEROSENE

ALADDIN stoves carry the most complete line of kerosene heaters and stoves.

The **ALPACA** is great if you need something stronger and simpler than a backpacking stove. It's very sturdy and will take as large a pot as you care to put on it. Extremely simple, reliable design, with a minimum of moving parts to wear out. Fuel tank holds 0.9 gallons and has a fuel level gauge. Runs for 16 hours on a filling. Output 8,500 BTU; weight 13 lbs; size about 13" high x 13" diameter. There are many foreign models as well, since Europe and South America use kerosene extensively. PRIMUS is perhaps the largest foreign model.

WATERLESS COOKWARE

VOLLRATH: The heaviest and the best. The **Vollrath Company**, L.L.C., Tel: 1-800-624-2051, Fax: (920) 459-6570 website www.vollrathco.com .

LONG LASTING 130V LIGHT BULBS

FEIT ELECTRIC LA, CA lasts 14,000 hours and costs only a little more than standard bulbs – best buy on the market from home improvement stores.

COMPACT FLOURESCENTS

GE brand. They will run better off an inverter than other brands.

SUNPIPES

1,500 watts of free, fresh light as easy to install as stovepipe. Hollow, super-reflective pipe runs from your roof down to a translucent ceiling fixture that spreads the light down. Natural, full-spectrum light without glare, heat, or uncomfortable hot spots. Less expensive and easier to install than a skylight. Doesn't build up unwanted summer heat, create condensation, sun-fading problems, and won't leak.

KEROSENE LAMP AND PROPANE LANTERNS

Rapid Kerosene Pressure Lamp uses pressurized fuel and a mantle to generate 500 lumens (300 watt light bulb). Burns 10 hours from one-third gallon kerosene (one filling).

Petromax Multi-Fuel Lantern $120 from Homestead Supply. This German beauty is the cadillac of lanterns. Burns all liquid fuels, nickel finish, very classy. Puts out tremendous light. See: www.petromax.com

Dietz Wick-Oil Lamp The best of the old fashioned wick/oil lamps – beautiful and inexpensive. **Lanterns Online**, http://members.tripod.com/~timcallen/lantern/index.htm .

Humphrey Propane Lamps The oldest and best company http://www.thesustainablevillage.com/servlet/display/products/byCat/7/29/170

FULL SPECTRUM COMPACT FLUORESCENT

Sun-A-Lite Compact fluorescent replace screw-in bulbs with total spectrum, radiation-shielded fixtures.

Excella Full spectrum fluorescents 20 watts to 40 watt tubes

All home improvement stores now sell full sprectrum fluorescents now.

FEATHER QUILTS, BEDS

The Company Store: http://www.thecompanystore.com 500 Company Store Rd, LaCrosse WI 54601, Tel: 1-800-356-9367.

RESIDENTIAL ELEVATORS

Lift-Avator 435 Park Ave, Lockport, NY 14094 Tel: (716) 434-1300. URL: http://www.stair-ease.com

Tri-State Elevators at http://www.tri-state-lift.com shows 4 or 5 of the most common residential elevators. Tri State Lift 1414 South Oak Street Owatonna, MN 55060 Toll Free Call: 1-800-626-6017.

NUCLEAR PROTECTION EQUIPMENT

RADIATION METER

Victoreen 717 surplus survey meters. Range 0-500 rads, comes with detachable ion chamber so you don't have to buy a separate probe to take measurements outside the shelter. Uses 1 "D-Cell" battery. Simple, low tech, reliable. These are not in production, unused in new condition. Have not been calibrated since production. Calibration will usually drift 10-20% at the most, which is not critical for the high dose measurements you would make in a nuclear war. KI4U website: http://www.radmeters4u.com/

CALIBRATION NOTE: Meters can be recalibrated if necessary by sending them to KI4U.com or Jordan Nuclear, 3244 Arroyo Seco Ave, L.A. CA 90065. Call for rates: 1-(323) 222-8143. Mgr: Ed Manughian

Dosimeter Corporation model 3510. Range 0-3000 rads. Probe is extra. Top of the line quality. Contact Tel: 1-800-322-8258.

KFM kit meter (Under $20) order from **Emergency Essentials**, Orem Utah. (1-800-999-1863).

NUCLEAR BIOLOGICAL, CHEMICAL (NBC) FILTER SYSTEM

Model **LUWA 180**, about $6,000 – super expensive. US Rep. for the Swiss Luwa Corporation is Sharon Packer, **Utah Shelter Systems**, PO Box 638, Heber, Ut 84032 or on the web: http://www.disastershelters.net/

MILITARY NBC ROOM FILTER

This unit is US made for the military and much cheaper than the LUWA. More importantly, it can be mounted outside your shelter where the particles trapped in the filter won't radiate your shelter.

HUNTER MFG:
http://www.huntermfgco.com/homedef/protectivefiltrationHF100C.htm
Model HF100C 100-cfm NBC Filter Canister Price: less than $2,000 Features: 100-cfm airflow Self-contained canister ASZM-TEDA carbon media Modularity allows for multiple filter applications Horizontal or vertical installation The HF100C is the civilian version of the US Army M48A1 100 cfm gas and particulate filter canister manufactured by Hunter.

ALTERNATE AND CHEAPER NBC FILTERS (HEPA SPECS)—for light duty

Order all **3 Replacement filters** for a Honeywell "Enviracaire" model #63200 filter unit:

1. Replacement HEPA filter (down to 3 microns) (#28600) about $90
2. Replacement CPZ filter (#36200) about $90
3. Replacement charcoal Pre-filters (pkg of 2) – (#34002) $20

WW GRAINGER carries the HEPA and the CPZ filter, but not the charcoal pre-filters. Here are the Grainger stock numbers: HEPA FILTER: 3GD14, CPZ FILTER: 3GD18

12 VOLT FANS

ITT JABSCO, model 35115-0020

WW GRAINGER stock # 4C814 Note, these are plastic blowers, high RPM 4200, hence noisy. These are not meant to be run on continuous duty (for continuous duty fan, order stock #2C646a 12 volt, 176 CFM). 110volt fan (141 cfm) for ventilation under normal power, buy unit number 2C916.

Round **AUTO AIR FILTERS** to place over shelter air inlets, about $5 each. available at auto supply stores.

EMP PROTECTION

EMP PROTECTORS

Zero Surge: The newest instantaneous clamping technology. Use for all your valuable plug in products like computers. ZeroSurge 944 State Route 12, Frenchtown, NJ 08825 Tel: 800-996-6696 Email: sales@zerosurge.com URL: www.zerosurge.com .

Alpha Delta Communications P.O. Box 620, Manchester, KY 40962 Tel. 606-598-2029 Products: Coax lightning arrestors, coax switches with surge protectors. http://www.alphadeltacom.com/

Ameritron, Louisville Road Starkville, MS 39759 Tel. 601-323-8211 Products: Remote coax switches, inrush AC current protector. http://www.ameritron.com/

ICE: Industrial Communication Engineers, Ltd. Website: http://www.iceradioproducts.com/ P.O. Box 18495, Indianapolis, IN 46218-0495 Tel. 317-545-5412 Products: Coax lightning arrestors suitable for EMP.

Polyphaser Corp. P.O. Box 9000, Minden, NV 89423-9000 Tel. 702-782-2511 Products: top of the line military grade EMP protection equipment. Prime source of all US government equipment, but expensive. Check with ICE first.

GROUNDING STRAPS, ETC

Certified Quality (**The WIREMAN : http://thewireman.com/index.shtml**) 261 Pittman Rd., Landrum, SC 29356 Tel. 800-727-9473 (orders), 803-895-4195 (Tech line) Products: The Wireman stocks copper wire up to #4 AWG, 2-inch flat copper strap, 8-foot copper-clad ground rod and 1 x 1/4 inch bus bar.

Rohn Towers P.O. Box 2000, Peoria, IL 61656 Tel. 309-697-5612 Products: Radio towers mostly, but also copper strap and tower grounding products. Rohn products available through Amateur Electronic Supply or Ham Radio Outlet (listed in radio section)

FALLOUT SHELTERS

PREFAB CONCRETE TANKS (use for burial underground)

Oldcastle Precast (Custom precast waterproof concrete tanks – Address: 2820 A Street, SE, Auburn, WA 98071-0608 Tel: (253) 833-2777 Fax: (253) 939-9126 Website: www.oldcastle-precast.com Toll free: (888) 232-6274. They have local manufacturers all over the USA.

UNDERGROUND STEEL TANK-TYPE FALLOUT SHELTER (using 8' round steel culvert pipe--about $10,000 to build)

Utah Shelter Systems P.O. Box 638,-Heber, Ut 84032 (Sharon Packer (801) 942-5638). http://www.disastershelters.net/

Storm Chaser Shelters http://www.stormandtornado.com/ 1200 Lawson Road, Fort Worth, TX 76131 Tel: (817) 847-9000.

Do-It-Yourself Plans for tank type shelters from Art Robinson, **Oregon Institute of Science and Medicine**, 2251 Dick George Road, Cave Junction, Oregon 97523 Tel: (541) 592-4142.

BASEMENT FALLOUT, SECURITY SHELTERS
see "*The Secure Home*" by Joel Skousen URL: www.joelskousen.com/secure/

CONCRETE BLOCK SHELTERS with stack block roof, built into existing homes – see "*How To Implement A High Security Shelter in the Home*" by Skousen, http://www.joelskousen.com/Secure/reports.html#HS

STEEL PLATE SHELTERS, CUSTOM OR PREFAB

SAFECASTLE http://www.safecastle.com/home.php

CO2 MONITOR

Tells you if carbon dioxide from occupant breathing activity is getting too high. Elevated CO2 will cause problems before you run out of oxygen. This unit also senses Oxygen levels too: Industrial Scientific, model CMX271. About $1200, $600 used or repaired.

http://www.plccenter.com/buy/Industrial+Scientific/CMX27

DRY FLUSH PORTABLE TOILET

Porta-John Systems, Inc. A Waterless Toilet. This portable, free-standing toilet doesn't use any water, but dry suctions everything into a bottom compartment lined with a plastic garbage bag. After 30 flushes, simply remove bag.
http://www.toilets.com/products/waterless.htm

ELECTROSTATIC CARPET SWEEPER

FULLER BRUSH sales Item # 101 – Price $49.99. Check with your local Fuller Brush salesperson. Many have internet sites such as http://www.hfbd.com /

PLUMBING SYSTEMS

COMPOSTING TOILETS

BIOLET mini-composting toilet. Finally a composter about the size of a regular toilet! www.biolet.com Tel: 1-800-5biolet (US) 800-6biolet (Canada)

CLIVUS MULTRUM II for large unified system, using special toilets. Will compost continuous use for multiple people and also kitchen waste. Large size, must be sited in a basement area.

SUN-MAR CENTREX PLUS moderately small sized for placement in bathroom. Works on AC or DC power, automatic controls available. From $1,200-1,800 depending on options.

GREYWATER SYSTEM

EARTHSTAR Greywater Systems Automatic operation, sand filter with backwash cleaning. Available at Sustainable Village:http://www.thesustainablevillage.com/servlet/display/product/detail/28514

GREYWATER FILTER

Filter and tank, with DC or AC pump Sustainable Village, see above.

BIODEGRADABLE LAUNDRY DETERGENT – must use with grey water so as not to damage plants. **Real Goods http://www.gaiam.com/**

SANITATION EQUIPMENT

Chemical Toilets: ($20-50) available at camping and RV stores.

Marine Toilets: --My preferred manual toilet recommendation for shelters. These toilets have a manual pump that will pump waste up a 1-1/2" pipe as high as 6' allowing use in basement shelter systems where one must connect to existing plumbing drains at ceiling height. JABSCO brand, call 1-714-545-8251 to find distributor nearest you. Available at yacht and marine supply stores – order model #29120-2000 for the larger, elongated bowl.

Dry Flush Toilet: Porta-John® Systems, Inc. 50633 Ryan Road, Utica, Michigan 48317 Tel: 1-888-PORTA-JOHN (1-888-767-8256).

POTASSIUM IODATE TABLETS Take after any nuclear incident to avoid thyroid contamination by radiative iodine uptake. www.KI4U.com

HYDRAULIC RAMS

Here's an explanation of how they work: http://www.p2pays.org/ref/01/00971.htm

Columbia Hydraulic Ram contact: **Skookum Co**. Inc. 8524 N. Crawford St. Portland, OR 97203.

Pacific Hydro Corp. 400 Forbes Blvd. San Francisco, CA 94080

Rife Hydraulic Engine Mfg. Co. 316 W. Poplar St., P.O. Box 790, Norristown, PA 19401 Tel: (717) 740-1100 Fax: (717) 740-1101 Email: rife@epix.net .

Highlifter Pumps and B & L Hydraulic Rams (cheaper and simpler) from **Abraham Solar Equipment.**

HIGH EFFICIENCY CONVENTIONAL WATER HEATERS

Vaughn Manufacturing Corporation, 26 Old Elm St., P.O. Box 5431, Salisbury, MA 01952-5431 Tel: (978) 462-6683 (R-18 Urethane insulated, hydrastone-sealed tanks for long life).

Rheem/Rudd -Marathon Non Metalic tank – should last a lifetime. Electric only. (available from all Rheem/Ruud dealers) R-20 urethane insulation. The Imperial Plus line of standard water heaters are 10 year warranty R-20 units) see URL: www.rheem.com.

WOOD WATER HEATERS

AquaHeater Lehman's also sells a stand-alone water heater (their "System Two" unit) which is an AquaHeater that heats hot water in only 12 minutes without electricity! It provides a continuous supply as long as the fire is maintained. After the fire goes out, the insulated tank keeps the 10 gallons of water hot for hours. It produces up to two gallons of water per minute. http://www.lehmans.com/

LOW SURGE SUBMERSIBLE WELL PUMPS

Grundfos Variable Speed 3 inch submersible pump. Check www.us.grundfos.com .

12 OR 24 VOLT SOLAR CIRCULATION PUMPS

Grundfos: www.us.grundfos.com Available through most plumbing distributors.

FLEXIBLE PLASTIC PIPING AND MANIFOLDS

There is no better plumbing system for the do-it-yourself plumber than plastic pipe systems. You used to have two choices. One was polybutylene. It is very flexible and freeze resistant since it will expand rather than split or break. There has been a lot of bad press given to polybutylene due to the occurance of leaks in the older systems (almost always at joints with plastic fittings that cracked under improper clamping). This pipe will soon be replaced by the following improved version:

POLYETHYLENE PIPE (PEX)

This is the newest type of plastic pipe that is on the market. It appears to be stronger and more chemical and heat-resistant than polybutylene. It also uses the new manifold type plumbing junction connections like polybutylene. It is a little more expensive, however. See URL www.vanguardpipe.com for details. Available at all plumbing supply stores.

WATER TANKS

There are several types of plastic water tanks on the market – all of them preferable to steel in the small to medium sizes. The white tanks are POLYPROPYLENE, colored

tanks are usually POLYETHYLENE, and black tanks are ABS plastic. FIBERGLASS tanks are used for the larger reinforced tanks and are not suitable for stored drinking water due to chemical outgassing. I will not list individual suppliers here because these are obtained locally in every rural farm community in the country, including the entire East Coast. Check the Yellow Pages for "tanks" or "water tanks."

Kolaps A Tank (bladder type collapsable tank, useful for hauling water in a pickup, and for temporary storage. It will even act as a giant solar water heater.
http://www.burchkolaps-a-tank.com/

RADIO EQUIPMENT

All of the following equipment is available from **Ham Radio Outlet** or **AES** – the two biggest mail order radio stores – contact info at beginning of section.

FAMILY BAND RADIO

No license required, 1-2 mile range, low powered – like a walkie talkie, only higher quality. Available at electronic and radio stores locally--these are the best buy alternatives in radio. Best deals at **Costco**

CB RADIO

40 Channel: **Radio Shack** (NO LICENSE REQUIRED).

SHORT WAVE RECEIVERS Portable

Sony ICF-SW100s The ultimate in miniature-sized world band receiver (size of cassette)

Grundig Satellite 700 best sound of the high-end, full sized portables.

Sony ICF-SW7600G Best buy of the medium-sized, fully capable receivers.

Note: I do not recommend the Baygen (Freeway brand) wind-up radio, unless you must have the wind-up option. The radio receiver is not a high quality unit compared to those listed above. Even the sub-$100 name brand SW radios are superior.

HF TRANSCEIVERS (transmit and receive; compact and portable} – MUST HAVE HAM LICENSE. The 4 major manufacturers, **Yaesu, Icom, Kenwood, and Standard** all put out extremely high quality products. Each have a similar range. If you aren't going to get deep into ham radio (which requires a lot of study and time), choose an HF transceiver that has the minimum features plus a built-in antenna tuner. These will cost between $1,200-$2,000. Don't go for the top of the line models as they are very complex and hard to remember how to use.

Kenwood TX-50S 12 volt Portable: can be mounted in a vehicle.

Kenwood TS-850S/AT Desktop model: built in antenna tuner.

UHF, VHF radios, portable base station, dual band, plus capable of acting as a repeater

Kenwood TM733 (2m/440mhz)

HANDHELD PORTABLE

(2m/440mhz) **Kenwood** TH-79A

ANTENNAS

Car mount: **Diamond** NR-72BNMO, base station Diamond X-200A.

CB antennas, car mount. **Radio Shack**.

MOBILE HF ant: **Outbacker Perth**. Vertical Home base ant: **Cushcraft** R7.

Short Wave Antenna for your portable: SWL antenna , **Ham Radio Outlet.**

SCANNERS

Hand held, continuous coverage: **AOR AR1000XLT** .

Desk top: **Bearcat 8500XLT** 500 channels, not continuous coverage of all frequencies.

Antenna for Scanners: Home base station: **Diamond D130.**

SECURITY EQUIPMENT

SPECIALTY METAL HATCH DOORS The biggest and best company to supply all types of specialty hatch doors (roof, floor, and wall hatches) is **Bilco door** – long known for their sloping basement/tornado shelter doors. URL: www.bilco.com The Bilco Company, P.O. Box 1203, New Haven, Connecticut 06505 Tel: 203-934-6363.

WINDOW WELL SECURITY

The Improvement Network (www.windowwell.com) markets a full range of lexan plastic window well covers for emergency escape and security against entry. Tel: 888/934-6776.

HURRICANE RESISTANT WINDOWS

Jarrett, Inc, Full range of custom hurricane-proof windows made to order, set in traditional window frames. http://www.jarrett-windows.com/Other_Specialties.htm 1-800-533-5097 .

PROTECTIVE FILM

Shatterguard Unbreakable backing to standard glass – can be applied to existing windows. Makes windows bullet-proof to small caliber (.22) weapons and makes windows inpenetrable to intruders. www.shattergard.com. You can also use this on car side and rear windows to keep thieves from breaking in, which is *highly* recommend. http://www.shatterguard.com/wellsfargo.html

STEEL UTILITY DOORS:

SteelCraft. This company makes the heaviest guage production doors available. You can get both B14 doors and 14 guage frames which are bullet-resistant to some small .22 or 25 caliber arms. This is the door I spec for my gravel fill option, with two deadbolts for providing the least expensive secure door for a shelter. It is bullet proof for all

normal handgun loads. To order the lock prep option, specify opt. 161. Contact: SteelCraft 9017 Blue Ash Road, Cincinnati, OH 45242 Tel: (513) 745-6400 or Toll Free: (800) 243-9780

VAULT DOORS

Liberty Safe Co. Springville, Utah Tel: (801) 489 8550. They have local dealers around the country. These are for high security doors on safe rooms. See may High Security Shelter report (appendix) for installation details.

LIGHT WEIGHT VAULT DOOR for retrofit onto a closet or security room:

AMSEC Model VD8030 Door opening: 77-1/2" H x 26-1/2"W Weight: 550 lbs. American Security Products Co. 11925 Pacific Avenue Fontana, CA 92337 Tel: 1-800-421-6142.

BULLET-PROOF DOOR

Amweld series 1544, bullet resistant to Level 3 (high powered handguns) about $1,500 including high security locks. Amweld Building Products, Inc.,1500 Amweld Drive Garrettsville, Ohio 44231 Email: info@amweld.com Tel: 1.330.527.4385.

Trussbilt level III and level IV ballistic protection available. Trussbilt's detention hollow metal products are used in prisons, jails, juvenile facilities and detention centers worldwide. http://www.trussbilt.com/html/detenholmetoverview.htm

ARMORED STEEL PLATE

Custom ordered for door sized 5/16" tempered steel – level 4 protection – 7.62 high velocity military rounds). Order from **Heflin Steel** Phoenix, Az Tel: 1-800-528-4021 or local 252-8061. Attach this plate to a **SteelCraft** Series B-14 door with pour-in-place F-14 steel frame (for 8" concrete. If you are near a large city in the East, call around to see if any steel distributors carried tempered steel or armored steel plate.

SECURITY CLOSET DOOR

Total Door http://www.totaldoor.com/DesktopDefault.aspx

BULLET-PROOF PANELS

(Kevlar fiber building panels for protecting walls) .

BULLDOG DIRECT: http://www.bulldogdirect.com/directory_frame.html

ARMORCO http://www.armorco.com/shop/item.asp?itemid=242

KEVLAR REINFORCING PANELS AND WEBBING FOR HOMES

4X8 KEVLAR/FIBER PANELS. Use webbing to create an earthquake or tornado-proof room or closet in the home. Nail special kevlar webbing crosswise (X-pattern) around home or walls to make powerfully rigid shear walls. Also binds home down to foundation. Tape is 3" wide in 100 foot rolls and about the thickness of a nickel. --Very strong stuff.

New Necessities 5710 Pebblebrook Trail Gainesville, GA 30506 Tel: 770-844 URL: www.millibar.com. (Currently, 2006, it doesn't look like they are doing business). **Use Spectra Shield by Bulldog Direct, above**

BULLET-PROOF FABRICS, VESTS

BulletProofME.com (Nick Taylor) Brand-name bullet proof vests and body armor accessories at discounted prices. Very reliable source you can trust. URL: http://www.BulletProofME.com .

Bulldog Direct P.O. Box 8561 Cincinnati, Ohio 45208-8561 Tel: (513) 281-6700 Website: http://bulldogdirect.com .

BULLETS:

http://www.cheaperthandirt.com/ammo.asp

SPOTTING SCOPES, TELESCOPES

For a great place to buy binoculars, spotting scopes, telescopes, and accessories, try Eagle Optics at www.eagleoptics.com or call 1-800-289-1132

SOUND PROOFING FINGER FOAM (for Underground Shooting Ranges)

SONEX by Ilbruck Inc, 3800 Washington Ave North Minneapolis, Mn 55412. Tel (612) 521-3555. Website: http://www.sonexfoam.com/

GATE OPENERS

The latest technology uses hydraulic actuators instead of gear motors.

STANLEY full range of residential and commerical gates and opening types (available nationwide) call 1-800-STANLEY for distributor info.

Mighty-Mule Gate Openers: GTO Inc. 738 Capital Circle NW, Tallahassee, Fl. 32304 Tel: 1-800-543-4283.

ROLLING SECURITY SHUTTERS

ALL SEASON ROLLING SHUTTERS: These people have the best product on the market now. **http://www.allseasonshutters.com/**

Roll-A-Way offers rolling or accordian shutters in Aluminum, PVC, or clear Lexan. email: info@roll-a-way.com **Rollaway National Headquarters** 10601 Oak Street NE, St. Petersburg, FL 33716 Tel: (800) 683-3230 (888) ROLLAWAY.

Rolsafe URL: www.rolsafe.com 5845 Corporation Circle Fort Myers, FL, 33905 Tel: (941) 694-5400 Fax: (941) 694-8000 Toll Free: 1 800 833-5486

Rolladen: Top of the line, most expensive system, aluminum, PVC rolling shutters. Rolladen also produces working colonial security shutters. Tel: (800) 748-8837.

SECURITY SYSTEMS

GE SECURITY PRO:

Security Pro 6000 (Another ITI company for wireless or hardwired connections) URL: http://www.gesecuritypro.com/NorthAmerica/residential/product.cfm?ProdID=5&ptID=1 .

The Security Pro® 6000 can deliver as much security as you want. It starts out as an attractive entry-level system, but its unique design lets you upgrade it easily--at your pace--so you never have to pay for more system than you want. Add powerful options like wireless sensors that check their own operation so you always know whether the system is working properly. Add light control for added security and convenience. Add telephone control for remote operation, audio verification for false-alarm prevention. Add the peace of mind of numeric paging in emergencies and you'll see what makes the Pro 6000 one of the most valuable additions to any home or business.

HONEYWELL: Used to be **APEX** (*hardwired*) Advantage has the latest in voice prompting technology (voice tells you where intrusion is). It also has numerous control features included which allow you to control lights and equipment automatically. See the 6100 or 6100-wt Security panels at URL http://www.security.honeywell.com/hsce/products/control/bu/ap/11796.html .

ADT Pro Custom: (***hardwired or wireless***) ADT is the largest national chain of alarm systems. The ProCustom system has most of the features that the Honeywell/Apex system has, including voice annunciation and being able to check the whole house from any master keypad. 1-800-238-3009 or www.adt.com. Check out the entire listing and description of all the different types of security devices you can order: http://www.adt.com/resi/products_services/browse_system_components/component/?subCategory=71&categoryId=71

RETARDANT SPRAY

Sprays for shingles, wood siding, cardboard – almost everything. Water-based, non-toxic, safe.

Flame Stop: http://flamestop.com/?source=google

Cold Fire: http://middlebury.net/coldfire/

Flame Seal Products Inc. 4025 Willowbend Blvd. #310, Houston, TX 77025 Tel: 713 668 4291 URL: www.flameseal.com .

SECURITY COMPONENTS, MAIL ORDER

Mountain West Supply Co. 9405 E. Doubletree Ranch Road, #B234, Scottsdale, AZ 85258 local Tel: 602-971-1200 Toll Free: 1-800-528-6169.

Security Base.com www.securitybase.com .

INTERCOMS with Cameras

NUTONE get their top of the line unit, with remote listen in, plus up to 10 cameras. http://www.nutone.com/product-category.asp?CategoryID=701

VEHICLE ALARM SYSTEM Add-on type

Mobile Alert Vehicle Security System: Radio Shack.

Optima II (monitors vehicle electric system for any turn on, or motion) from a variety of online sources. Sample: http://www.guarddog.net/aalarm.htm .

HIDDEN VIDEO CAMERAS

Security Base Phone: 1-800-616-0213 URL: www.securitybase.com (has the widest selection of covert video cameras. Look under "CCTV").

VIDEO MOTION DETECTION

Quark manufactures a complete line of Video Motion Detectors, from lower resolution (generally indoor use) 8, 12, and 18 channel devices (the Q-line) to enhanced 4 & 8-channel unit (the ESP-line) to the NET-line of 4 & 8 channel high resolution devices. URL: www.quarkdigital.com 1 800 327 5616.

DTS-1000 A more expensive commercial lineup of equipment to allow computers to detection intrusion and motion from a video surveillance camera. Website: http://www.magal-ssl.com/products/?pid=22

MICROWAVE FENCE AND PERIMETER DETECTION

SouthWest Microwave http://www.southwestmicrowave.com , Tempe, Arizona. INTREPID system – uses coax cable and sensor to detect any vibration (3 yards accuracy) on fence from climbing. Their MICRONET system is even more accurate and displays to a computer screen with map of your property layout.

SAFES

LIBERTY SAFE CO Builds gun safes and vault doors for home installation. Springville, Utah (801) 489 8550 (also builds National and Remington brand safes). http://www.libertysafe.com/

FLOOR SAFES

Hayman Safes (Website: www.haymansafe.com)

Adesco Floor Safes (Website www.adesco.com)

SURVEILLANCE AND ANTI-SURVELLANCE EQUIPMENT:

Electromax International Inc. 11140 Westheimer, #276, Houston, Texas 77042 Tel: (281) 531-7437. Check out the full range of high-tech equipment available for surveillance and for counter-surveillance work. http://www.electromax.com/indexreg.html .

DRIVEWAY MONITORS

DWA-3 Suitable for burying beside driveway – so you won't have to dig up asphalt or concrete drive. ($200) URL: www.drivewayalarms.com .

GARAGE DOOR OPENER ENCRYPTION

These systems rotate the codes on your door openers so they cannot be reused by a burglar who uses a special electronic eavesdropper to record your code. All new garage door openers come with this system built-in. **Code Encrypter Plus**, or Code Encrypter II, by **RCI Automation,** (619) 484-6307 URL: http://ourworld.compuserve.com/homepages/rciautomation/p4.htm .

STRESS FLOOR DETECTORS

Pressure sensors for use under flooring or roofs or under decks of boats for marine security.

PULSORS (8000 series) by Sure Action, Inc URL: www.sureaction.com .

GPS VEHICLE LOCATORS

To protect against auto theft or carjacking and kidnapping in your own vehicle. Small transmitter is hidden in vehicle which allows a GPS signal to alert a North American tracking company of the vehicle location.

Aertrax Vehicle Locator Address: **AerComTec International**, 1359 Silver Bluff Rd., Suite G-5, Aiken, South Carolina 29803 Tel: (803) 649-2900. Available from many sites online: Sample: http://www.spysupplystore.com/aertrax.html

ROOM FOGGER

Smoke Cloak fogs the room in seconds with a dense, non-toxic glycerin-based fog that dissipates with no residue. This is an excellent passive defense against mobs or vandals entering the home. **Smokecloak** Ltd., 10 Cochran Close, Crownhill, Milton Keynes, MK8 0AJ, ENGLAND Phone : 44 (0) 1908 567007 URL www.smokecloak.com Email: sales@smokecloak.com .

HIGH SECURITY DEAD BOLTS

Medeco: Has special pins and key that rotates the lock tumbler pins to prevent picking URL: www.medeco.com (Available at Locksmiths everywhere).

Assa 6000 pickproof, double-keyed, drill resistanct deadbolt (at locksmiths nationwide).

ELECTRIC DOOR STRIKES

Von Duprin Company, Strike Force electric latches. http://www.vonduprin.com/prod_strikeforce.asp

BRONZE PIVOT BEARINGS

For concealed pivoting cabinet (about $3 for a set of two). All major cities have bearing specialty shops. Check the phone book. Ask for oil-impregnated brass or bronze bushings.

ARMORED CAR CONVERSIONS

Alpine Armoring Inc. 503 Carlisle Drive, Herndon, Virginia 20170 Tel: 703-471-0002 or 1-800-992-7667 http://www.alpineco.com/armored/vehicles.htm .

Bulldog Direct: Your **do-it-yourself source**. Armored Vehicle Kits. Armored vehicle kits provide N.I.J. level IIIA hand gun protection from: 9 mm, .357 mag., .44 mag., and higher. Each armor kit comes with installation instructions. **Bulldog Direct**, P.O. Box 8561, Cincinnati, Ohio, U.S.A., 45208-8561 Tel: (513) -281-6700
URL: www.bulldogdirect.com .

PRIVATE ENCRYPTION SOFTWARE FOR COMPUTERS

Pretty Good Privacy (PGP) Learn all about it from URL: www.pgp.com.

HEARING AMPLIFICATION MUFFS

WOLF EARS: These specialty ear muffs will not only amplify small sounds, but they will attenuate loud sounds so that everything comes within your hearing comfort range. These are a must for combat shooting when you want ear protection but not so much as to keep you from detecting intrusions. These are very high tech. Here is the online source list: http://www.derry.gentexcorp.com/hearing-resellers.htm

SOLAR EQUIPMENT

For complete installation of full system, contact www.beselfreliant.com or www.abrahamsolar.com

PHOTOVOLTAIC SOLAR PANELS

Abraham Solar 1-800-222-7242. New and Used.

POLE MOUNTED SUN TRACKING EQUIPMENT (OPTIONAL)

Wattsun Sun Tracker (for a pole-mounted, tilting rack for solar panels to track sun) Abraham Solar 800-222-7242.

Zomeworks pole mount trackers, P.O. Box, Albuquerque, NM 25805, Telephone: (505) 242-5354 also from **Abraham Solar** 800-222-7242.

ROOF MOUNTED PANEL RACKS (rotating racks for roof mounting)

Zomeworks Albuquerque NM P.O. Box 25805, Tel: (505) 242-5354 or Abraham Solar.

A. For slanted roof mount: Order 2 drive axles, and one slave axle.

B. For Pole mount, 12 panels. Order 8612 unit – rack only, not the sun tracker.

Direct Power Fixed rack for direct roof mount: (2) six panel racks from **Abraham Solar**.

SOLAR CHARGE CONTROLLERS

When not using the more expensive XANTREX/TRACE power center option, try the following alternatives from **Abraham Solar** 800-222-7242.

A. **Sun Selector** NDR-30 CD-EMP(30 amp capacity with power divert). There are other models available depending on system size.

B. **Sun Selector M-16** (16 amp capacity with no automatic power diversion) for small systems.

SOLAR WATER PUMPS from **Abraham Solar**

Coenergy and Aerovironment provide turn-key pumping systems. Check with Mick Abraham and Abraham solar. 800-222-7242

Individual pumps as follows:

SolarJack SCS Submersible Centrifugal Pumps – expensive submersibles down to 800 feet deep, performance comparable to small conventional pumps.

Powerlifter 1000

Shurflow or **Flowjet** pumps for lower cost pumps.

Slowpumps are medium-priced pumps that pump high vertical distances with low power, and low, steady output. Good for domestic water.

Dankoff Solar Surface Pumps – non-submersible centrifugal pumps for irrigation, using a small length of suction hose to draw from a creek or pond.

Highlifter Ram type pump. Use where you have no power source other than a stream. Will pump water between 400 and 1,000 high, depending on model. Volume is low, but steady. Very reliable.

SOLAR DESALINATORS

AGUA DEL SOL Agua Del Sol, PO Box 1114, Pima, AZ 85543 Tel: (520) 485-9211 (www.mrsolar.com) Prices: $650-$850 output 1-3 gallons per day (panels 4, 6, or 8 ft long x 36" wide).

PUR (Recovery Engineering) Models: Survivor 35 (manual).2115 (smaller liferaft model), PowerSurvivor 40E, Recovery Engineering, Inc. 2229 Edgewood Ave. S., Minneapolis, MN 55426 Tel: 800-845-7873 local: 612-541-1313. Sample seller: http://www.seakayak.ws/kayak/kayak.nsf/NavigationList/NT0000BE3E

Sea Recovery Marine desalinators for boats Crystal Sea 12v or 24v or 110v models P.O. Box 2560 Gardena, California 90247-0560 Tel: 1-310-637-3400 Website: www.searecovery.com .

SOLAR WATER HEATERS

Progressivtube: PO Box 3887, Sarasota, Fl 34230 Tel: (941) 953-2177 http://www.solardirect.com/swh/pt/pt1/why_progressivTube/why_progressivtube.htm or **Abraham Solar Equipment**.

Solahart USA Self contained storage tank, easy to install. Solahart 939 South, 48th Street #207, Tempe, AZ 85281 Tel: 602-967-6785, 800-233-7652. http://www.solahart.com/default.asp?V_DOC_ID=1

Solar Works, **Inc**. Roof mounted panel systems—large http://www.solar-works.com/ 64 Main Street, Montpelier, VT 05602 Tel: 802-223-7804 or 800-339-7804 (VT).

EVACUATED TUBE COLLECTORS (The best, and most high-tech)

Thermomax Evacuated Tube Collectors: 5560 Sterrett Place, Suite 115, Columbia, MD 21044 Tel: (410) 997-0778 URL: www.thermomax.com . This company has wide experience in joining a solar water heating system with a wood heating backup system into a hydronic floor-heated home.

SOLAR WATER PURIFIER

Sol*Saver Solar Water Pasteurizer Safe Water Systems 2800 Woodlawn Drive, Suite 131, Honolulu, Hawaii 96822 Tel: 808-539-3937 website: www.safewatersystems.com (they also have a wood burning water purifier).

SUN POWERED COOLING

Solar Powered Evaporative Coolers: "Solar Chill" by PB solar Solacool by Advantage Solar: http://www.advantagesolar.com/solacool.htm

SOLARIUM, ADD-ON GREENHOUSES

Durango Solariums, Durango Co, (970) 385-4561. There are similar custom solarium builders in every major city. http://durangosolariums.com/welcome.php

SOLAR GREENHOUSE VENT OPENERS

Thermofor, http://www.greenhouses-etc.net/equipment/solar_vents.htm

Bayless Mk-7 or XL from **A Gardener's Resource**, P. O. Box 85072, Tucson, Arizona 85754 Tel: (520) 792-8023 URL: www.greenhousesupplies.com .

SOLAR FANS, BLOWERS, COOLERS

The Sustainable Village: http://www.thesustainablevillage.com/products/display.do

SURVIVAL EQUIPMENT

SEVERE COLD WEATHER CLOTHING

PALS SYSTEM --the very best in extreme cold weather clothing. Available in economical kits or ready-made suits (you add the outer shell by buying high quality Goretex outerwear. contact: **PST** (Preparedness and Survival Training Institute) in Utah at (801) 785-6027. Ask for the Inner Thermal Lining Kits. They also have a complete series of preparedness training videos on the clothing system and all other aspects of survival. Excellent. Jim Phillip's website is www.jimsway.com

TOOLS

Harbor Freight Tools: Deep discounted tools, quality is not the best, but improving every year--mostly Chinese or Taiwanese. Retail stores in all western States plus Lexington, Kentucky. Info: www.harborfreight.com . Call for printed catalog, 1-800-423-2567.

TRANSPORTATION EQUIPMENT

ELECTRIC BICYCLES

Plans to Convert a Mountain Bike: $29 from **Bill Gerosa, Convergence Tech., Inc.,** 12-6 Foxwood Drive, Pleasantville, NY 10570 Website: www.econvergence.net/emb.htm Tel: 914-773-6749

ZAP Power System: add-on package to motorize a mountain bike. Can still pedal with this system. ZAP SX Rear Range 15 miles with SX and 8 miles with DX. Has regenerative charging of battery while going downhill and pedalling. Can buy their "Electric Cruiser" bicycle ready and a ready made mountain bike. http://www.zapworld.com/ProductDetail.aspx?id=1500

Charger Bicycles: Electric bike designed from ground up with the latest innovative technology – multi option pedal assist system, dual chain, 20 mile range. http://www.electric-bikes.com/charger.htm

US Pro Drive (Currie Technology – used in Schwinn Bikes) Van Nuys, CA 91406 Tel: (818) 947-0366. Here's a direct-drive adaptive system with a variable speed controller. The direct drive system mounts on the rear hub of most 26" bicycles and weighs 6 lbs. The battery shell locks. Most people change out the awkward thumb throttle to a twist grip type http://etxcur.accpaconline.com/izipbikepage.html

EV Rider, Inc., 1060 Commerce Boulevard, North, Sarasota, Florida 34243 USA Toll-Free: 888-RIDEREV(743-3738) Fax: 941-351-2699, http://www.evrider.com . Mostly electric powered wheeled carts, but also have a folding electric bike: http://www.evrider.com/folding_bikw.htm

Electrobike, **Inc**. Ready to go bike with 20 mile range: http://www.electrobike.com/html/pro_jazz.html

ELECTRIC VEHICLE CONVERSIONS

This is the most economical way to get an electric vehicle. Convert a pickup or van to electric use with batteries and solar panels and have a short-range, reliable commute vehicle when gas becomes unavailable. Maximum range is typically 40 miles. The most experienced one stop shop for all necessary items is **ELECTRO AUTOMOTIVE** in California: www.electroauto.com or P.O. Box 1113, Felton Ca 95018-1113.

MILITEC-1 DRY LUBE FOR WEAPONS

http://www.militec1.com/

MILITEC-1 OIL ADDITIVE

I think this is the best oil additive for all types of engines/transmissions – proven to double the life of an engine: 16 Oz bottle (Half a bottle added to engine oil every 15,000 miles) http://www.militec1.com/

REDLINE OIL PRODUCTS

REDLINE Simply the best racing oils available. Too expensive for me, since I use Militec-1 anyway, I don't feel I need the pricy oil. But I do use their **transmission** fluids. In a long term crisis, I want the longest life out of the transmission, and these special fluids have proven to be at least twice as good as normal hypoid oil. These are products primarily for manual transmission and differentials. I use 2 oz of Militec-1 in automatic transmission for protection. http://www.redlineoil.com/ Available online all over the www.

HIGH PERFORMANCE OIL FILTERS

AMSOIL http://www.amsoil.com/prod.html MSOIL INC. AMSOIL Building, Superior, Wisconsin 54880 Phone: (715) 392-7101. Amsoil makes a full range of very high performance synthetic oils and the best oil filter systems around.

WATER PURIFICATION/FILTERING EQUIPMENT

OXYGEN BASED WATER PURIFIERS

Aerobic K07 potassium based water purifier (about $20 each retail, local health food stores) Only buy the potassium based liquid with the "K" http://www.aerobiclife.com/

WATER FILTERS

Aquasana Uses high tech filters, low replacement price, lasts longest. Also, shower filters and multiple installation choices. best price:
http://www.aquasana.com/catalog.cfm

Big Blue 20" is the best type of whole house filter. Has UV sterilization as well. Good prices at http://www.purewaterexpress.com/

WEAPONS

BOWIE KNIFE: **Western Cutlery** 9-1/2" blade Available at local knife shops that carry Western Cutlery products. Here's a pic: http://www.afterknife.com/western-cutlery-ww49-western-bowie-knife-95-in-p-454354050.html

MAG-NA-PORT ARMS – recoil reduction mod to weapons. 41302 Executive Dr., Mt. Clemens, MI 48045 Tel: 1-313-469-6727. http://www.magnaport.com/company.html

MAG-SAFE AMMO: Special penetrating shotgun type ammo for auto weapons. Awesome and deadly stuff. **http://www.magsafeonline.com/**

TRITICON glowing night sights: **Armson**, 1-313-553-4960.
http://armson1.stores.yahoo.net/

DILLON Reloading Press: best of the progressive reloading presses.
http://www.dillonprecision.com .

SILENT .22 AMMO: CCI brand .ww CB CAP cartridges – at most gun shops.

Williams Trigger Specialties – smooth trigger mods RR 1, Box 26-G, White Heath, Il 61884, Tel: 1-217-762-7377. http://www.soldierstuff.com/wts/

WATER POWER

LARGE HYDRO-ELECTRIC SYSTEMS

Hydro West Group, Inc. Manufacturer, service, large hydro-powered electric generators, complete system design (50 kW), microhydro electric generators, hydro energy components, hydro turbines. Address: 1422 130th Avenue N.E., Bellevue, WA 98166 Telephone: (425) 455-0234Web Site: http://hydrowest.com ,

American Hydro Corporation For big projects. Custom design and manufactured upgrades for existing hydroturbines to boost output by 10 to 50%. Service : system design and installation. http://www.ahydro.com/

MEDIUM-SIZED HYDRO

Canyon Industries, Inc. Builds and engineers pelton and cross-flow turbines for medium head hydro conditions. Good hands-on experience. Call Dan New (360) 592-5552. P O Box 574 HP, Deming, WA 98244. URL: http://www.canyonhydro.com/

MICRO-HYDRO

Harris Pelton Turbines High head turbines (200-600 vertical feet of drop) 2, 3 or 4, nozzle designs. Abraham Solar Equipment.

Turgo Pelton Wheels – slightly better than Harris units: from Abraham Solar Equipment.

WIND POWER

WIND GENERATORS

Best of the Small Windchargers:

AIR 403– costs about $550 for the new 400 watt machine (installation is cheap and easy because this system is so small and portable). Abraham Solar 1-800-222-4727 or http://www.etaengineering.com/windpower/air_x_vs_403.shtml

Best of the Medium sized Windchargers:

WHISPER C**orp**. builds excellent units from 600 watts to 4500 watts – cost all below $2.00 a watt. Widely available online. Sample: http://www.advancepower.net/wind.htm

WINDMILLS FOR WATER WELLS

Dean Bennett Supply (many types) Toll Free: 800-621-4291. http://www.deanbennett.com/

Aeromotor: http://www.aermotorwindmill.com/Index.asp

Appendix

- **Bibliography**
- **Other Books by Joel M. Skousen**
- **Consultation and Custom Design Services**

BIBLIOGRAPHY

BioDiesel Fuel

Tickell, Joshua and Kaia. *From the Fryer to the Fuel Tank: How to Make Cheap, Clean Fuel from Free Vegetable Oil*, $24.95 post/pd, BookMasters, PO Box 388, Ashland, Oh 44805, (800) 266-5564, or www.bookmasters.com.

Boating

Bingham, Bruce. *Ferro-cement: Design, Techniques and Application*, 1974, Cornell Maritime, Cambridge, Maryland.

Whitener, Jack R. *Ferro-Cement Boat Construction*, Cornell Maritime Press, Inc. 1971.

Catalogs

JC Whitney. Everything Automotive
1 JC Whitney Way, P.O. Box 3000, LaSalle, IL 61301-0300
Phone: 312-431-6102 **Fax:** 800-537-2700
http://www.jcwhitneyusa.com

Lehman's Non Electric Catalog
P.O. Box 51, Kidron, OH 44636
Phone: 330-887-5757

Log Home Living. Annual buyer's guide, Home Builder Publications, PO Box 5361, Chantilly, Va 22022. This is a must have book if you are going to buy a packaged log home. Every major log company has advertisements in this annual edition. It will give you a feel for the market. But shop around for price. Eastern prices can sometimes be double western prices.

The Coast Connection. Coast RV. The largest of the RV catalogs--huge selection at reasonable prices. You can pick up one of these at all major RV dealerships around the country.

Master Mechanic. Alternators, winches, hoists, lathes, bandsaws, engines, drill press, etc. Master Mechanic Mfg. Co., P.O. Box A, Burlington, Wis. 53105 **Phone:** 414-763-2428, outside Wisconsin 1-800-558-9444

Surplus Center. Burden Sales Company. Air compressors, battery chargers, fuel tanks, inverters, generators, hydraulic motors, etc. 1015 West "O" Street, P.O. Box 82209, Lincoln, NE 68501-2209 **Toll Free:** 800-488-3407 **Phone:** 409-474-4055 **Fax:** 402-474-5198

Amateur Electronic Supply. Ham radio equipment. 5710 W. Good Hope Road, Milwaukee, WI 53223 **Toll Free:** 1-800-558-0411 **Phone:** 414-358-0333 http://www.aesham.com Email: help@aesham.com

Amateur Radio Trader. The Ham Radio market place. P.O. Box 3729, Crossville, TN 38557 **Toll Free:** 1-800-774-2623 Classified Ads Subscriptions subs@smradiotrader.com

Ham Radio Outlet Communication Equipment Catalog, 933 N. Euclid St. Anaheim, CA 92801 http://www.hamradio.com **Toll free** numbers for orders and quotes: Western US/Canada 1-800-854-6046, Mountain/Central 1-800-444-9476, Southeast 1-800-444-7927, Mid-Atlantic 1-800-444-4799, Northeast 1-800-644-4476, New England/Eastern Canada 1-800-444-0047

Hosfelt Electronics, Inc. Tools, radios, surveillance equip., books, videos, and MORE. 2700 Sunset Blvd., Steubenville, OH 43952-1158
Toll free: 888-264-6464, 800-524-6464 **Phone:** 614-264-6464
Fax: 800-524-5414

Harbor Freight Tools
Call Toll Free: 1-800-423-2567 to receive catalog

Hard-To-Find Tools, Brookstone Company
Corporate Headquarters
17 Riverside Street, Nashua, New Hampshire 03062
Phone: 1-800-926-7000
http://www.brookstoneonline.com

Northern Tool & Equipment Co. Home and garden supplies. P.O. Box 1499, Burnsville, MN 55337-0499
Toll Free: 1-800-533-5545 **Fax:** 1-612-894-0083
http://www.northern-online.com

Combat Shooting

Applegate, Rex. *Bullseyes Don't Shoot Back*, 1998, Michael Janich, Paladin Press. The Complete Textbook of Point Shooting for Close Quarters Combat Learn why point shooting is the most practical technique for aiming and shooting a handgun in a real gunfight.

Buttler, Warren. W. *Art & Science of Basic Handgun Accuracy*, 1991 Alpha Publications. Provides the finest instruction on handgun accuracy and combat techniques.

Buttler, Warren W. *The Armed Option: Zen in the Art of Combat Pistolcraft*, 1993 Alpha Publications. Chapters provide overviews of the shooting fundamentals such as grip, stance, and positions. More advanced techniques regarding weak hand firing, reloading, use of flashlights, and covert carry are also discussed.

Taylor, Chuck, Jack P. Lewis. *The Gun Digest Book of Combat Handgunnery, 4th edition*, 1997 Dbi Books.

A complete and exhaustive look at today's fighting handguns, the popular cartridges, and all the tactics and techniques one can use for defensive shooting.

Conspiracy Against Liberty

General

Chambers, Whittaker. *Witness*, 1952 Random House. The brilliant autobiographer of the former Communist who revealed the extent that the Left had penetrated both government and media in the 1940s. A literary masterpiece to boot.

Chasey, William C. *Foreign Agent 4224: The Lockerbie Cover-Up*, 1995 ProMotion. The real reason for this destruction of hundreds of lives has to do with our own government deciding to destroy a CIA team returning home to blow the whistle on CIA-middle eastern narco-terrorism.

Cuddy, Dennis and Robert Goldsborough. *The New World Order: Chronology and Commentary*, 1992 American Research Foundation.

Kellett, Michael. *The Murder of Vince Foster, One More Link*, 1997 CLS Publishing. Another massive cover-up which documents that this conspiracy goes far beyond saving Bill Clinton.

Ruddy, Christopher. *The Strange Death of Vincent Foster: An Investigation*, 1997 Free Press. The details are fascinating. It becomes very clear that any official who ruled this death a suicide had to be working for or at least under the influence of the dark side of government. This story reeks with distortion and manipulation of the facts.

Larson, Martin A. *The Federal Reserve and our Manipulated Dollar*, 1975 Devin-Adair.

Lee, Robert W. *The United Nations Conspiracy*, 1981 Western Islands. An excellent overview of the anti-liberty foundations of this globalist organization intent upon removing all national sovereignty

Pearloff, James *The Shadows of Power*, 1990 Western Islands. The presumed workings of the higher levels of conspiracy. There is evidence here, but few proofs, since there are almost never any defectors from the higher ranks of the elite. Lack of proofs doesn't mean it isn't true, however.

Roberts, Craig. *The Medusa File*, 1997 Consolidated Press International. More specific documentation of cover-up from the lower levels--where there is an abundance of facts

Sanders, Jim. *Soldiers of Misfortune*, 1992 National Press Books. More specific evidence

Sanders, James. *The Downing of TWA Flight 800*, 1997 Zebra Books. The evidence is overwhelming that this airliner was brought down by two missiles and that the US government was engaged in the most massive cover-up since the JFK murder.

Skousen, W. Cleon. *The Naked Capitalist*, 1970. One of the original works on conspiracy that showed the incredible linkage between globalists and the rise of Communism.

Stevenson, Monika. *Kiss the Boys Goodbye; How the United States Betrayed Its Own POW's in Vietnam,* 1991 Plume. Tragic evidence of US government betrayal.

Stich, Rodney. *Defrauding America 3rd Edition*, 1998 Diablo Western Press. 1-800-247-7389. If you read any one book, this is the book to read. This book contains the first hand stories of dozens of Federal agent-whistleblowers who were imprisoned by the US government after they began to complain about the illegal and unconstitutional activities they had observed. Not only is a massive scheme of cover-up revealed within every level of Federal law enforcement, it spills over into every big city police force. Worst of all, this book documents how *deep* the conspiracy against liberty has penetrated the Federal and state court systems.

Sutton, Antony C. *Wall Street and the Rise of Hitler*, 1976 '76 Press. The same pattern used to build up Russia and China, prior to war, was used to build up Hitler.

Sutton, Antony C. *How the Order Creates War and Revolution,* 1984 Research Publications. Explains the dialectic theory that uses war to achieve quantum leaps forward in the destruction of liberty.

Sutton, Antony C. *Wall Street and the Bolshevik Revolution*, 1981 Arlington House. A companion volume to "Wall Street and the Rise of Hitler."

Sullivan, David S. *The Bitter Fruit of SALT,* 1981 Texas Policy Institute. Details the deception of disarmament.

International Betrayal

Ashbrook, John M. et al. *Broken Seals*, 1980 Western Goals. Devastating betrayal of numerous governments by the US State Department. Each one of the following books tells the tragic story of how the State Department undermined nation after nation. The pattern of betrayal in these books is one of the most convincing evidences of an over-arching conspiracy against liberty.

Wittmer, Felix. *The Yalta Betrayal*, 1954 Caxton Printers.

Fanning, Louis A. *Betrayal In Vietnam,* 1976 Arlington House.

Lazo, Mario. *Dagger in the Heart: American Policy Failures in Cuba*, 1968 Twin Circle Publishing.

Prewett, Virginia. *Washington's Instant Socialism in El Salvador*, 1981 Council for Inter-American Security.

Rowe, David N. *Ally Betrayed . . . The Republic of Korea*, 1982 Western Goals.

Shams, Abdul. *In Cold Blood – The Communist Conquest of Afghanistan,* 1987 Western Islands.

Smith et al, Earl E.T. *Ally Betrayed . . . Nicaragua*, 1980 Western Goals.

Somoza, Anastasio with Jack Cox. *Nicaragua Betrayed*, 1980 Western Islands.

U.N.I.T.A. *The Angola Road To National Recovery*, 1984 The National Union For The Total Independence of Angola.

The JFK Cover-Up

Carroll and Graf. *High Treason Vol. 1 & 2 The Great Coverups: The Assasination of Pres. John F. Kennedy*.

Lifton, David S. *Best Evidence*, 1980 Mass Market Paperbacks. One of the best books on the specific evidence that leads to a positive conclusion that forces within the US government where in charge of killing JFK. Lifton doesn't make any conclusion, but the facts are clearly represented.

Marks, Jim. *Crossfire, The Plot That Killed Kennedy*. This has good specific evidence, but weak conclusions

Roberts, Craig. *Kill Zone: A Sniper Looks at Dealy Plaza*, 1994 Consolidated Press International.

Current events and Geo-Politics

Newsletters

Skousen, Joel *World Affairs Brief* This is a weekly news analysis briefing is send out by email every Friday. Subscriptions are only $48/year for the weekly briefs or $72/year for the monthly print version. Subscription details at http://www.worldaffairsbrief.com or email Joel at editor at worldaffairsbrief.com to receive a sample of the printed edition.

McAlvany, Donald. *McAlvany Intelligence Advisor*, $115/yr, P.O. Box 84904, Pheonix, AZ 85071. Don always puts out the most comprehensive overview of geopolitical analysis of any newsletter.

North, Gary. *Remnant Review*, $129/yr, 1217 St. Paul Street, Baltimore, MD 21202. Gary's wit and insight is always cogent, and enjoyable

Skousen, Mark. *Forecasts and Strategies*, $187/yr, Phillips Publishing, 7811 Montrose Rd., Potomac, MD, 20854. My brother's monthly financial letter. He has called the general markets correctly for over 20 years. Hope he can call the next collapse--it will be the biggest the world has known.

Periodicals

The Freeman, $30 Donation, Foundation of Economic Education, (914) 591-7230, http://www.fee.org, Irvington-on-Hudson, NY 10533.

The New American, $39/yr, 770 Westhill Boulevard, Appleton, WI 54914, (920) 749-3784, http://www.jbs.org/tna.htm

Internet News

www.worldaffairsbrief.com (Joel Skousen's weekly news analysis)

www.newswithviews.com (one of the best news source on the web)

www.worldnetdaily.com (The biggest of the conservative news services)

Design/Engineering Tables

American Society of Civil Engineers. *Minimum Design Loads for Buildings and Other Structures*, 1995 Am Soc Civ.

Breyer, Donald E. *The Design of Wood Structures*, 1993 McGraw-Hill Companies. Complete and up-to-date treatment of major building codes and the use of wood in building design. Table of Contents: Wood Building and Design Criteria; Design Loads; Behavior of Structures Under load; Properties of Wood and Lumber Grades; Structural Glued-Laminated Lumber; Beam Design; Axial Forces and Combined Bending and Axial Forces; Plywood and Other Structural-Use Panels; Horizontal Diaphragms; Shear walls; Nailed and Stapled Connections; Bolts, Lag bolts, and Timber Connections; Connection Hardware; Diaphragm-to-Shearwall Anchorage; Appendices. 450 illustrations.

Earth Sheltered House (Underground)

Boyer, Lester L. and Walter T. Grondizik. *Earth Shelter Technology*, 1987 Texas A&M University Press. Although the book was written in 1987, there are no other books which have pulled together all of the design issues and formulas required to properly design a structure, including heating & ventilation, waterproofing techniques and studies of existing structures.

Roy, Robert L. (Rob Roy) *Complete Book of Underground Houses: How to Build a Low-Cost Home*, 1994 Sterling Publications. Instead of marring a grassy knoll or field with the construction of a conventional house, you could design and build an environmentally sound underground or earth-sheltered home. Roy, director of the Earthwood Building School, provides detailed instructions, from choosing a piece of property to excavating and building a home from top to bottom, with case studies, photos and diagrams, and further resources.

Underground Space Center, The. *The Earth Sheltered Residential Design Manual*, University of Minnesota Van Nostrand Reinhold Co. 135 West 50th St. NY. NY. 10020.
The finest design reference for residential applications

Wells, Malcom. *How to Build an Underground House*, 1991 Malcom Wells.

Education

Marilyn and Joel Skousen, *Handbook for Home Schooling.* This is an unpublished manuscript containing all the ideas, philosophy and curriculum that we developed as well successfully homeschooled our six children. $10 to cover the copying and mailing cost. 290 W. 580 S. Orem, Ut 84058.

Ballmann, Ray E. *The How & Why of Home Schooling.* Crossway Books, Wheaton, IL, 1995. (Good News Publishers, 1300 Crescent St., Wheaton, IL, 60187.) Excellent guide for parents who are interested in homeschooling.

Duffy, Cathy. *Government Nannies, The Cradle-To-Grave Agenda of Goals 2000 & Outcome Based Education.* Noble Publishing Associates, Gresham, OR, 1995. An eye-opening account of what the federal government plans to do with your children. A must read for everyone.

Stormer, John. *None Dare Call it Education,* 1998 Liberty Bell Press, Missouri (PO Box 32-1, Florissant, Missouri, 63032, $24.95 includes shipping.) An excellent book about the destruction of the US educational system by the political left.

Electric Vehicles

Brown, Michael with Shari Prange. *Convert It,* 1993 Electro Automotive POB 1113, Felton, Calif 95018-1113 (128 pgs., 8 1/2" x 11", $24.95 plus $4 s/h, soft-cover).

Expedient Shelters

France-Boyer, Marie. *Cabin Fever: Sheds and Shelters, Huts and Hideaways,* 1993, Thames & Hudson.

The search for solitude and the need to throw off the trappings of worldly life have produced some of the world's most romantic and beguiling buildings. Brought together here, they remind us of that wilder side of human nature which we all recognize and perhaps seek to nourish more.

Kearney, Cresson H. *Nuclear War Survival Skills* 1988 Oregon Institute of Science and Medicine. This is the classic expedient shelter book for those who haven't or won't prepare in advance. After you read this book, I think all my readers will be motivated to built a better shelter inside their home.

Generator, Diesel repair

Black, Perry. *Diesel Engine Manual,* 1972 Audel.

Greenhouses and Gardening

Ashworth, Suzanne. *Seed to Seed,* 1995 Seed Saver Pubns. How to save non-hybrid seeds.

Bartholomew, Mel. *Square Foot Gardening: A New Way to Garden in Less Space With Less Work,* 1981 Rodale Pr.

Bubel et al, Mike. *Root Cellaring: Natural Cold Storage of Fruits and Vegetables,* 1991 Storey Books. Root cellaring is a simple, energy-saving way to keep food fresh all year.

This book explains building and using different types of root cellars and which vegetables and fruits store best. Includes specific storage requirements for nearly 100 home garden crops, plus dozens of delicious recipes.

Ellis, Barbara W. *The Organic Gardener's Handbook of Natural Insect and Disease Control: A Complete Problem-Solving Guide to Keeping Your Garden & Yard Healthy,* 1996 Rodale Pr.

Freeman, Mark. *Gardening in Your Greenhouse (Greenhouse Basics , No 2),* 1998 Stackpole Books.

Freeman gives tips on gardening year-round in greenhouses, with information on selecting equipment, preparing the soil, watering, regulating heat and light, starting seeds, fighting pests, transplanting, and hardening off – all presented in a lively, down-to-earth manner. 98 drawings.

Poisson, Leandre. *Solar Gardening: Growing Vegetables Year-Round the American Intensive Way*, 1994 Chelsea Green Pub Co. "American intensive" gardening is what the authors call a continuous food-producing system that provides an ideal growing environment for the entire plant. By creating and maintaining a deep, well-balanced, fertile soil, the system optimizes growing conditions below the ground. By using heat-assisting devices to create beneficial microclimates for seedlings and mature plants, it ensures optimum growing conditions above the ground.

Health

Nutritional books

I haven't found any single health book yet that I totally agree with. However, each of the following books puts major parts of the solution together.

Abrams, Leon and Melvin Page. *Your Body is Your Best Doctor.* (available from the Price Pottenger Nutrition Foundation.) Sensible book on nutrition, includes interesting findings on the role of glands.

Airola, Paavo. *How to Get Well,* 1974 Health Plus Publisher, AZ. Classic book on nutrition from the 70's.

Balch, James and Phyllis. *Prescription for Nutritional Healing.* Avery Pub. Group, Garden City park, N.Y., 1997. A best-selling guide to traditional remedies and therapies for health problems.

DeCava, Judith. *The Real Truth about Vitamins and Anti-oxidants,* 1997 Printery, Centerville, Mass. Thoroughly researched and documented work in nutrition and vitamins.

Dufty, William. *Sugar Blues,* Warner Books, New York, NY. Expose on the dangers of sugar.

Fallon, Sally. *Nourishing Traditions*, 1995 ProMotion Publishing, San Diego CA. (Available from Promotion Pub. 3368 F Governor Dr. Ste 144, San Diego, CA.) This book challenges the "politically correct nutrition" that prevails in American society. It has some of the best, succint explanations on the controversial issues of fats, milk, proteins, enzymes, carbohydrates, etc. that I have seen in one book. It also offers hundreds of recipes and culinary traditions from societies that have enjoyed robust health.

Jensen, Bernard. *Tissue Cleansing Through Bowel Management*, 1981 Published by Bernard Jensen, 24360 Old Wagon Rd. Escondido, CA 92027. Excellent programs for effective bowel management.

Jensen, Bernard. *Visions of Health* 1988 Avery Pub. Group Inc., Garden City Park, N.Y. Basic primer in iridology, one of the best methods of health diagnosis. There is no doubt in my mind that the iris of the eye does show a reaction to problem areas in the body. This is due to the neural connections from brain to body parts that also show up in acupuncture theory.

Latham, Paul. *The Interactive Body of Man.* Paul is an expert Iridologist and Nutritionist with a love of biology that has led him to develop one of the most simple and effective health regimes available. He is one of the few that has developed effective methods that are not expensive and that don't set up for life taking pills, natural or otherwise.

Malstrom, Stan. *Own Your Own Body*, 1985 Woodland Books, Provo, UT. He gives a background on the body and how it functions and then touches on sensible living habits of diet, exercise, rest, mental attitude, and the use of herbs to maintain optimum daily health.

Children's Health

Davis, Adelle. *Let's Have Healthy Children*, 1981 New york: New American Library.

Wootan, George and Sarah Verney. *Take Charge of Your Child's Health*, 1992 Crown Publishers.

Heart Disease and Cholesterol

Two well documented works revealing the fallacies and dangers of the low-cholesterol, low-fat diet and suggestions for a healthy diet and lifestyle:

Mann, George. *Coronary Heart Disease*, 1993 Janus Pub. Co. (Available from Health Education Corp. 1-800-745-0393).

Mudd, Chris. *Cholesterol and Your Health.* American Lite Co., PO Box 18662, Oklahoma City, OK 73118.

Immunizations

Murphy, Jamie. *What Every Parent Should Know about Childhood Immunization*, 1993 Earth Healing Products (PO Box 11, Dennis, MA 02638). Do the benefits of vaccines really exceed the risks? The decision you make may have critical lifelong implications. This book will help you face this critical health issue intelligently.

Neustaedter, Randall. *The Vaccine Guide,* 1996 North Atlantic Books (PO Box 12327, Berkeley, CA, 94712). Hard to find factual information on routine vaccines and options for parents to choose from.

http://newatlantean.com This anti-vaccination Internet site documents hundreds of first hand tragedies at the hands of immunizations. It also documents the government-medical community's attempt to cover-up the evidence.

Herbs

Foster, Steven and James Duke. *Peterson Field Guides, Medicinal Plants.* Houghton Mifflin Co., Boston. Find at least one good field guide pertinent to your area that has pictures and descriptions of herbs in your locale.

Keith, Velma and Monteen Gordon. *The How to Herb Book.* Mayfield Publications, 1996. Good beginner's book and reference for health problems.

Moore, Michael. *Medicinal Plants of the Mountain West,* 1979 The Museum of New Mexico Press (PO Box 2087, Santa Fe, New Mexico, 87503).

Ody, Penelope. *The Complete Medicinal Herbal*, 1993 Dorling Kindersley, N.Y., N.Y. Growing and preparing herbs.

Rodale's *Illustrated Encyclopedia of Herbs,* 1987 Rodale Press, Inc. How-to information on the many uses of herbs.

St. Claire, Debra. *The Herbal Medicine Cabinet, Preparing Natural Remedies at Home,* 1997 Celestial Arts Pub. Berkeley, CA. (PO Box 7123, Berkely, CA 94707).

Childbirth

Books on childbirth may be ordered from: ICEA bookmarks 1-800-624-4934

Birth Choices:

Goer, Hence. *Obstetric Myths Vs. Research Realities*, 1995 Bergin & Garvey, Westport, CT. A scholarly evaluation of the many controversial interventions and issues involved in obstetrical care.

Harper, Barbara. *Gentle Birth Choices, A Guide to Making Informed Decisions about Birth*, 1994 Healing Arts Press, Rochester, VT. Easy to read guide to sort through the myriad choices and options in childbirth.

Kitzinger, Sheila. *The Complete Book of Pregnancy and Childbirth,* 1996. Order from ICEA Bookmarks. Comprehensive guide to pregnancy and childbirth with many photographs and diagrams.

Korte, Diana and Roberta Scaer. *A Good Birth, A Safe Birth*, 1992 The Harvard Common Press, Boston, Mass. The benefits and drawbacks of today's childbirth options in each stage of pregnancy are given so that the parents can make decisions for a better birth experience.

Simkin, Penny *The Birth Partner,* 1989 Harvard Common Press.

Walter, Johanen, and Karis Crawford. *Natural Childbirth After Cesarean: A Practical Guide.* Order from ICEA bookmarks.

Pregnancy and Infant Care

La Leche League International. *The Womanly Art of Breastfeeding*, 1997 A Plume Book, Penguin Books, NY., NY. (La Leche League International, PO Box 4079, Schaumburg, IL 60168, $14.95 +$4.95 shipping.) Breastfeeding is more than a motherly art--it is essential to good health and proper immunal development of babies.

Ludington-Hoe, Susan M. *Kangaroo Care, The Best You Can Do to Help Your Preterm Infant.* Bantam Books, 1993. A wonderful, rewarding technique that any parent can do to improve preterm outcomes. A MUST for every parent of a **premature** baby!

Simkin, Whalley & Keppler. *Pregnancy, Childbirth and the Newborn,* 1991. Order from ICEA bookmarks. Covers nutrition, birth places and providers, prenatal changes and care, birth, labor support tech., parental choices.

Midwifery Textbooks

Brown & Bennett. *Myles Textbook for Midwives*, 1998 Churchill Livingstone, NY, NY. Comprehensive textbook for midwives.

Davis, Elizabeth. *Heart and Hands, A midwife's Guide to Pregnancy & Birth*, 1997 Celestial Arts, Berkeley, CA. (Elizabeth Davis, 555 Pistachio Pl., Windsor, CA 95492, $21.95 + $3.50 shipping) Easy to read text for midwives and parents on all aspects of pregnancy, birth, and postpartum care.

Frye, Anne. *Holistic Midwifery – A comprehensive Textbook for Midwives in Homebirth Practice, Vol. I, Care During Pregnancy,* 1995. Labrys Press.

New Age Expose

Baer, Randall N. *Inside the New Age Nightmare,* 1989. Huntington House, Inc., LA. (PO Box 53788, Lafayette, LA 70505). A New Age leader tells the inside story of the New Age movement and the horrifying realization of who is behind it. A book everyone should read.

Marrs, Texe. *Dark Secrets of the New Age,* 1987 Crossway Books, Westchester, IL.

Home Building (Contracting and Construction)

Ching, Frank et al. *Building Construction Illustrated,* 1991 John Wiley & Sons. In response to numerous requests by readers, this edition of a classic manual on residential and light construction techniques includes increased coverage of concrete material and methods – plus the latest data on concrete, steel and glazing technology, energy efficiency in buildings, moisture and thermal protection, natural lighting and masonry. 380 line drawings.

Connel, John. *H oming Instinct: Using Your Lifestyle to Design and Build Your Home,* 1999 McGraw-Hill. For anyone planning to build a home, this is the only book to combine both design and construction how-tos. Almost a first course in architecture and construction essentials, this book provides a great amount of detail on how things really work, from floor plans, heating systems and plumbing to selecting the right materials. For the ultimate in do-it-yourself books, this is the book to buy first.

Haun, Larry. *The Very Efficient Carpenter: Basic Framing for Residential Construction,* 1993 Taunton Pr.

If you have a basic knowledge of how to use tools, you should be able to frame a house using this book. If you can't get it all from the text, you can order three companion videos from Taunton Press that show you, step by step, how to frame a house.

Howe, Jeff and Rae Laflamme. *The 9 Biggest Pitfalls of Home Construction,* 1997 Belmont Distributors.

This book examines some of the different ways consumers get themselves in trouble when building a new house, adding to an existing house, or just hiring a single person to work for them. It describes how to avoid some of these pitfalls, and other ways to save money. It also goes over the proper way to hire someone to work on their home, whether they should be their own contractor, how to schedule, etc..

King, Bruce. *Buildings of Earth and Straw: Structural Design for Rammed Earth and Straw Bale Architecture,* 1997 Ecological Press. These forms of building are only recommended as a wilderness survival mode of living, coupled with severe lack of funds.

Lester, Kent and Dave McGuerty. *The Complete Guide to Contracting Your Home,* 1997 Betterway Pubns. This book is for anyone planning to build or contract their own home. Unlike most how-to books, this one is organized like a project manual, with checklists and inspection criteria. I have no doubt that anyone could build a conventional house with this book as a guide, but it won't help if you go outside the conventional field.

MacKie, Allan B. *Building With Logs,* 1997 Log House Pub Co Ltd. This classic, now revised and updated for 1997, is still considered the best book ever written on making a full-sized log home. This enlarged eighth edition is filled with numerous major construction improvements, and clearly shows the novice and experienced log builder every necessary step to build a home.

Merrilees, Doug and Ralph Wolfe. *Low-Cost Pole Building Construction*, 1980 Loveday, Storey Books. Perfect for the first time builder. Detailed descriptions of pole construction techniques. 290 photographs, illustrations, and plans including: year-round and vacation homes, tool and wood sheds, a solar cottage, and pole barns.

Sobon, Jack, Roger Schroeder. *Timber Frame Construction: All About Post-And-Beam Building*, 1984 Storey Books. Explains the basics of timber-frame construction in terms the beginner can understand: framing; designing for strength and beauty; using modern tools, and selecting the appropriate wood.

Home Electrical Wiring

Black & Decker Home Improvement Library. *Advanced Home Wiring*, 1992 Creative Publishing International.

Advanced Home Wiring tells you everything you need to know about wiring your house from the beginning to the end. Each chore is thoroughly explained with both color pictures and text. The majority of pictures are photographs and the latest technology is shown. Outside wiring and use of conduit is included. It details how to determine how many receptacles to put on a circuit and how to plan your entire project.

Cauldwell, Rex. *Wiring a House*, 1996 Taunton Pr.

Master electrician Cauldwell has been wiring houses for almost thirty years and is in a fine position to explain the job. From avoiding the wrong materials to designing new wiring and working with old, Wiring a House focuses on safety and long-term durability alike, telling how to work with both new and old construction. An invaluable guide.

Home Repairs

Allan, Benjamin W. *Better Homes & Gardens - New Complete Guide to Home Repair & Improvement*, 1997 Better Homes & Gardens Books. With 3,000 full-color illustrations, step-by-step instructions for common repairs and improvements, special sidebars, and expertly informed attention to detail, this is the only home reference guide every homeowner needs.

Black and Decker *The Complete Guide to Home Plumbing: A Comprehensive Manual, from Basic Repairs to Advanced Projects*, 1998 Creative Publishing International. The only book on plumbing that a homeowner will ever need, Black & Decker's guide to this often frustrating chore includes information on everything from fixing a leaky faucet to renovating an entire plumbing system. 600+ color photos.

Hamilton, Gene, Katie Hamilton. *Fix it Fast Fix it Right – Hundreds of quick and easy home improvement projects*, 1991 Rodale press.

Nuclear Defense

Sharon B. Packer & Paul W. Seyfried. *Nuclear Defense Issues* Utah Shelter Systems, PO Box 638, Heber, Utah 84032 Tel. 435-657-2641 This is the bible for hardened blast shelters built outside the home and deep underground. If you live in a blast area, where

you need extraordinary sheltering, this is the book you need to follow. It covers blast issues and all the military grade hardware you'll need to survive in a devastation zone. Sharon is a nuclear engineer and highly qualified.

Radios and Antennas

Carr, Joseph J. *Practical Antenna Handbook,* 1994 McGraw-Hill Companies. Designed for use by the novice as well as the professional, this book/CD- ROM combo gives the reader all kinds of projects with material that explains why they work. A wide variety of antennae are covered: high frequency dipole, vertically polarized HF, multiband and tunable wire, hidden and limited space, directional phased vertical and directional beam, VHF/UHF transmitting and receiving, shortwave reception, microwave, mobile, marine and emergency. This third edition has new material on wire antenna construction methods, antenna modeling software, antennas for radio astronomy and Radio Direction Finding, and antenna noise temperature

John Devoldere, *Antennas and Techniques for Low-Band Dxing: Your Guide to Ham Radio Dxcitement on 160, 80, and 40 Meters,* 1994 Amer Radio Relay League. This is an especially difficult area of antennas, since you almost always have to build your own. But these low frequencies really reach out a long way, so it is good to know how to build these antennas. Most are of long wires, so the expense is not great.

Wagman, Gerald H. *The Handy Ham Book: A Technical Data Handbook for the Amateur Radio Operator*, 1994 Romanco Enterprises.

Solar Electrical

Kachadorian, James. *The Passive Solar House,* 1997, Chelsea Green Publishing. Describes a technique for building homes that heat and cool themselves using ordinary building materials and methods familiar to building contractors and do-it-yourselfers. Explains how to build and use the author's formerly patented design for a solar heat exchanger built into the foundation of a house, with chapters on the passive solar concept, basic solar design, insulation and venting, basic layouts and floor plans, backup heating and cooling, and interior design. Includes many b&w photos, diagrams, and plans, plus useful calculations, formulas, and worksheets, and reference appendices of thermal properties of materials and temperature and latitude statistics for selected cities in the US and Canada.

Strong, Steven J. *The Solar Electric House: Energy for the Environmentally-Responsive, Energy-Independent Home,* 1994 Sustainability Press. Steven is one of the best passive solar architects, so you can expect only things that really work in this book.

Solar Design

Mazria, Edward *The Passive Solar Energy Book: A Complete Guide to Passive Solar Home, Greenhouse and Building Design* Rodale Press.

Stone Work, Stucco, Masonry

Kreh, Dick, Richard T. Kreh. *Building with Masonry: Brick, Block & Concrete,* 1998 Taunton Pr. With this specialty book specifically for those about to embark on a do-it-yourself masonry repair or building project, Kreh, a recognized third-generation master mason, provides all the basics on tools and materials, estimating materials needed for any project, descriptions and diagrams of bond patterns and wall types, fundamentals of laying brick and block, and clear, useful information on masonry repair and restoration for preexisting work. Chimneys, retaining walls, foundations, decorative walks and planters, steps, and all varieties of construction masonry are covered here with excellent diagrams; explanations of terminology, tools, and materials; and photographs that vividly illustrate some of the finer points of masonry work.

Long, Charles K. *The Stonebuilder's Primer: A Step-By-Step Guide for Owner-Builders,* 1998 Firefly Books. Developing a compromise method of stone construction that is both simpler and truer to the stonemason's art than the popular slipform method, the Longs built an aesthetically satisfying home of stone on a limited budget and no previous construction experience. In this classic how-to book, the author describes the complete building process in clear, easy-to-follow steps and, in so doing, dispels the myth of difficulty that surrounds stone construction.

Schwenke, Karl and Sue. *Build Your Own Stone House: Using the Easy Slipform Method,* 1991 Storey Books.

Features complete instructions on tools, types of materials, estimating needed amounts, siting the house, excavating, and using and removing forms.

Time Life Books. *Advanced Masonry (Home Repair and Improvement (Updated Series), Vol 29)* 1998 Time Life. This covers regular masonry construction in detail. Much broader than stonework.

Survival (Wilderness, Desert)

Angier, Bradford. *How to Stay Alive in the Woods,* 1998 Simon & Schuster Trade. Camping enthusiasts, hunters, and even the occasional hiker will benefit from this all-inclusive guide to the woods which offers tips on finding food, water, and shelter, and reveals fascinating secrets of the wilderness.

Brown, Tom. *Tom Brown's Guide to Wild Edible and Medicinal Plants,* 1985 Berkley Publishing Group. "I was tired of seeing too many technical and rather boring plant books on the market. A student who has finished one of them hardly knows the plant at all, and the information is soon forgotten. I believe that each plant has a marvelous story of its own. I have incorporated these stories into the text to add form and dimension to the discussion of each plant. Now the student can know plants intimately, as I do. I want to make the study of plants exciting to the beginner as well as the seasoned herbalist." – Tom Brown, Jr.

Fry, Alan. *The Wilderness Survival Handbook, Vol. 0,* 1996 St. Martin's Press, Inc. Here is an essential guidebook to clothing, sheltering, eating, staying warm, and finding one's way in the outdoors. In clear, concise style, Fry covers what people need to know

before starting out, including choosing appropriate clothing and footwear, signaling for help, starting and managing fire, building emergency shelter, first aid, and obtaining water and food. 100 illustrations.

Lehman, Charles A. *Desert Survival Handbook,* 1988 Primer Pub. This easy-to-read handbook provides the reader with the basic survival skills necessary to deal with emergencies in the desert. The author uses a variety of scenarios to illustrate survival techniques. Lehman also stresses the importance of considering "what if" to prepare for potential emergency situations

Meuninck, Jim. *Basic Essentials of Edible Wild Plants and Useful Herbs,* 1999 Globe Pequot Press.The illustrations are in black and white, they are quite legible and the volume is made to be used in conjunction with the author's 60-minute video with the same title." Outdoor Gear. Identify, collect and eat over 100 of the most nutritious plants in North America. Find 35 wild plants growing in your back yard. Discover ancient pharmaceutical uses for common herbs. An appendix catalogs and indexes many poisonous and poisonous look-a-likes. Edible Wild Plants also provides categorization by environment rather than by alphabet. Examples are rivers, lakes, ponds and swamps, woodlands, yards, and meadows, and others.

Olsen, Larry Dean. *Outdoor Survival Skills,* 1997 Chicago Review Press. Text and photographs outline the necessary skills for surviving in the wild including making a shelter, finding food, and effectively using natural resources. guide to survival in almost any outdoor environment using little equipment or none aside from what can be found in nature. This is true primitive survival--how to live like an Indian. It doesn’t get any more realistic than this book. Excellent

Stevens, James Talmage. *Making the Best of Basics: Family Preparedness Handbook,* 1997 Gold Leaf Press.

This is the tenth edition of the bestselling bible for stocking up and storing everything your family will need to ride out any unexpected disaster, whether it's year 2000 problems, an earthquake, or a hurricane. James Talmage Stevens covers staples like water, grains, and dried fruits and vegetables along with essential supplies, including first aid gear, fuel, seeds, and more. Worksheets, food storage charts, resource listings, recipes, advice on living from a kitchen garden, and much more add to this book's usefulness. The best book on basic preparedness skills.

The Survival Center. *Basic Preparedness--a how to guide to preparedness and self-reliant living,* The Survival Center, Mckenna, Wa. 1-360-458-6778. A very well done overall work that covers everything from gardening and farming, to basic preparedness.

http://forums.cosmoaccess.net/forum/survival/prep/survival.htm How-To Survival Library: mini articles on every survival aspect

Water Power

Hamm, Hans W. *Low Cost Development of Small Water Power Sites,* 1982 Vita Publications.

Tong, Jeandong (Editor). *Mini-Hydropower,* 1997 John Wiley & Sons. Mini hydropower (MHP) is an increasingly important means of generating primary electricity using the water resources of small rivers, particularly in areas remote from the national grid.

Water Pumping Windmills/Wind Power

Gipe, Paul. *Wind Power for Home and Business: Renewable Energy for the 1990s and Beyond,* 1993 Chelsea Green Publishing. Gipe is very qualified in this specialty, and has the great advantages ofa superb writing style and the ability to focus on the most useful details. These include all of the things that will not work, or work poorly, or work but are not economical. Gipe names failures and successes from projects all over the world. He includes tips on everything from checking turbulence (by flying a kite with streamers!) to dealing with zoning laws to getting the safest type of harness for climbing a wind tower. His writing is in marked contrast to other books in the field, often written by professors or engineers with limited practical experience. All in all, an ideal handbook for anyone contemplating the installation of a wind machine. Well illustrated, well organized, and very comprehensive. Recommended for all levels.

Kentfield, J. A. *The Fundamentals of Wind-Driven Water Pumpers,* 1996 Gordon & Breach Publishing Group.

A comprehensive reference for engineers, researchers, and students involved in the design, testing, and improvement of wind-driven water pumps, providing a thorough treatment of the factors which affect the success of pump performance combined with the fundamentals of machine design. Includes discussion of the latest international developments in wind- driven water pumping technologies, including a survey of the advantages and disadvantages of the alternative configurations to the more "standard" designs. B&w line drawings and charts.

Water Wells, Cisterns

Burns, Max. *Cottage Water Systems: An Out-Of-The City Guide to Pumps, Plumbing, Water Purification, and Privies,* 1993 Cottage Life Books.

Fowler, Lloyd C. *Operation and Maintenance of Ground Water Facilities,* 1996 Am Soc Civ.

This manual describes various aspects of the operation and maintenance of ground water facilities, including water wells for extraction of ground water, as well as flooding basins and injection wells for recharge of ground water. Chapters review key factors involved in the location, design, and construction of water wells; common types of ground water extraction facilities; and starting and stopping ground water production. Additional topics covered include the importance of preventive maintenance of water wells; rehabilitation of water wells; water quality considerations and treatment procedures; and artificial recharge procedures for both surface facilities and injection wells. A glossary of ground water terms is included.

Rowles, Raymond. *Drilling for Water: A Practical Manual*, 1995, Ashgate Publishing Company.

Weapon's Repair

Walker, Ralph. *The Gun Digest Book of Shotgun Gunsmithing*, 1983 Krause Publications.

Wood, J. B. *The Gun Digest Book of Firearms Assembly/Disassembly: Part V*, 1992 Krause Publications.

Wood Working

Griffiths, Duane L. and William P. Spence. *Woodworking Basics: The Essential Benchtop Reference*, 1995 Sterling Publishing Company, Incorporated.

Find the answers to all your woodworking questions quickly and easily. "Nearly 1000 photos, diagrams and illustrations make instructions and explanations as simple as possible."

Jackson, Albert, David Day, Simon Jennings. *The Complete Manual of Woodworking*, 1996 Knopf Alfred A.

With more than 1,800 drawings, diagrams and photos, this authoritative guide encompasses the whole art and craft of woodworking. Designed to instruct and inspire every woodworker from the beginner to the most exacting expert, it has become a classic. It includes a discussion of all the principal hardwoods and softwoods, how to choose and use hand tools, detailed information on every woodworking technique--jointing, bonding, fastening, laminating, and much more.

Wood Books. ***The Home Workshop Planner:*** *A Guide to Planning, Setting up, Equipping, and Using Your Own Home Workshop*, 1994 Wood Pubns.

Not only is this the best book on planning a home woodworking shop I've found, it's also one of the best how-to books I've read in general. It's geared toward the person who doesn't have a clear picture of space layout, tool purchasing, maintenance, and workshop use. With an interview and description of THE Master Carpenter, Norm Abram, it opens a Pandora's Box for the aspiring or beginning woodworker. The book contains detailed samples of workshops for different stages of woodworker, from beginner to professional. It also lists suggested tool purchases for each stage with example costs and advancement from mid-line to professional quality tools. Several helpful build-it-yourself shop aids are also described. If you're just starting out and are looking for a book which will guide you through the bewildering task of laying out, stocking, maintaining, and using a home workshop, this is the book for you.

OTHER BOOKS BY JOEL SKOUSEN

STRATEGIC RELOCATION – North American Guide to Safe Places Second Edition, 2006

In today's bookstores, you can find a fair amount of literature on the "best places" to live. Almost all of these books concentrate upon the positive aspects of life – especially for the retired person: numbers and ratings of golf courses, doctor/patient ratios, warm sunny climates, availability of cultural activities, status of educational institutions, and the growth potential of the local economy. While all of these may be welcome amenities to a retiring life-style, what happens to these highly rated metropolitan areas when a major crisis strikes? Are these communities going to provide the basic necessities of life when a labor crisis brings the inflow of food and business goods to a halt? Or what about an economic crisis that threatens pensions, investments, and other so-called "guaranteed" income? What about a major earthquake or other natural disaster that suddenly upsets the natural social order for months at a time? Can you get out of harm's way if massive social unrest erupts in the wake of a crisis? Do you have contingency plans to exit an urban area when all of the freeways are clogged? What happens if the "unthinkable" happens – if the Russians have been cheating on disarmament all along, just waiting for the United States to fully disarm before they strike? Or have you thought about the potential of a major terrorist attack on a US city with chemical or biological weapons? These are not simply musings of the paranoid mind. These are real threats to society that are increasing in probability each year, despite the illusions of peace and prosperity.

This then, is what *strategic thinking* is all about – watching ahead for potential threats that most other people fail to see or choose to ignore. Living in a sea of unprepared people only makes us all more vulnerable, especially when we live in one of the US or Canada's 150 major metropolitan areas. *STRATEGIC RELOCATION* is a complete discussion of the strategies and relocation contingencies to help you avoid or mitigate each of the major modern threats to your well-being – from NATURAL DISASTERS to ECONOMIC COLLAPSE and NUCLEAR WAR, plus much more. If all this seems a little far fetched, then you may be one of those that can benefit most from this book.

To Order:

Strategic Relocation costs $35 plus $8 shipping and handling. To order by credit card go to www.worldaffairsbrief.com and click on "Strategic Relocation" on the left. send check or money order to Joel Skousen 290 West 580 South, Orem, UT 84058. As a relocation expert, Mr. Skousen also does personal paid consultations for those who want his advise on selecting land or working out special contingency retreat plans. It is recommended that you read the book first in order to make more efficient use of his time and your money. The hourly fee ($60/hr) can be pro-rated by the minute. No appointment necessary. Week-end calls are OK too. (801-224-4746)

How To Implement A High Security Shelter In The Home

1996, by Joel M. Skousen. 111 pages illustrated plus building plans.

This high security shelter system is designed to protect you and your family from multiple threats. This book differs from the *Secure Home* manual in that it provides architectural plans for placing a masonry shelter into an existing home, using do-it-yourself building techniques with reinforced concrete block. In contrast, the *Secure Home* manual deals with new construction and poured concrete shelters.

- It is a reinforced storm shelter protecting you from tornadoes and hurricanes – the highest winds known.
- It provides a crush-proof, reinforced shelter against earthquakes.
- It serves as a concealed vault room so that you can store your valuables in safety and security.
- It acts as a secret hiding place, providing your family members the highest security possible if they do not want to confront an intruder. Various communications means for calling for help are available from within the safety of the shelter – including a concealed exit for emergencies.
- It provides live-in fallout protection in case of a nuclear attack complete with bunk beds, water, food, cooking center, bathroom, and filtered ventilation.

The book covers design, layout, construction, ventilation, filtration, 12v lighting, escape exits, water tanks, sanitation, solar electric systems plus controls and wiring, EMP protection, radios, antennas, radiation meters and effects, concealment, stockpiling and barter lists, plus a complete list of equipment sources and costs. Over 100 pages including plans.

The Plans:

The plans include architectural details of reinforced masonry walls and ceiling, the vault door installation, and complete instructions covering all other major systems including electrical and plumbing notes. The shelter is designed for the do-it-yourself handyman and uses conventional materials that are readily available. The plans are designed for the person who wants to add such a shelter to an existing home or basement, but can be modified to accommodate new construction by replacing the concrete block construction with poured cement. Only *The Secure Home*, however, has the necessary reinforcing details to properly implement a poured concrete ceiling.

To Order:

The book and plans cost $25 plus $5 for shipping and handling. If not satisfied, you can return the plans (in new condition) for a full refund. Order online at www.worldaffairsbrief.com or send check or money order for $309, payable to JOEL SKOUSEN. Mail to Joel M. Skousen 290 WEST 580 SOUTH; OREM, UT 84058.

Ten Packs For Survival

$5 postpaid, a small, professionally illustrated booklet by Mr. Skousen listing all the basic survival necessities in 10 unique categories to get your home in minimum condition to survive a variety of crises or shortages. This is a nice little introductory listing of preparedness items to give to a friend who needs to get started in preparation. A listing of useful barter items is also included at the end. The ten packs are:

1. Food Pack
2. Water Pack
3. Power Pack
4. Medical Pack
5. Vehicle Pack
6. Travel Pack
7. Communications Pack
8. Household Equipment Pack
9. Defense Pack
10. Tool Pack

Quantity prices are available if you want to give these to your friends and family: qty 2-9: $4 each and 10 or more are $3 each.

How To Fortify A Closet

Special report by Mr. Skousen. Is now included in *How to Implement A High Security Shelter In The Home*.

Concept:

Many readers of my High Security Shelter Book found that they could not find the space to build a dedicated vault room, or it was too expensive for their present budget. To help them out, I have written up designs and instructions on how to fortify a bedroom walk-in closet or other closet in the home so that it serves as a semi-secure vault room, and a short term safe room close to your sleeping area. This new section (chapter 4) is 14 pages in length and has 6 drawings detailing the plans and instructions you need to follow in order to do this relatively simple remodeling task. It is printed and pre-punched with holes so that you can add it to your existing copy of the Shelter Book, if you purchased the 1st edition. If you are purchasing the current edition, you do not need to purchase this separate section – it is already included in the latest edition of *How to Implement a High Security Shelter in the Home*.

In this closet section, I discuss three progressive levels of security you can use, including a bullet proof option without solid masonry construction or costly bullet proof fabrics. I cover emergency escape exits, concealed entrances and high security doors, locks and jambs.

Even if you are building a high security vault room, you may also want to implement this security closet into your master bedroom so that you can have a safe room against intrusion, and a safe storage area for valuables you want frequent access to (like furs, jewelry, or important papers). This closet will also double its fire rating as well.

CONSULTATION FEE SCHEDULE

JOEL M. SKOUSEN

HIGH SECURITY DESIGN SPECIALIST

290 West 580 South
Orem, Utah 84058
(801) 224-4746
email: jskousen@enol.com

Specializing in the design of high security and self-sufficient residences and retreats.

Featuring:

- Alternate energy integrated systems (generators, solar panels, inverters, batteries, and controllers)
- Multi-purpose, concealed high security vault rooms
- Multi-fuel equipment (for heating, cooking, and water heating)
- Integrated, real time security warning system
- Bullet proof and entry resistant construction
- Multiple storage elements for food, water, and fuel

CONSULTATION AND CUSTOM DESIGN SERVICES

I specialize in the design of self-sufficient, secure, personal residences and retreats. In the preparedness area I provide consultation on a wide variety of subjects: Relocation, site selection, contingency planning, self-sufficient living, and home design. I have been working in this field since 1976 and thus have a broad range of personal experience in everything I recommend. In the design field, I am equally as comfortable working with a remodeling design as a new custom home or retreat. I also do some stock plan modification for those who cannot afford custom design services. Almost any standard stockplan with a basement can be made secure and energy efficient. I am also pleased to help you implement your own designs and let you do as much of the design work that you feel comfortable with. In my design philosophy, I try to give the client what he or she wants, and am not interested in designing monuments to my reputation. I will, of course, advise you if I feel something you are planning to implement has serious drawbacks. That's what you pay me for. In general, self-sufficiency and security can be designed into a full range of styles, from classical to modern. I emphasize the need, however, to keep a low profile, and generally recommend that the finished product not draw undue attention to itself. In all of these areas, I design with the goal of complete integration of the applicable technical equipment you need to become more self-sufficient.

SPECIAL NOTICE: Due to the high demands on my time as the publisher and principle author of the World Affairs Brief, I am limiting my design work to a few clients per year. I can still do a full range of consultation, however. You can, therefore, make my limited time more effective by studying my books on the subject before you call or ask for my design help. You can work with a stock plan or local designer or architect to come up with the conventional design of a home, as I can advise you on how to modify almost any plan to make it suitable for security and self-sufficiency. Working with someone local often helps in securing the various building permits necessary in your area since you will have someone to help deal with any objections that may arise. More and more often, unfortunately for your budget, many building officials are requiring you to get the plans certified by a local, licensed engineer. It's not so much that engineering fees are too high, but rather, that the increased structural requirements added by licensed engineers will add thousands of dollars more in cost to the design. Over-engineering is a chronic problem in engineering, as applied to residential construction.

Consultation

I try to be accessible to those who need telephone consultation about relocation or on security design and equipment. My rates are still only $60 per hour, pro-rated by the minute. If I advise you for 15 minutes, you simply send me $15 dollars. No appointments are necessary. I find it works best for all involved for me to take your calls as they come in. If we establish an ongoing consultation, I bill you at the end of the month. Consultations out of town to help you select and assess property must be made in advance and require a retainer fee of $500 – my daily rate. I cannot guarantee how long my rates will stay this low, as our government keeps inflating the currency. Check with me when you call.

How To Proceed

The design and construction of a preparedness residence is fairly costly and time consuming. In order to maximize your dollars, you will need to analyze certain aspects of your intended plan before proceeding with the actual design:

1. Suitability of location as related to work, population centers, shopping, and schools.
2. Property access problems and related costs.
3. Availability of utilities and cost of alternatives.
4. Development restrictions, zoning, and sanitation requirements.

Additionally, we need to discuss the features of terrain and vegetation on the specific intended property, to include:

1. Water availability
2. Precipitation, wind patterns
3. Forestation and landscape screening
4. Rock, soil, or water table problems

5. Alternate power generation sources, if desired

6. House site possibilities

If you have not selected a specific home site, I can offer considerable assistance as to the best general and specific locations in which to find self-sufficient or secure property. Once we have talked and you have searched out recommended areas and located one or two prospective sites, you may wish to have me come out and help select the best specific location. I usually take care of the preliminary design interview at this time in order to generate a rough preliminary plan (once the property has been selected).

The first step in getting started is to prepare a written summary of your proposed plans and projects for my review. A retainer of $200 is required, to cover my time to review, analyze, and respond in writing to your plans. Feel free to call me during this period of initial review for any personal clarification. After the analysis and preplanning are firm and the property selected, you will be ready to proceed with a formal design – either with a modified stock plan or a custom design in conjunction with the designer or architect of your choice in your local area. I will work with the designer to make sure the overall plan can accommodate the specialty features you need for a prepareness home.

Fee Schedule

Travel and onsite consultation: $500 per day plus travel expenses. Retainer for one day's consultation due in advance of actual travel to your location.

Hourly rate: $60 per hour for telephone consultation and general design work.

Percentage fee schedule: For full service custom designs 6% of the first $100,000 of estimated construction cost, 5% thereafter. $1,000 retainer to start. 15% of the total estimated fee is due upon completion of the preliminary plan, 35% upon completion of the structural design phase, and the final 50% after completion of the final working drawings.

One final note: If your finances are very limited and you can only afford partial design services or consultation , please let me help you on the *beginning* portion, rather than at the end where changes of design or location that I may recommend are much more costly and frustrating to implement. For those with very limited budgets, it is most cost effective to select a stock plan from one of the hundreds of books available and let me help you modify it for self-sufficiency and security. I hope to be able to serve you in bringing your self-sufficiency plans to fulfillment**.** **Joel M. Skousen**

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