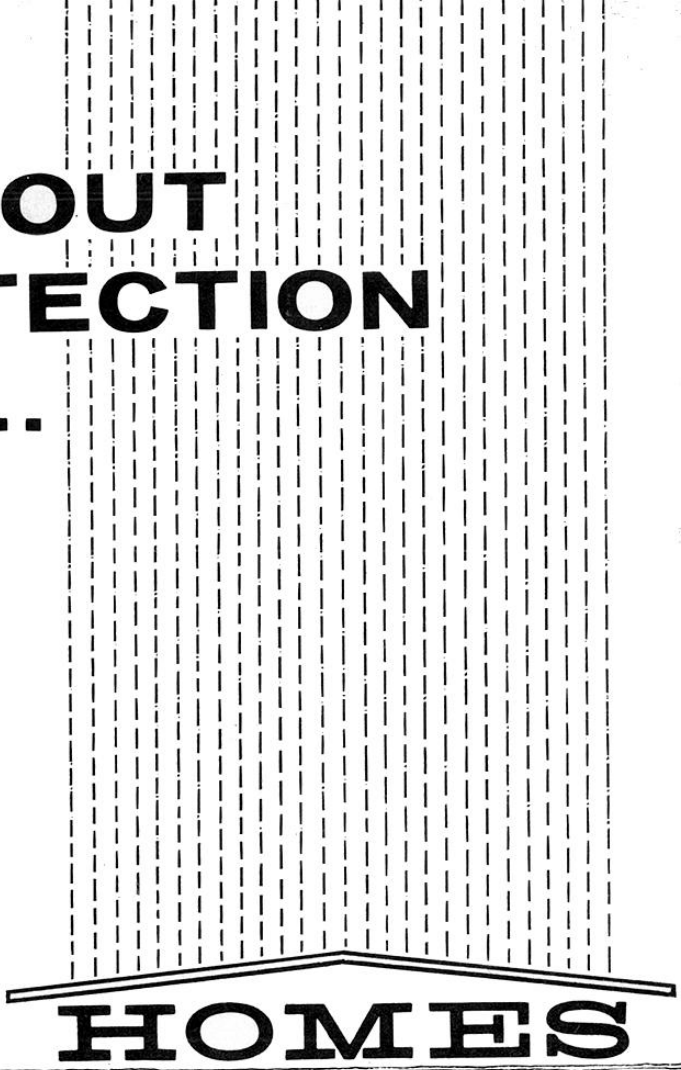
FALLOUT PROTECTION FOR...



HOMES

WITH BASEMENTS

See back cover for your individual Home Protection Factor

DEPARTMENT OF DEFENSE • OFFICE OF CIVIL DEFENSE
MAY 1967 H—12 (Revised)

This booklet has been specially prepared for the householder whose basement has been analyzed for fallout protection as a result of a questionnaire filled out in the Home Fallout Protection Survey.

FALLOUT PROTECTION FOR HOMES WITH BASEMENTS

January 18, 1965

"It is already clear that without fallout shelter protection for our citizens, all defense weapons lose much of their effectiveness in saving lives. This also appears to be the least expensive way of saving millions of lives, and the one which has clear value even without other systems. We will continue our existing programs and start a program to increase the total inventory of shelters through a survey of private home and other small structures."

President of United States

Excerpt from the President's message to the Congress

THE FALLOUT PROTECTION IN YOUR HOME

This booklet is about fallout protection. It will tell you what radioactive fallout is and how you can improve your protection against it if this country were ever attacked with nuclear weapons. But first of all, because your home has a basement, you already have some fallout protection. Let's see what that protection is:

On the back cover of this booklet a box like this appears:

BASEMENT PF (PROTECTION FACTOR)		ADDED WEIGHT
CENTER	BEST CORNER	

Entered in the space labeled Basement "PF" are two numbers which tell you the fallout protection that was calculated for the "center" of your basement and the "best corner" of your basement. Information on the box labeled "Added Weight", is on page 20 of this booklet.

The "PF" above the box stands for "Protection Factor." Before going into the details of what your "Protection Factor" numbers mean, let's talk for a moment about what fallout is.

WHAT IS RADIOACTIVE FALLOUT?

When a nuclear weapon is exploded close to the ground, dirt and other debris are drawn up into the mushroom cloud and pick up the radioactivity created by the explosion. The heaviest pieces of dirt and debris drop back to earth within a few miles of the explosion. But the lighter pieces are carried by the winds for many miles before drifting back to earth.

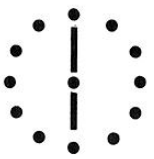
These radioactive particles are called "fallout." Any part of the United States might be covered with deadly or dangerous amounts of radioactive fallout, depending on which way the winds were blowing and the size and number of nuclear weapons exploded. The radioactivity could cause serious health damage or fatal injury to unprotected persons. In a nuclear attack, the

blast, heat, and fire from the explosions would be very destructive, but the destruction would be in the areas near the explosions. Radioactive fallout, though, could spread in a thin layer over millions of square miles.

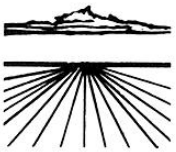
Radiation would come from the fallout wherever it settled—the ground, trees and bushes, or the roof of your home. *Fallout does not behave like a gas.* In areas that would be affected by dangerous amounts of fallout, the fallout particles would look like dirt or sand and you may see them after they have settled on the ground or other places. The exact amount of radiation given off by the particles can be measured only by special instruments.

HOW CAN YOUR PROTECTION BE IMPROVED?

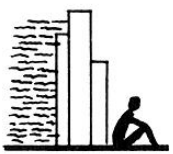
There are three ways of improving your protection against fallout—time, distance, and getting some heavy material between you and the fallout (called "shielding").



1. *Time*—Radioactivity decreases rapidly at first. After an attack, the radiation would be most intense during the first few days. Even so, radiation protection may be needed for an extended period—days or weeks.



2. *Distance*—The amount of radiation is less the further away you are from the source of radiation.



3. *Shielding*—Any material that is put between a person and the source of radiation cuts down the amount of radiation that reaches the person. The thicker and heavier the material, the better the protection.

In the event of an attack, you have little control over time and distance, but YOU CAN DO SOMETHING TO IMPROVE YOUR PROTECTION BY MEANS OF SHIELDING.

It is the principle of shielding that is employed in fallout shelters. Under the guidance of the Office of Civil Defense, a system of fallout shelters is being developed throughout the nation. It consists of public shelters, private shelters, industrial and home shelters.

THE FALLOUT SHELTER SYSTEM

As a result of the National Fallout Shelter Survey, in which existing large buildings were examined and evaluated for fallout protection, space for millions of people has been identified. Those community shelters having a protection factor of at least 40 and space for at least 50 people are now being marked with the familiar black and yellow shelter sign. Where necessary storage space is available, they are being stocked with food, water (if needed), sanitary and medical supplies, and radiation detection instruments. The survey is a continuing effort. Through it, a current inventory is maintained of shelters added by new construction.

The fallout protection found in homes with basements represents important additional shelter space.

Personal and other special considerations may make fallout protection at home more practical or desirable than community shelters for certain individuals or families. For example, in rural and suburban communities and even in many cities, families may live a considerable distance from the nearest community shelter. For these families, a home shelter will provide more accessible fallout protection. Fallout protection at home is usually more accessible to housewives and young children during the day and may be preferred by the whole family when at home.

HOW MUCH PROTECTION DOES YOUR BASEMENT PROVIDE AGAINST RADIOACTIVE FALLOUT?

In homes, basement areas provide the best shelter against fallout because they are mostly belowground. This gives them a natural shield. This booklet tells you the amount of protection your basement offers and what you can do to increase this protection to provide for your family's safety. Keep in mind that fallout shelter provides only limited protection against blast.

Look at the back of this booklet again. Two numbers are printed there which tell you the amount of fallout protection your basement offers. These numbers were calculated for your home by electronic computer from the information you gave in the recent Home Fallout Protection Survey questionnaire. The analytical method used is based on the best scientific information available. It was designed to give the maximum accuracy possible while requiring minimum information from you. A more complex method might produce more precise results in some cases but would sacrifice simplicity, speed and economy.

The numbers are given in terms of a "Protection Factor" or PF. This is the relation between the amount of fallout radiation

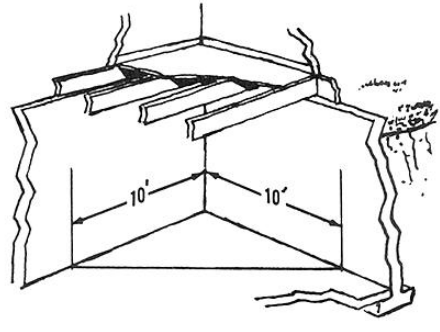
which would be received by a completely unprotected person compared to the amount which would be received by a person in a fallout shelter. For example, a person in a fallout shelter with a PF of 40 would receive about one-fortieth (or 2½ percent) of the radiation he would be exposed to if he were completely unprotected. The higher the PF for your home, the more protection your basement affords against radiation.

BASEMENT PF (PROTECTION FACTOR)		ADDED WEIGHT
CENTER	BEST CORNER	

The number in the box marked "center" (see back of your booklet) is the Basement Protection Factor (PF) calculated for the center of your basement. The other number is the PF calculated for the best corner of your basement. If your cover shows an X in place of either PF number, it means the PF is smaller than 10. Information on the box labeled "Added Weight," is on page 20 of this booklet.

WHICH IS THE BEST CORNER OF YOUR BASEMENT?

The best corner of your basement is the one which has the highest outside ground level—that is, the least amount of basement wall sticking up aboveground. In this corner make a triangle by measuring ten feet from the corner along each wall, and drawing a line between these points (see illustration).



The best corner protection factor listed on the back of this booklet means the average protection factor within the triangle is above this value. This 50 sq. ft. area provides adequate fallout shelter space for 5 persons; however, if necessary, several more persons could crowd into the corner area.

A smaller area could be used if equipment such as a furnace occupies part of the corner. If additional shelter space is required or the best corner is not usable, another corner having the next highest ground level to that of the best corner could be used. If all the corners have equal outside ground levels, the most convenient corner may be used, and of course all corners may be used.

The fallout protection afforded in the corner is better closer to the wall and closer to the floor. Therefore, you should lie on the floor next to the wall or sit on the floor with your back against the wall as much as possible. You may stand to stretch, and for essential needs, you can leave the corner shelter area for a few minutes.

WHAT ABOUT THE CENTER OF THE BASEMENT?

In nearly all basements, the highest protection factor is in the corner and the lowest is in the center. This means the whole basement can be thought of as a fallout shelter with a protection factor in the center equal to the first PF number on the back of your booklet and a higher protection factor in the best corner equal to the second PF number.

STEPS YOU CAN TAKE TO INCREASE YOUR FALLOUT PROTECTION

If the protection factor in the best corner of your basement as indicated on the back cover is less than 40 and you wish to bring the PF up to the minimum recommended for public shelter, then you need additional shielding.

You can provide additional shielding for your basement by:

1. *Permanent shelters*—By making part of your basement into a shelter area or by building a permanent shelter which might also serve other purposes. Listed on the back label are the plans recommended for your home.
2. *Preplanned shelters*—By locating shielding materials so that you can complete a shelter quickly in time of crisis.
3. *Improvised shelters*—By taking last-minute improvised actions if an emergency actually occurs.

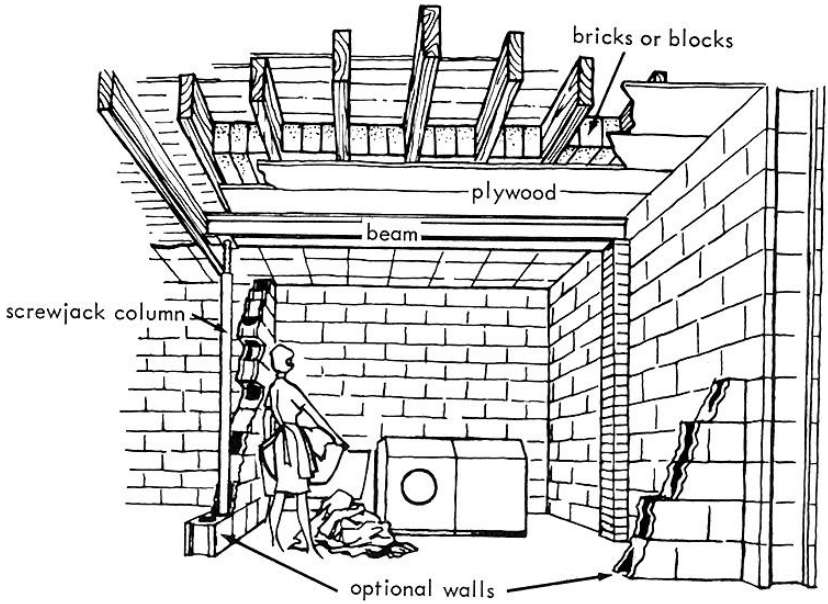
A WORD OF CAUTION TO THE HOME HANDY MAN

Fallout Shelter Plans A through F which follow are so simple that you may be tempted to construct them from the drawings in this booklet—and in many cases a thoroughly experienced "do-it-yourselfer" could do this. However, it requires very careful calculation of materials and fasteners to safely hold the heavy materials to be placed overhead; therefore, it is strongly recommended that you build from the detailed plans and lists of materials which are available by mailing the post card enclosed with this booklet.

PERMANENT SHELTER

Ceiling Modification To Basement PLAN A

NOTE: If too much of the basement wall is exposed, this plan will not provide sufficient protection and should not be used. The back cover of this booklet will indicate if this plan is recommended for YOUR home.

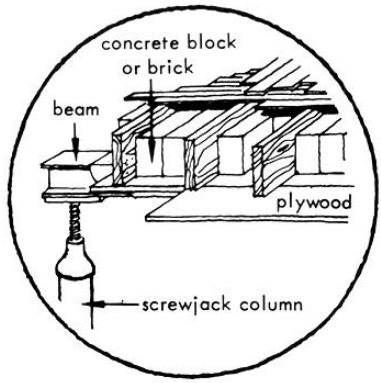


Here is a shelter which can be permanently installed in the basement of your home without affecting the use of the basement in any way.

All that is needed is a basement, some basic woodworking skills and approximately $165 for materials. The shelter can be accomplished while the basement is being built or it can be added to an existing basement by modifying the ceiling in the corner which furnishes the best protection.

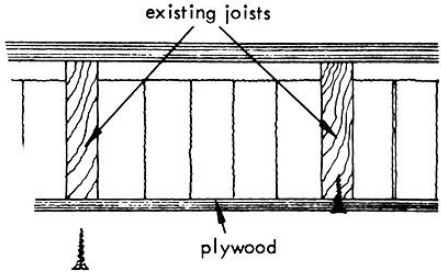
A significant amount of protection can be achieved merely by inserting heavy material in the ceiling above the best corner if this plan is recommended for your home. If this plan is not indicated on the back cover of your booklet, it can still be used by providing two additional masonry walls to enclose the corner of the basement. Fixtures and installation of ceiling tiles or walls will increase the cost a bit, but you will be able to achieve a significant amount of protection without interfering with the functions of the basement.

Because the basement area is almost all belowground level, you can increase the fallout protection by installing bricks or solid concrete blocks between the wood joists in the best corner. The filler materials are supported by sheets of plywood fastened to the floor joists. A beam and screw jack column may be needed to keep the floor joists from bending too much. A carpenter can tell you if this is needed.



Plywood sheets (2′ x 8′ x ½″ cut to fit) should be securely fastened to the joists using 2 inch, #8 screws 10 inches apart. Bricks or blocks are then packed as tightly as possible into the openings between the joists. Be sure to fill as much space as possible. To get the most protection out of this improvement, one-quarter of the basement ceiling over the best corner should be filled with bricks or solid concrete blocks.

To obtain detailed plans, see page 24.

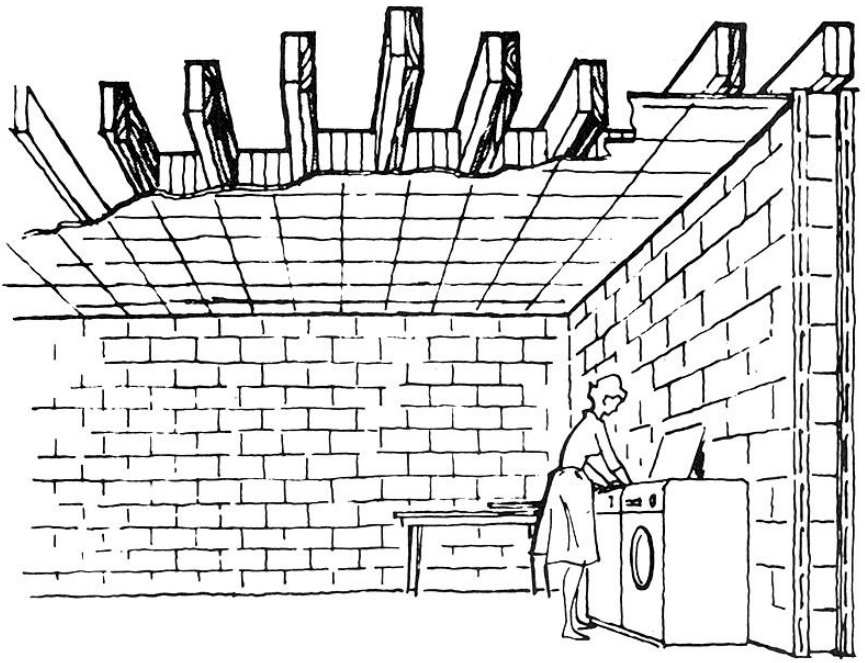


In fastening the plywood sheets to the joists, nailing is not enough. Nails will pull loose. Use two-inch screws in the manner shown here.

PERMANENT SHELTER

Alternate Ceiling Modification To Basement PLAN B

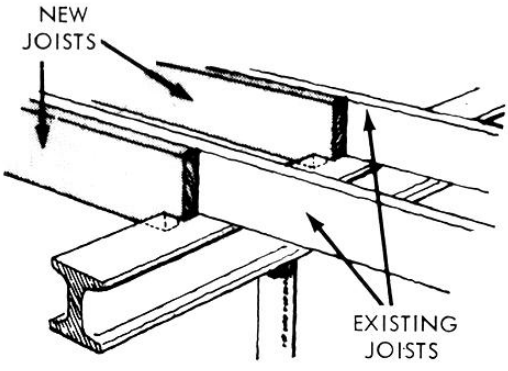
NOTE: If too much of the basement wall is exposed, this plan will not provide sufficient protection and should not be used. The back cover of this booklet will indicate if this plan is recommended for YOUR home.

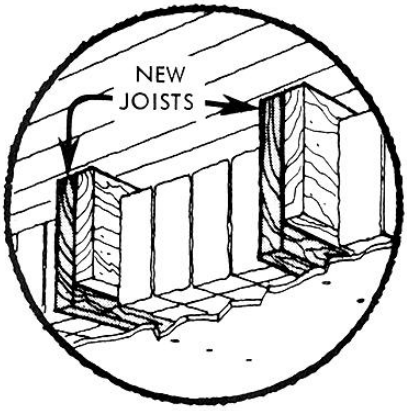


If you need a minimum shelter which will not interfere with an existing corner of your basement, try this plan. It is so arranged that the shelter area can be enlarged at either end, depending upon the size of the basement.

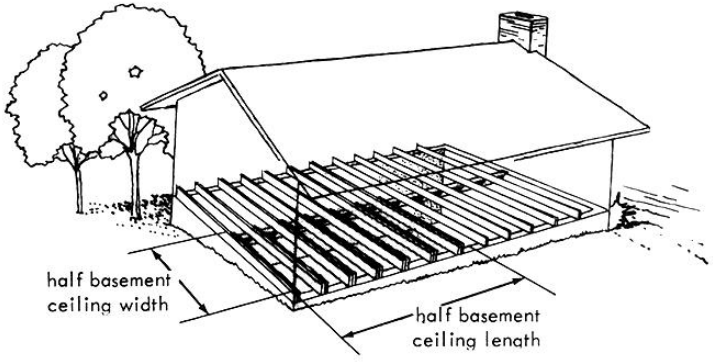
This type of construction does not require a beam and screw-jack column to support the joists. The protected area can be used as a workshop, recreation room, pantry area, laundry room, or part of a family room. With ceiling tile covering the plywood panels, no one would recognize the area as a fallout shelter. Since the objective is to provide as much overhead mass as possible, the heaviest weight of solid brick or block (placed on an end if possible) should be used. If this plan is not indicated on the back cover of this booklet, it can still be used by providing two additional masonry walls to enclose the corner of the basement.

Wooden joists (2″ x 12″), notched at the ends for bearing, are installed between existing floor joists. Plywood panels are then fastened to the 2″ x 12″ joists.





Brick or concrete blocks are packed into the spaces between the 10″ and 12″ joists; they are supported by the plywood panels.

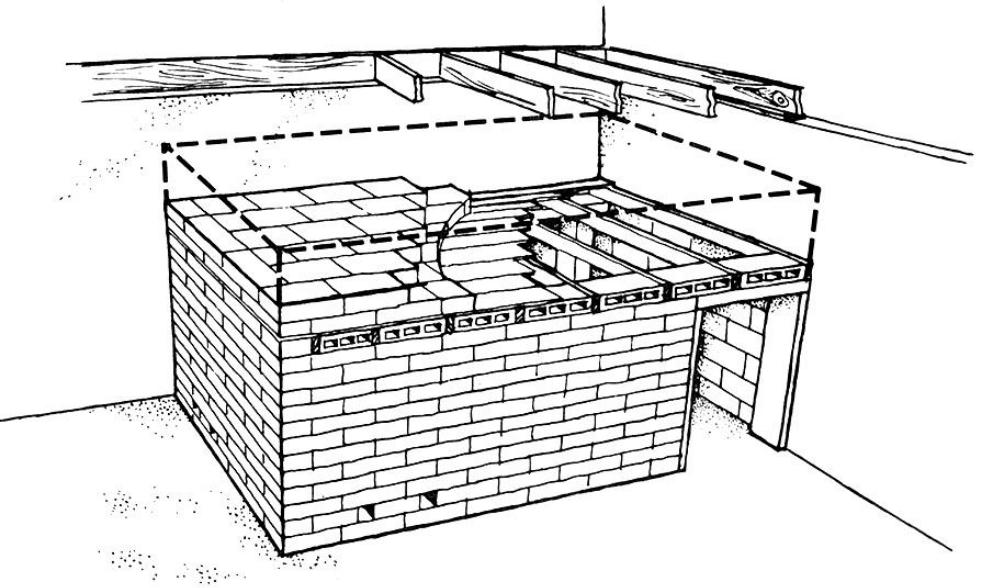


This basement floor plan shows how the additional joists and the filler material might be used in the corner of the basement which furnishes the best fallout protection. To get the most protection out of this improvement, one-quarter of the basement ceiling should be filled with bricks or solid concrete blocks.

To obtain detailed plans, See page 24.

PERMANENT SHELTER

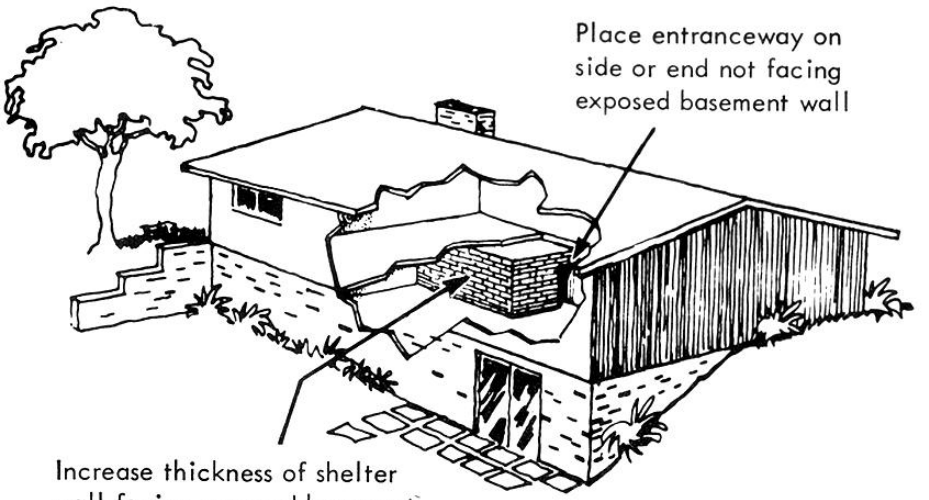
Concrete Block Shelter PLAN C (for best corner of basement)



The above concrete block shelter is designed to provide a protection factor of at least 40 when placed in the basement. Its principal advantages are simple design, speed of construction and ready availability of low-cost materials. It can be designed as a sit-down shelter, or by increasing the ceiling height to 6 feet or more, it could make a more comfortable shelter and serve a dual purpose as a storage room or similar facility. The shelter ceiling, however, should not be higher than the outside ground level in the basement corner where the shelter is located. The ground level could be raised as shown on pages 18 and 19.

Natural ventilation is provided by the entrance and the air vents in the shelter wall. Materials for this type of shelter will cost an estimated $135–$150 depending on its height and the area of the country.

To obtain detailed plans, see page 24.



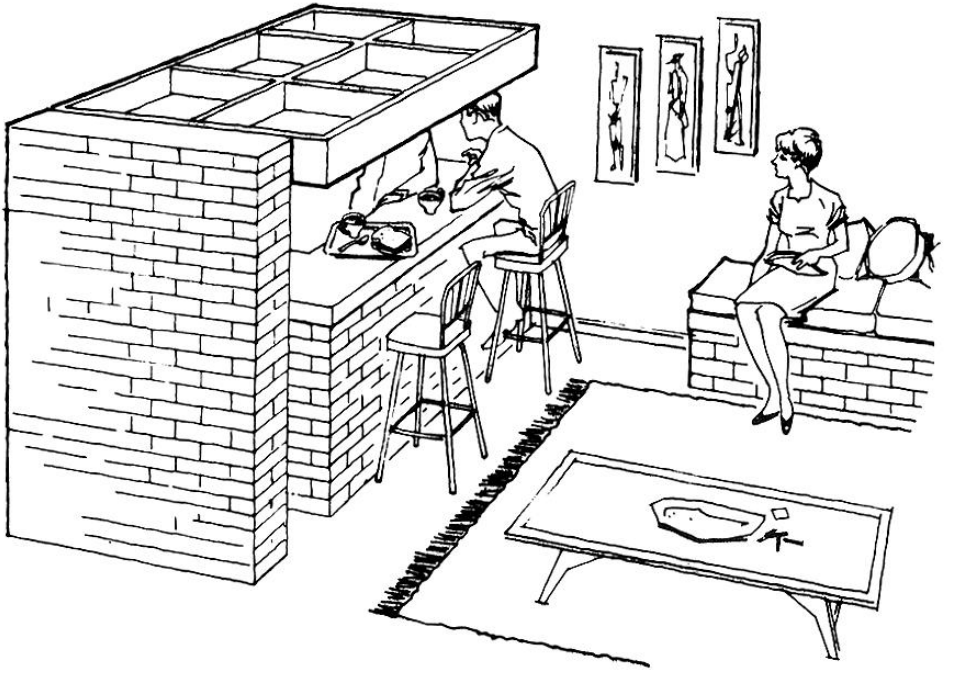
If your basement ceiling is near ground level on three sides and exposed on one side (as with "walk-in" basements), the concrete block shelter (Plan C) must be modified to achieve the desired effectiveness. The following changes should be made:

1. Increase the thickness of the shelter wall facing the basement wall which has no ground cover by four inches of brick, concrete block or similar materials.

2. Place the shelter entrance on a side or end which does *not* face the exposed basement wall.

PRE-PLANNED SHELTERS

Snack Bar PLAN D (for best corner of basement)

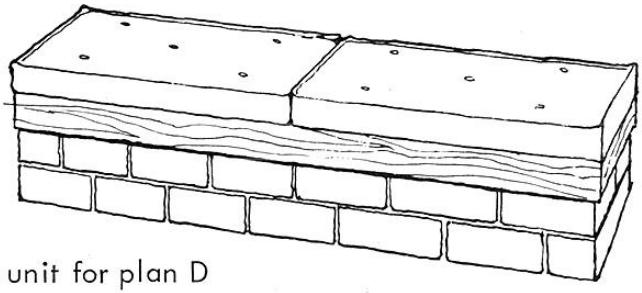


A snack bar built of brick or block can be converted into a fallout shelter in a short period of time by lowering a strong hinged false ceiling to rest on the snack bar.

The false ceiling section can then be loaded with brick or block. The bricks or blocks can be conveniently stored by incorporating them into recreation room furniture such as benches and room dividers.

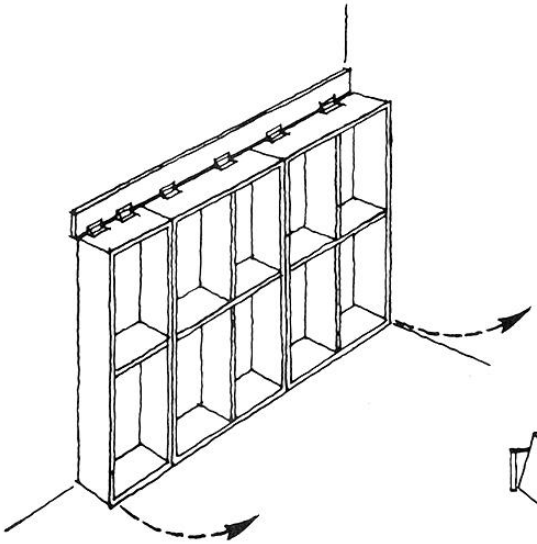
An attractive bench unit for your recreation room can be made from blocks or brick. Pillows and a wood frame to enclose the bench will provide a finishing touch.

To obtain detailed plans, See page 24.

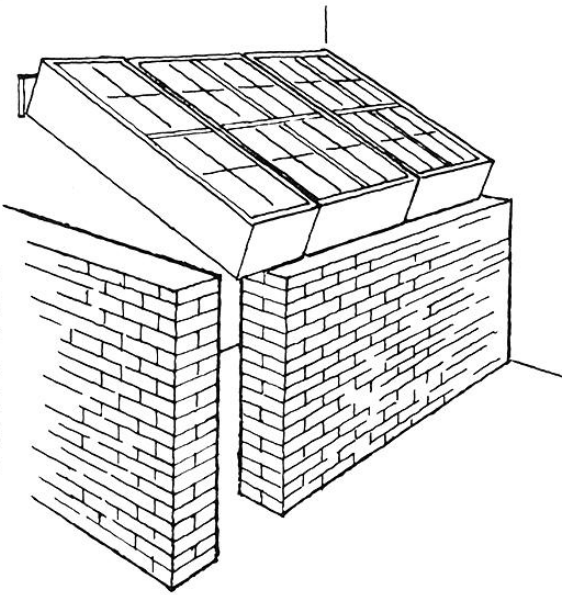


Bench unit for plan D

Tilt-Up Storage Unit PLAN E (for best corner of basement)



A tilt-up storage unit in a corner of your basement is another approach similar to the snack bar. The top of the storage unit can be hinged to the wall and the unit can be used as a bookcase, pantry shelves, or for miscellaneous storage.

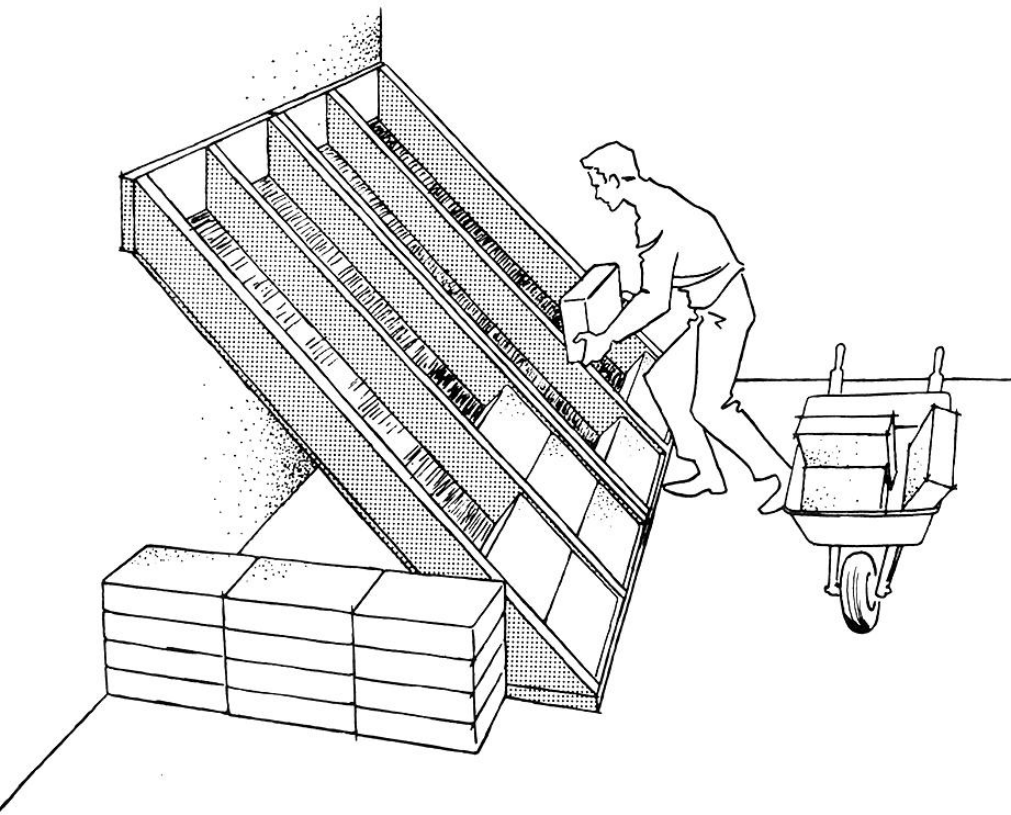


In an emergency, the storage unit can be tilted so that it rests on a wall of brick or concrete blocks stored for just such as emergency. Additional bricks or blocks can then be placed in the storage unit to provide an overhead shield.

To obtain detailed plans, see page 24.

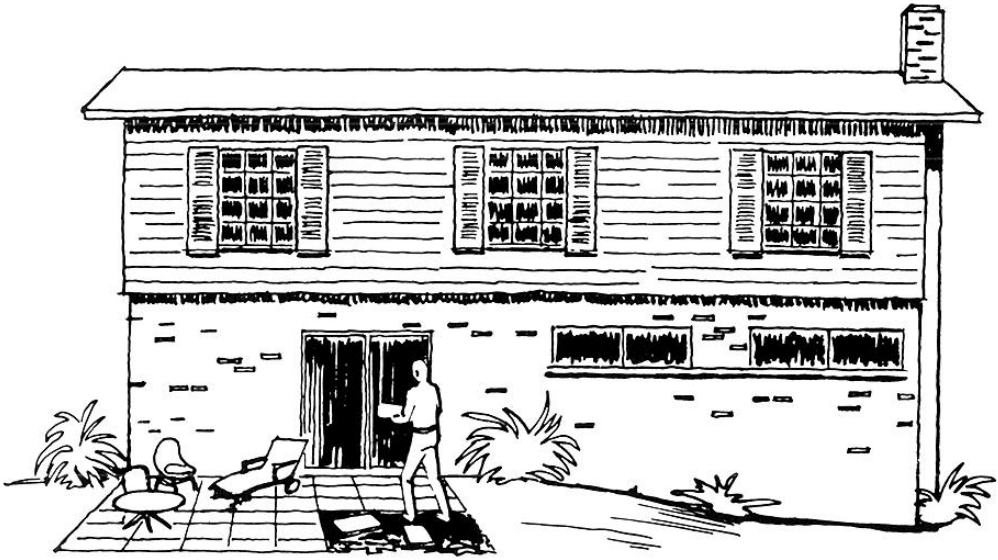
PRE-PLANNED SHELTERS

Lean-To Shelter PLAN F (for best corner of basement)

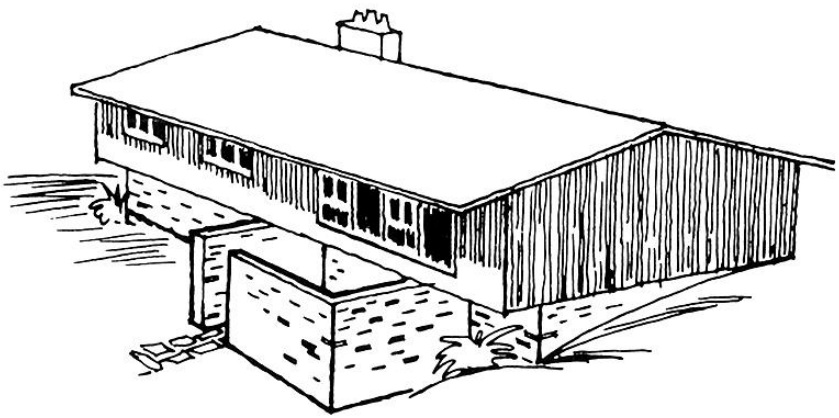


A simple and effective lean-to shelter can be built by constructing the components and storing them in your basement where they can be quickly assembled in an emergency. Components consist of a frame and filler materials, such as brick or blocks.

For detailed plans, see page 24.

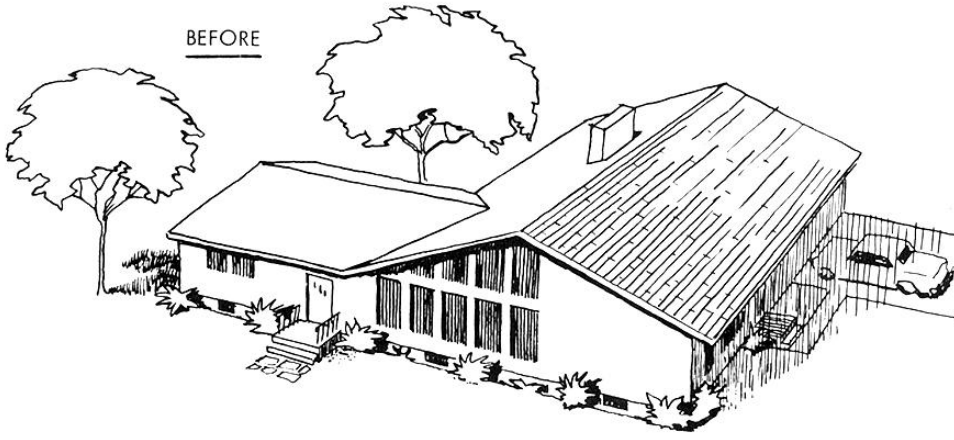


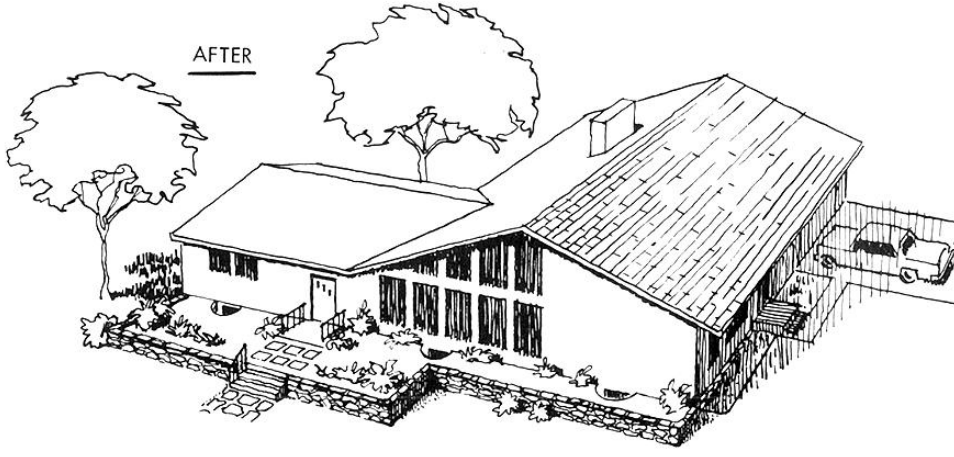
A patio of brick or concrete block supported on a bed of sand will provide a ready source of shielding material which could be quickly removed for use in an emergency. See Plans D, E and F.



Enclosing your patio area with a solid masonry screen wall will give you privacy for lounging and cook-outs, and will provide a barrier shield to increase the PF in the basement area.

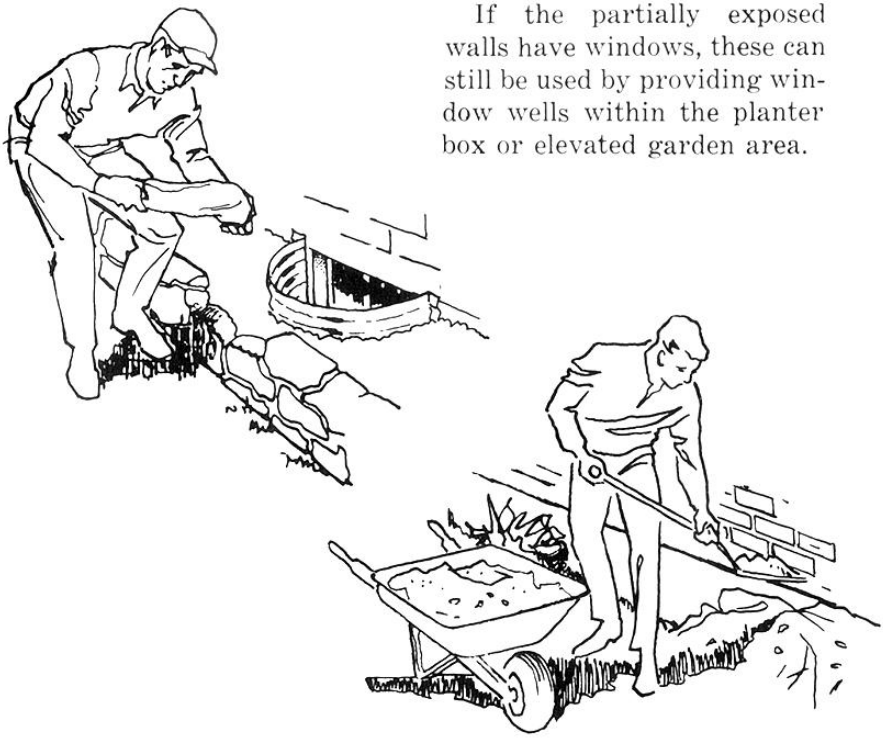
AN ELEVATED FLOWER GARDEN





Where basements are not completely belowgrade, here are some additional ideas which can be used to increase the shielding of exposed basement walls. A brick, masonry, or stone planter box along one or more sides of the house will improve protection substantially, and will provide an attractive setting for shrubs and flowers as well. If the partially exposed wall is at the rear or side of the house, an elevated garden could be built with masonry retaining walls.

If the partially exposed walls have windows, these can still be used by providing window wells within the planter box or elevated garden area.



Your basement's PF will also be increased by providing additional shielding to the exposed section. This can be done by piling patio block, sand, earth, cordwood or similar materials against the exposed wall.

IMPROVISED SHELTERS

If a community shelter is not available and you have not provided your own fallout shelter, what would you do if you suddenly heard that the United States had been attacked with nuclear weapons?

You can still protect yourself and your family if you know what to do and if you act quickly. Pick out the corner of your basement with the highest ground level outside. That is the safest place in the basement. NOW MAKE IT SAFER.

In belowground basements, it is most important to have shielding overhead. Entered in the box labeled "Added Weight" on the back cover of this booklet is a number which tells you approximately how much weight of material should be placed over each square foot of the area over an improvised shelter, as illustrated on the following pages, to obtain a PF of 40, the minimum recommended.

If the letter "Y" appears in the box labeled "Added Weight" this means that adding overhead materials alone will not provide adequate protection against radiation unless heavy walls surrounding the shelter area are also added. If you already have a PF of 40 or more in the best corner of your basement, a zero, "0," will be shown in the box on the back cover labeled "Added Weight" indicating that additional weight is not required.

BASEMENT PF (PROTECTION FACTOR)		ADDED WEIGHT
CENTER	BEST CORNER	

YOUR OWN NUMBER WILL APPEAR IN THIS BOX ON THE BACK COVER OF THIS BOOKLET.

Here are the weights of typical shielding materials:

4 inches of sand weighs approx. 35 pounds per sq. ft.

4 inches of wood weighs approx. 10 pounds per sq. ft.

4 inches of water weighs approx. 21 pounds per sq. ft.

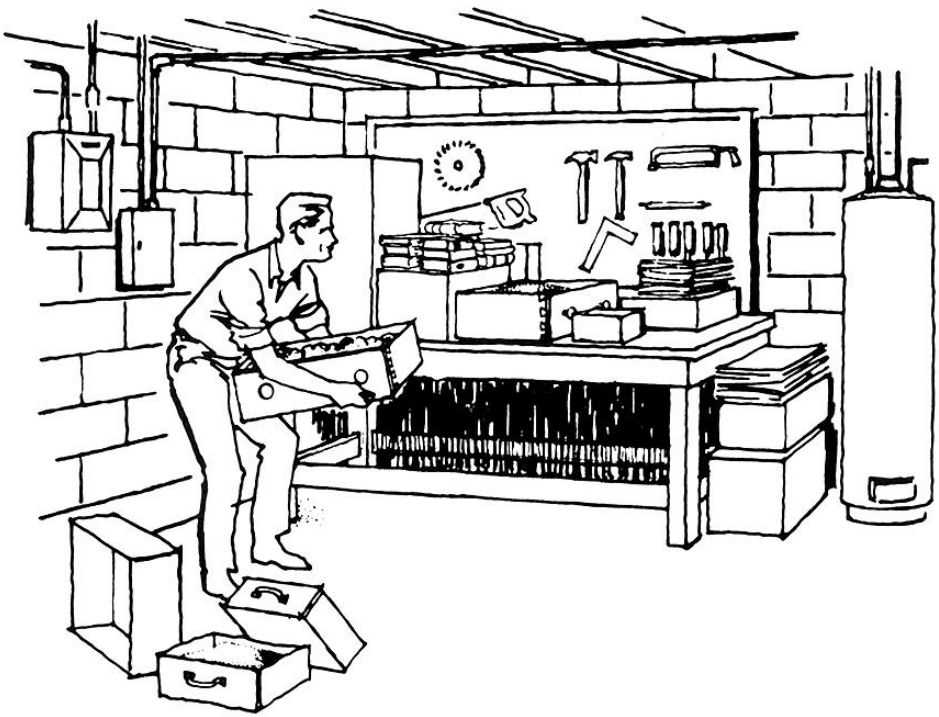
4-inch cinder blocks weigh approx. 22 pounds per sq. ft.

4-inch bricks weigh approx. 32 pounds per sq. ft.

4-inch solid concrete blocks weigh approx. 48 pounds per sq. ft.

4 inches of library books weigh approx. 15 pounds per sq. ft.

If you have a sturdy table or workbench, place it in the corner. Quickly fill drawers or boxes with the heaviest material which is readily available—sand or dirt, bricks—or if you have nothing heavier, newspapers or books. Stack these materials on the top of the workbench. If a "Y" appears in the "Added Weight" box on the back cover of this booklet, then in order to obtain a PF of 40 in the shelter you must place an equivalent of 70 pounds per square foot on top of the shelter *as well* as adding heavy material on the sides of the shelter.



Be careful not to overload the table to the point where it will collapse.

IMPROVISED SHELTERS

If a workbench is not available, you can improvise a somewhat larger shelter area by using furniture, doors, dressers, or other materials. Remove doors from their hinges and place them over supports in the corner of your basement having the best protection. The supports for the table can be chests of drawers or anything that can take a heavy load. Use two or three doors over each support for this shelter to provide sufficient strength to carry the heavy loads placed on them. Place bricks, concrete blocks, earth- or sand-filled drawers, books, a collapsible children's swimming pool filled with water, etc., over the doors to provide an overhead shield. Use anything with weight that can be moved. The heavier the material, the more the protection. The minimum weight of material to be added for each square foot over the doors is shown in the "Added Weight" box on the back cover. If a "Y" appears in the "Added Weight" box, then in order to obtain a PF of 40 in the shelter, you must place 70 pounds per square foot on top of the shelter *as well* as adding heavy material to the sides of the shelter to serve as a vertical shield.

Be careful not to overload the doors to the point where the shelter will collapse.

If the figure entered in the box marked "Added Weight" on the back cover happens to be a number such as 30, this means that *every square foot* over the shelter area should be covered with material having a sufficient height so as to weigh 30 pounds. Using the weights of typical shielding materials as given on page 20, the required shielding material can be obtained by the following:

Approximately 3½ inches of earth or sand or

Approximately 12 inches of wood or

Approximately 6 inches of water or

4-inch (nominal thickness) layer of bricks or

Approximately 8 inches of library books

The shielding materials can be used individually such as providing a 3½-inch layer of sand completely over the improvised shelter or in conjunction with other materials as shown in the illustration on the opposite page.

If vertical shielding is required (a "Y" has appeared in the "Added Weight" box) this can be obtained by placing heavy material along the sides of the improvised shelter. Examples are: single course of bricks or concrete blocks, washing machine filled with water, chest of drawers filled with earth, deep-freeze, two rows of books, etc.

GENERAL

Until the extent of the radiation threat in your town is determined by trained monitors using special instruments, you should stay in your shelter as much as possible. For essential needs, you can leave your shelter for a few minutes. Before leaving the shelter for longer periods of time, listen to your radio station for information and instructions. A battery operated radio should be available for this purpose.

For quick reference, after you have finished reading this booklet, hang it up in the corner of your basement having the best protection so that it will be available in an emergency.

DETAILED PLANS ARE AVAILABLE FREE OF CHARGE

Detailed plans of many of the shelters you have read about in this booklet are available free of charge.

These plans contain construction details, suggested construction sequences and lists of materials needed. The plans supplement the material presented in this booklet.

Before constructing any of the permanent shielding devices described here, you should check to see that the construction conforms to your local building code.

The plans may be obtained by sending the attached post card to the Jeffersonville Census Operations Office, 1201 East 10th Street, Jeffersonville, Indiana 47130

Be sure that you identify the plan or plans you want as they are designated in the booklet:

For further information on fallout protection and personal and family survival, consult your local Civil Defense Director and send for the personal and family survival booklet using the attached post card.

* U. S. GOVERNMENT PRINTING OFFICE : 1967 O—262-425

DEPARTMENT OF THE ARMY
OFFICE OF THE SECRETARY OF THE ARMY
OFFICE OF CIVIL DEFENSE
WASHINGTON, D.C. 20310

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
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Jeffersonville Census Operations Office
1201 East 10th Street
Jeffersonville, Indiana 47130

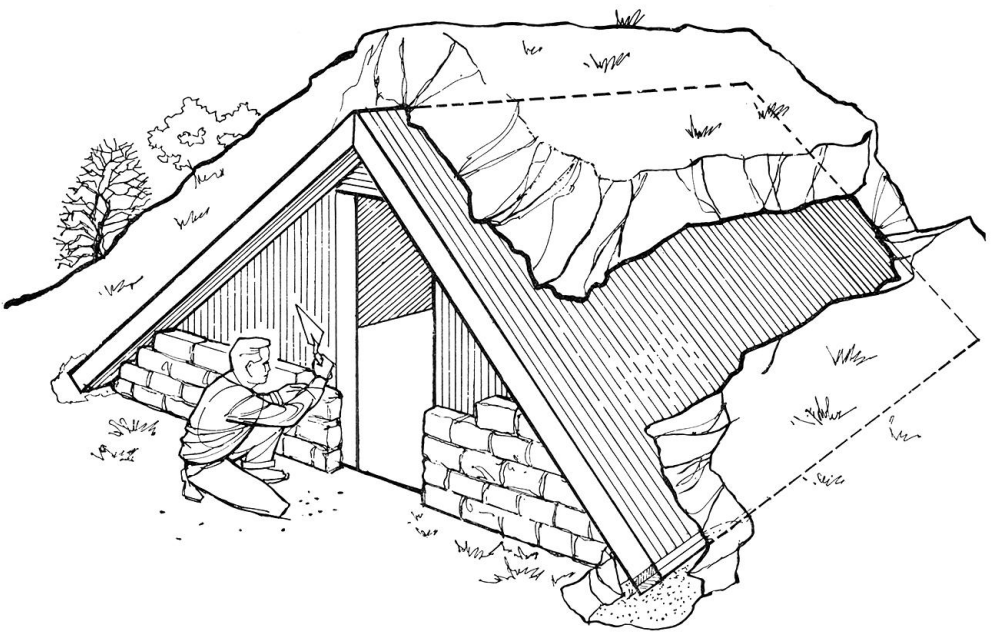
For further information on fallout protection and personal and family survival, send for detailed shelter plans and the personal and family survival booklet using this post card.

POSTCARD ON INSIDE FLAP

For quick reference, hang this booklet in the corner of your basement having the best fallout protection.

FAMILY SHELTER SERIES PSD F–61–7

Aboveground Earth-Covered Lumber A-Frame Shelter

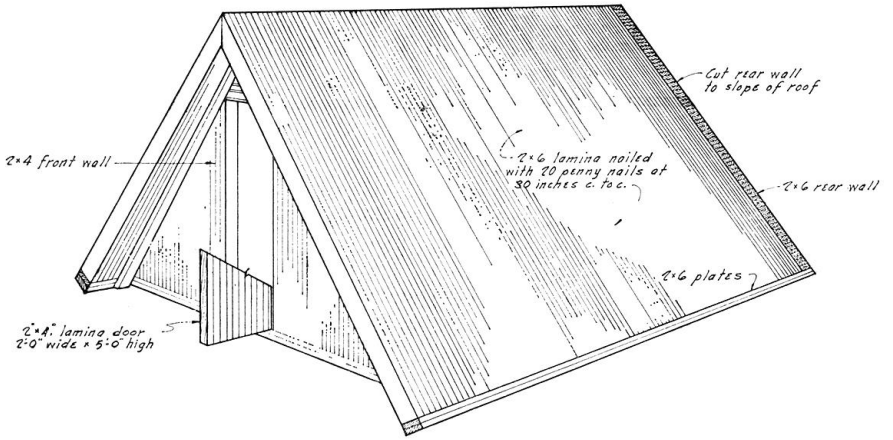


GENERAL INFORMATION

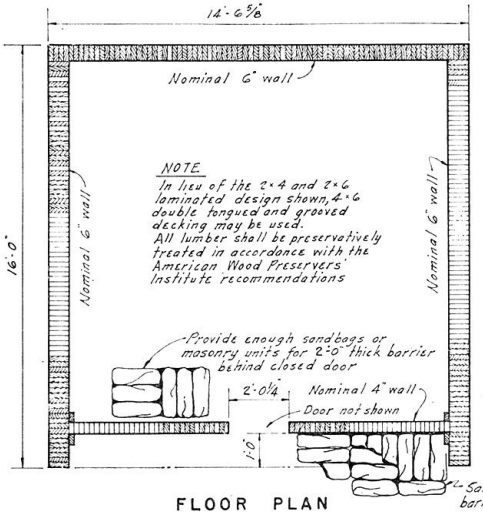
The purpose of this shelter is to provide protection for 10 persons from the effects of radioactive fallout at a location near but separate from a residence or other nearby buildings. The principal advantage of this shelter is that it can be erected without excavation in locations where there is poor drainage or where the ground water table is close to the surface. However, this shelter is not a low-cost structure. Footings or thrust ties are needed where the earth is soft or of poor bearing capacity.

TECHNICAL SUMMARY

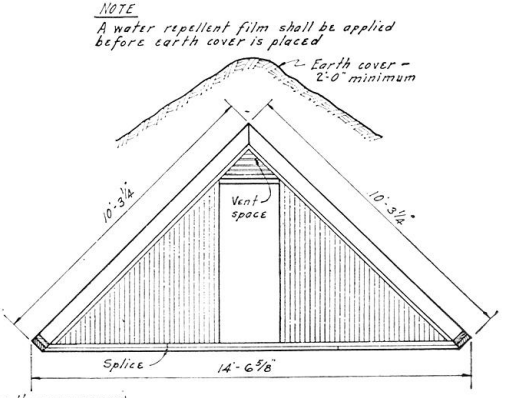
Space and Occupancy.—This shelter provides almost 150 square feet of area and approximately 640 cubic feet of space. Although only a small portion of this area provides sufficient headroom for standing erect, practically the entire area can serve as sitdown space for 10 persons and storage space for supplies.



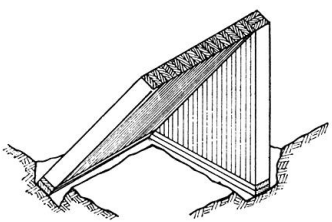
PERSPECTIVE VIEW



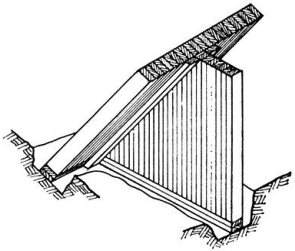
FLOOR PLAN



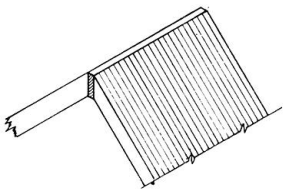
FRONT ELEVATION

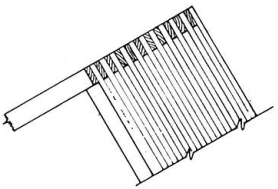


Rear Wall



Front Wall





Alternate Ridge Details

CONSTRUCTION DETAILS

Availability and Cost of Materials.—The pressure-treated lumber which is required is generally available at retail lumberyards. In certain areas it may be necessary to allow time for the treated lumber to be ordered and transported from stock at other locations. The estimated cost of materials is $550.

Fallout Protection Factor.—The recommended minimum earth cover of 2 feet with an entranceway and door shielded by a 2-foot thickness of sandbags, and the rear wall mounded will provide a protection factor of about 500.

Blast Protection.—While the basic function of this shelter is fallout protection, limited blast resistance of about 5 pounds per square inch of overpressure would be afforded by the heavy wood structure. The blast resistance would vary somewhat with the workmanship and materials but the laminated design tends to offset variations.

Ventilation.—Ducts for mechanical ventilation may be located in the ventspace over the doorway without involving structural change. Hand-operated ventilation equipment should be used.

Construction Time.—After materials are delivered at the jobsite, 4 man-days should be allowed for erecting the structure. Earth covering would require 4 additional man-days, without the use of power equipment.

Structural Life Expectancy.—The life expectancy of this shelter should be from 15 to 20 years.

CONSTRUCTION SEQUENCE

1. Assemble the materials at the shelter site.
2. Trench to subsoil for the wallplates as shown on the floor plan and details. Assemble plates in the trenches. (See construction details, rear-front walls.)
3. Begin at either end and erect roof wall members in pairs. (See alternate ridge details.) Progress to the opposite end, spiking laminations together. If 2″ x 6″ lamina are used, they should be nailed with twentypenny nails at approximately 30-inch spacing. If 4″ x 6″ decking lamina are used, they should be fastened together with $\frac{5}{16}$-inch diameter spikes at approximately 30-inch spacing.
4. Erect the end walls as shown on the drawings with ends of the lamina cut flush with the roof wall top surface. The lamina should be spiked together in the same manner as the roof members.
5. The supporting structure is now complete. It should be covered with the polyethylene film and covered with earth. The earth cover should be started at the base of the roof walls and applied evenly to both sides. Next mound earth against the rear wall. The sandbags or masonry blocks are applied on both sides of the front wall to a thickness of 2 feet. A supply of filled sandbags or blocks should be stored inside the shelter to add to the protection afforded by the door.
6. Vegetation, riprap, or other means of holding the soil in place should be provided.
7. A duct for air intake will be required with the installation of the hand-operated blower. The intake duct may be located in the rear wall of the shelter and the air can be exhausted through the louvered ventspace over the doorway.
8. The door may be of heat- or blast-resistant construction, as manufactured commercially, or may be contrived by nailing 2″ x 4″ studs together to make a 4-inch-thick door. This then can be mounted with ordinary hinges and should be painted white.

BILL OF MATERIALS

Item	*Quantity*
Roof walls 2″ x 6″ x 10′	250 pieces.
Rear wall 2″ x 6″ x 8′	50 pieces.
Front wall 2″ x 4″ x 8′	40 pieces.
Plates:	
2″ x 6″ x 10′	10 pieces.
2″ x 4″ x 10′	3 pieces.
Fastenings:	
Fortypenny nails	10 pounds.
Twentypenny nails	30 pounds.
Water repellent—building felt or plastic film	150 square feet.
Bagged earth or masonry blocks for front wall shielding.	600 filled sandbags (30 pounds) or 176 concrete blocks (8″ x 12″ x 16″).
Blower, manually operated (rated at 30 cubic feet per minute).	1.
Intake pipe, galvanized (to be mounted through rear wall).	6 feet.
Flyscreen 7″ x 7″ (for intake pipe)	1.
Flyscreen 24″ x 24″ (to cover ventspace over door)	1.

ABOVEGROUND HOME SHELTER

H-I 2-2
JUNE 1980
(Supersedes H-12-2
dated Feb. 1973
which may be used.)

Protection is provided in an outside aboveground shelter. The shelter can be used as a tool shed or workshop.

federal emergency management agency

GENERAL INFORMATION

This family shelter is intended for persons who prefer an aboveground shelter or, for some reason such as a high water table, cannot have a belowground shelter. In general, belowground shelter is superior and more economical than an aboveground shelter.

The shelter is designed to meet the standard of protection against fallout radiation that has been established by the Federal Emergency Management Agency for public fallout shelters. It can also be constructed to provide significant protection from the effects of hurricanes, tornadoes, and earthquakes, and limited protection from the blast and fire effects of a nuclear explosion. 1/ It has sufficient space to shelter six adults.

The shelter can be built of two rows of concrete blocks, one 12" and one 8", filled with sand or grout, or of poured reinforced concrete. Windows have been omitted; therefore, electric lights are recommended for day to day use.

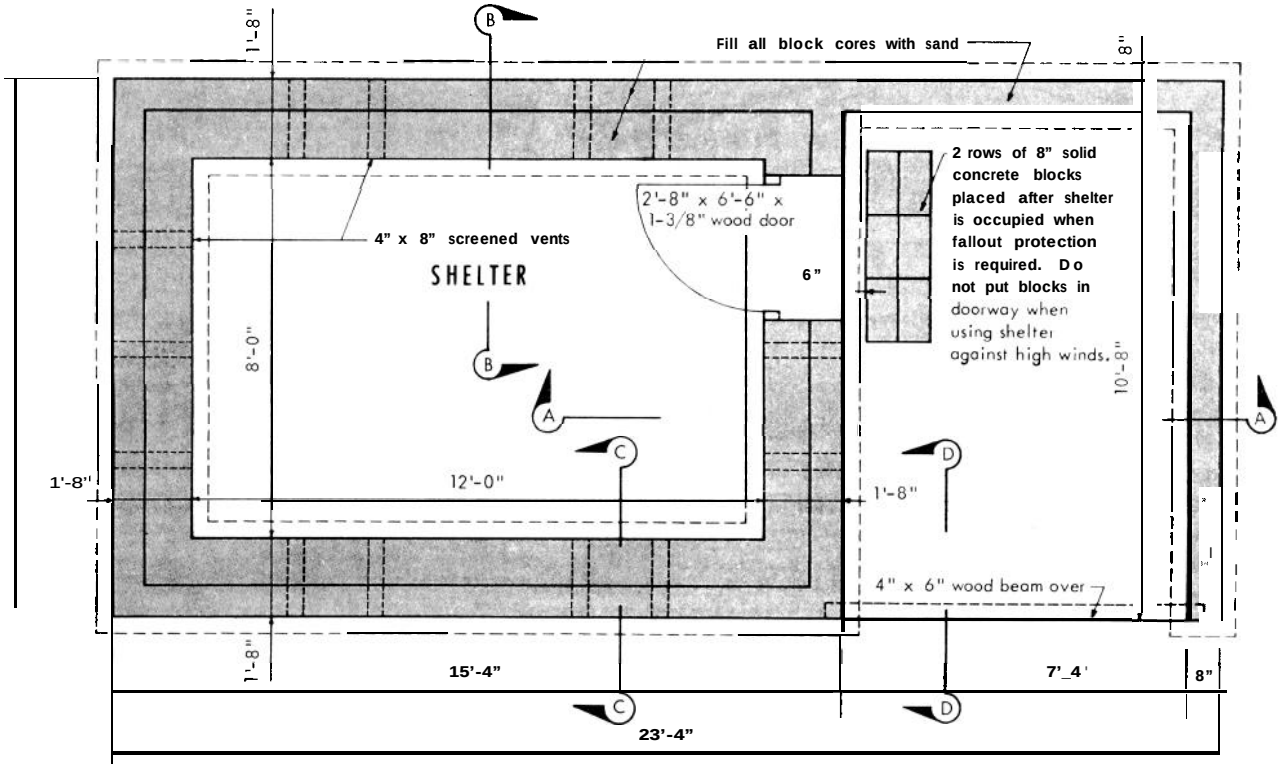
The details and construction methods are considered typical. If materials other than shown are selected -- for example, concrete block faced with brick -- care should be taken to provide at least the same weight of materials per square foot: 200 lb. per sq. ft. in the walls and 100 lb. per sq. ft. in the roof. The wood frame roof over the reinforced concrete ceiling probably would be blown off by extremely high winds such as caused by a blast wave or tornado. However, the wood frame roof is intended primarily for appearance; the concrete ceiling provides the protection. When using the shelter for protection against high winds, DO NOT place the concrete blocks in the doorway or windows.

This structure has been designed for areas where frost does not penetrate the ground more than 20 inches. If 20 inches is not a sufficient depth for footings, one or two additional courses of concrete blocks may be used to lower the footings. Average soil bearing pressure is 1,500 lb. per sq. ft. Most soils can be assumed to support this pressure without special testing or investigation.

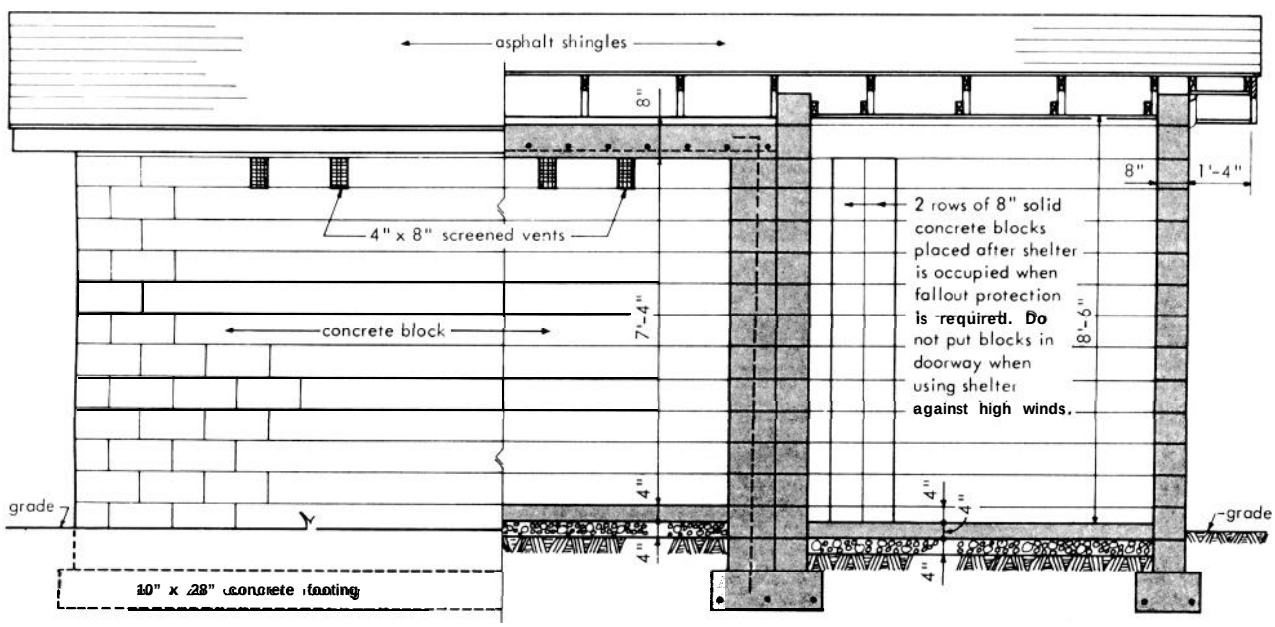
The baffle wall outside the entrance to the shelter is extended out 7'-4" to allow storage of lawn equipment such as wheelbarrows and lawn mowers. If additional space is desired, extend this dimension.

Before starting to build the shelter, make certain that the plan conforms to the local building code. Obtain a building permit if required. If the shelter is to be built by a contractor, engage a reliable firm that offers protection from any liability or other claims arising from its construction.

1/ This shelter will withstand over-pressures of up to 5 p.s.i.

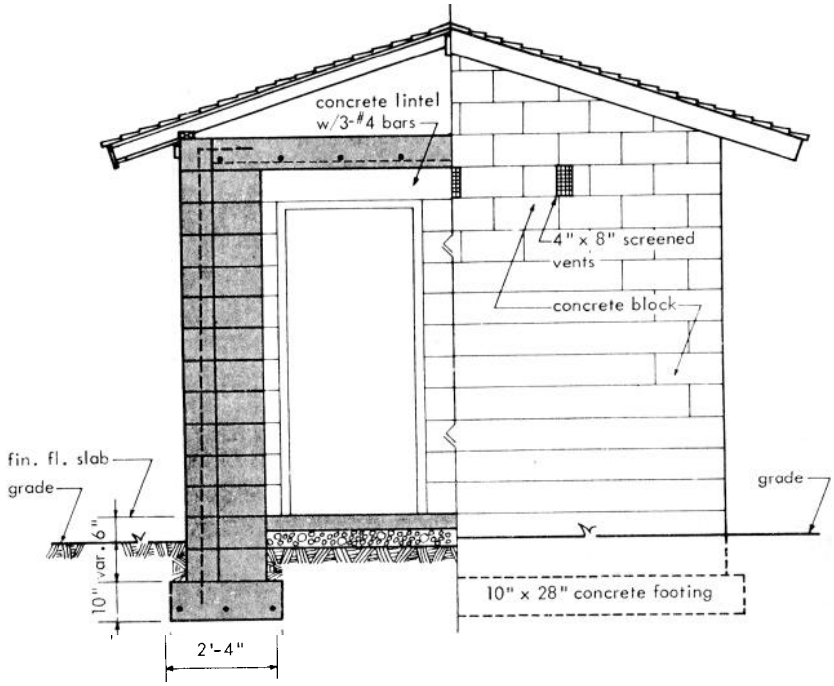


PLAN



ELEVATION

SECTION A-A



SECTION B-B ELEVATION

NOTES

Provide horizontal joint reinforcement for 1'-8" walls in every third course and metal cross ties at 2'-0" o.c. in every alternate course.

If concrete is used in place of block, the walls of the shelter shall be 1'-2" thick with #4 bars at 14" o.c., each way, each side.

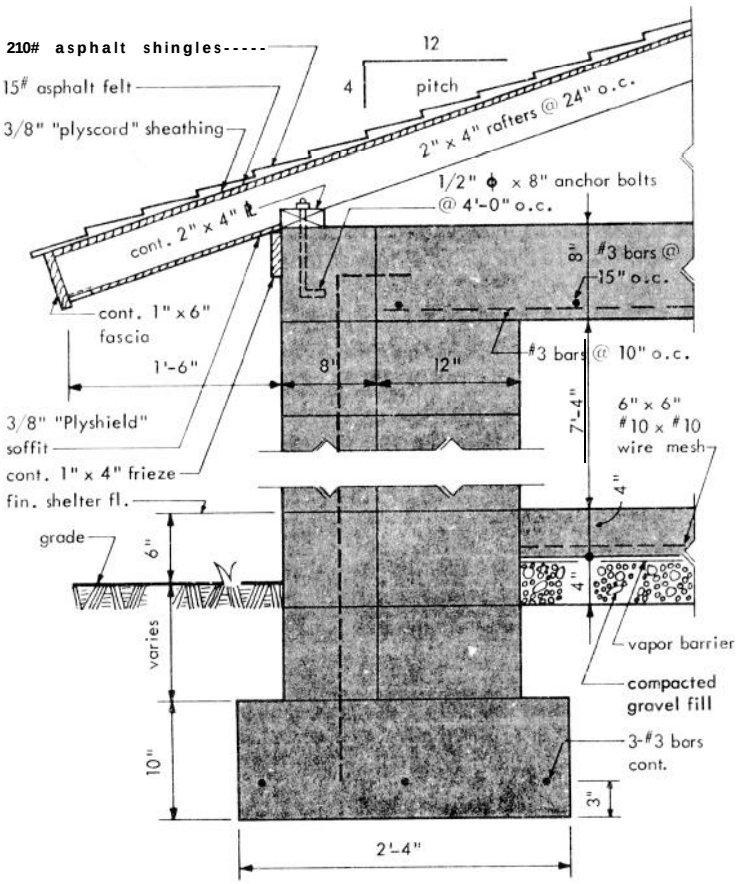
The dimension from finish grade to bottom of footings is dependent upon the depth of frost and varies with geographic location. Consult your local building code.

In areas subject to hurricanes, tornadoes, or earthquakes, walls shall be reinforced with #4 bars at 16" o.c. vertically. Place bars in block cells and then fill with grout. Lop bars between wall and footing dowels, and between wall and roof slab.

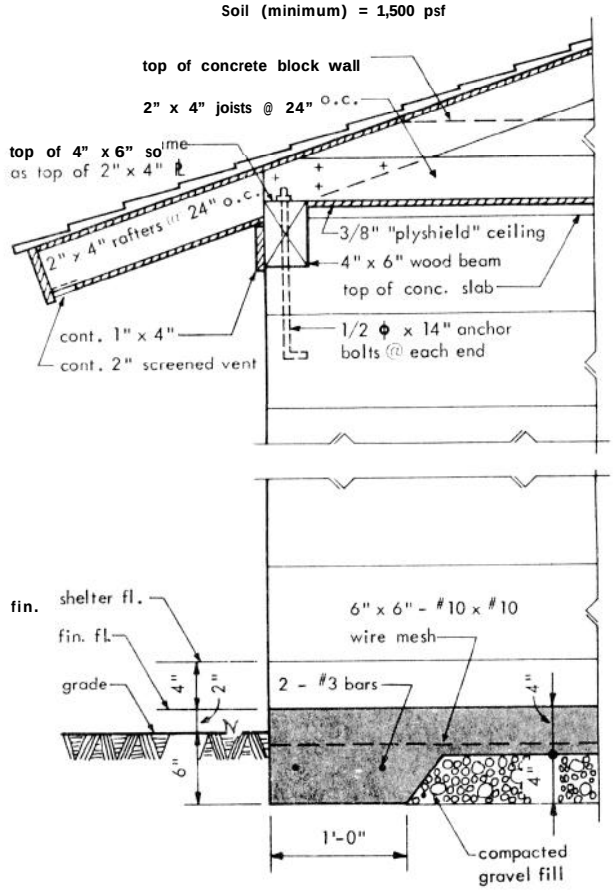
The wood frame roof over the reinforced concrete ceiling probably would be blown off by extremely high winds such as caused by a blast wove or tornado. However, this roof is primarily intended for appearance; The concrete ceiling provides the protection.

Structural design data:

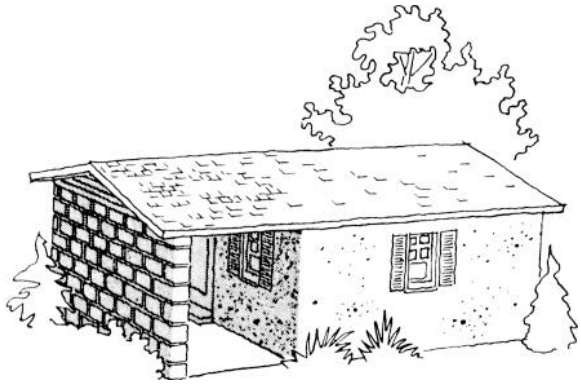
Steel = 20,000 psi
Concrete = 2,500 psi
Soil (minimum) = 1,500 psf



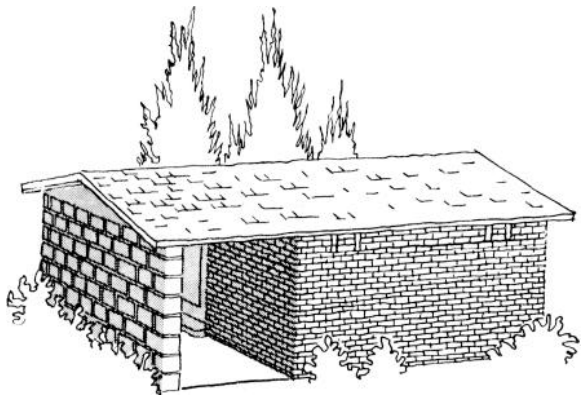
SECTION C-C



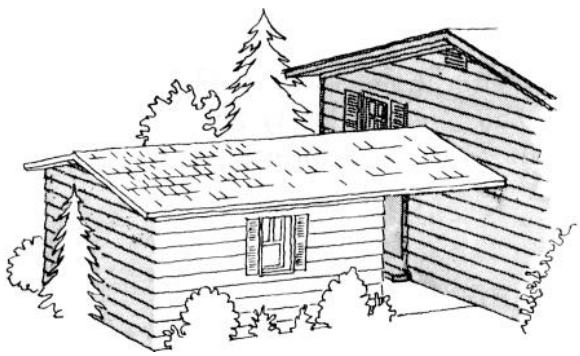
SECTION D-D



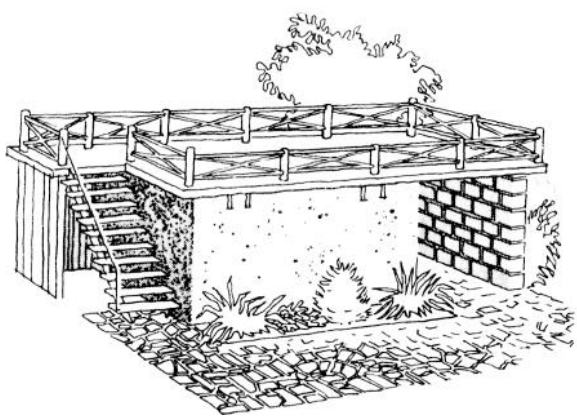
FIRST ALTERNATE indicates windows in the workshop area. Solid blocks, equal to a thickness of 12 inches, should be available to fill these openings to provide adequate fallout protection. Window sizes should be kept small. When using the shelter for protection against high winds, do not place the concrete blocks in the doorway or windows.



SECOND ALTERNATE shows the cement block faced with bricks. Use one course 4-inch brick and two courses of 8-inch cement block to obtain the required weight per unit area.



THIRD ALTERNATE is to attach the tool shed or workshop to the house, with a covered area between. In this case, the facing materials should match the house.



FOURTH ALTERNATE is to install built-up roofing of asphalt or tar, or other wearing surface, on top of the concrete deck.

GUIDE TO CONTRACTS AND SPECIFICATIONS

It is generally advisable to have a written contract with your contractor as well as specifications to supplement the drawing. A widely used and convenient contract form for construction of this size is AIA Document A 107, "Short Form For Small Construction Contract Stipulated Sum," which is available from the American Institute of Architects, 1785 Mass. Ave., Washington, D.C. 20036. It would be impractical to write a specification to suit every local condition; however, the following summary of generally accepted construction materials and practices is a useful guide:

CONCRETE

For details of concrete construction, follow "Building Code Requirements for Reinforced Concrete (AC I-3 18-71)." This publication can be obtained from the American Concrete Institute, Detroit, Michigan 48219.

DAMPPROOFING

Dampprcofing the bottom slab is necessary to make the room more comfortable in most areas. Any contractor will be accustomed to compacting gravel and applying a polyethylene vapor barrier course. In areas that regularly experience high humidity, the outside walls of the block or concrete should be treated with a colorless type of protective coating material which is readily available at building supply stores. In areas of very low humidity, dampproofing might be omitted.

VENTILATION

Ventilation is obtained by natural convection. Air will enter the doorway and be exhausted through the holes at the ceiling. If a roof exhaust ventilation system is desired, the following manufacturer makes units that will meet the requirements:

Penn Ventilator Co.*/
Red Lion and Gantry Rd.
Philadelphia, Pennsylvania 19115

*/The listing of a specific manufacturer of equipment does not denote a preference for his products.

OPTIONS

To accommodate additional persons, increase the shelter length 2' -6" for each two shelter spaces. Do not increase the 8' -0" width.

Lighting and receptacles may be installed with electric service obtained from a separate residence circuit. A branch circuit breaker should be installed inside the shelter.

MATERIALS LIST

Item		Quantity
Concrete:		
footings		4.5 cu. yd.
floor		2.3 cu. yd.
ceiling		3.4 cu. yd.
	Total:	10.2 cu. yd.
Steel Reinforcing:		
footings (3# deformed bars)		198 lin. ft.
ceiling (3# deformed bars)		257 lin. ft.
walls (4# deformed bars for hurricane, tornado, or earthquake resistance)		
	approx.	300 lin. ft.
	Total:	755 lin. ft.
tie wire		100 lin. ft.
Masonry:		
8" X 8" X 16" hollow concrete blocks		800
12" X 8" X 16" hollow concrete blocks		430
8" X 8" X 16" solid concrete blocks		75
sand (to fill cores)		12-1/2 yd.
Mortar:		
sand		1-1/2 yd.
portland cement		9 bags
lime		2 bags
Lumber: ("construction"grade)		
2" X 4" X 8'-0" roof rafters		32 pcs.
1" X 6" ridge		26 lin. ft.
2" X 4" X 12'-0" ceiling joists		5 pcs.
4" X 6" X 8'-0" beam		1 pc.
2" X 4" bearing plate		36 lin. ft.
4'-0" X 8'-0" X 3/8" "plyscord" sheathing		13 sheets
4'-0" X 8'-0" X 3/8" "plyshield" soffit & ceiling		6 sheets
1" x 4" x 3/4"		48 lin. ft.
1" X 6" X 3/4"		84 lin. ft.
3/4" - 1/4 ϕ		24 lin. ft.
2'-8" X 6'-6" X 1 3/8" solid core wood door		1
2'-8" X 6'-6" X 5 1/2" wood iamb		1

Miscellaneous:

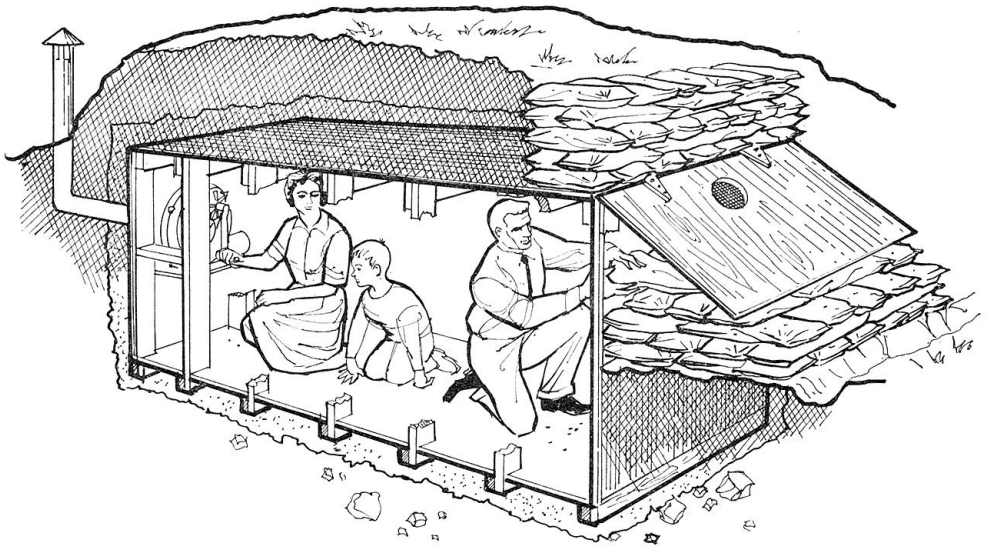
15# roofing felt	4 1/2 squares
210# asphalt shingles	4 1/2 squares
1/2" ϕ X 8" anchor bolts	12
1/2" ϕ X 14" anchor bolts	2
copper screen	20 sq. ft.
6" X 6" - #10 X #10 wire mesh	200 sq. ft.
polyethylene vapor barrier (4 mil)	200 sq. ft.
gravel fill	2 1/2 yds.
4" butts w/screws	3
lockset	1
16d common nails	25 lb.
8d common nails	20 lb.
6d common nails	10 lb.
8d casing nails	5 lb.
exterior paint, primer	5 gal.
exterior paint, 2 coats	6 gal.
interior paint, primer	4 gal.
interior paint, 2 coats	5 gal.

Distribution:

FEMA Regions and Staff College
State & Local Civil Preparedness Directors

U.S. GOVERNMENT PRINTING OFFICE : 1980 0 - 329-360

Outside Semimounded Plywood Box Shelter



GENERAL INFORMATION

This shelter is designed to provide low-cost protection from the effects of radioactive fallout. Its principal advantages are ready availability of low-cost materials, ease and speed of construction, adequate protection from fallout radiation, and limited blast resistance.

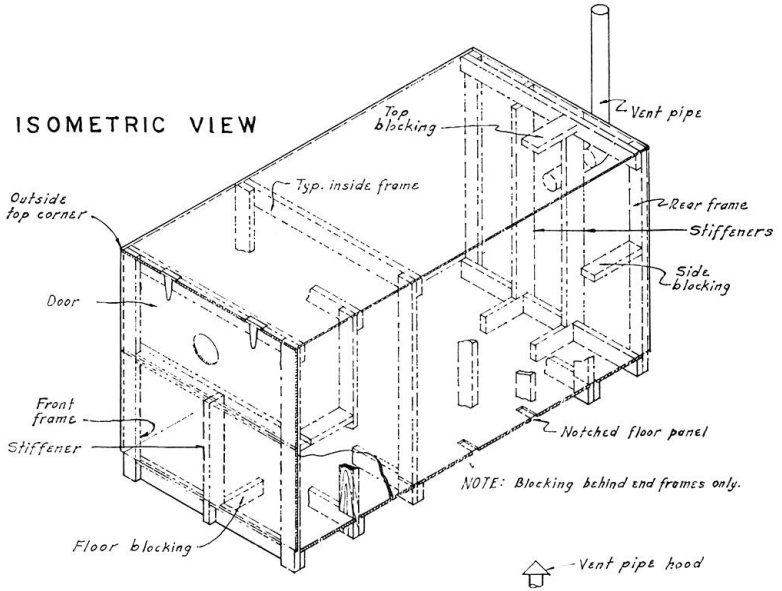
TECHNICAL SUMMARY

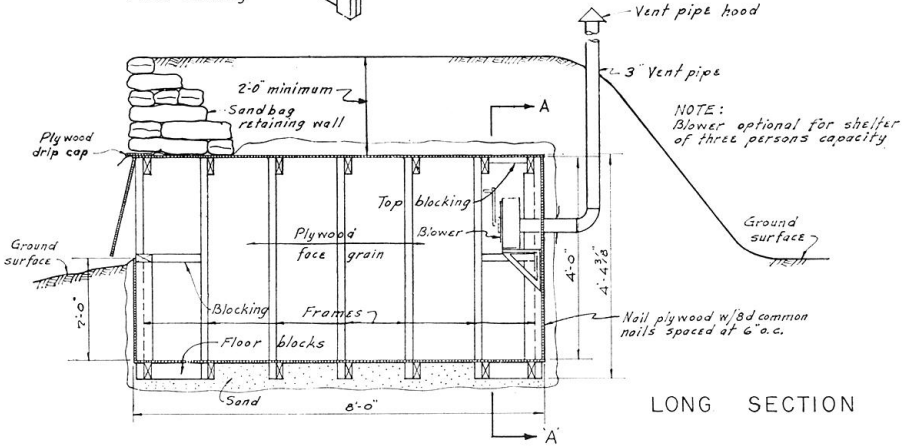
Space and Occupancy.—The shelter in this design has 32 square feet of area and 128 cubic feet of space and will house three persons. See "*NOTE*" after "Construction Sequence" for description of a size to house more persons.

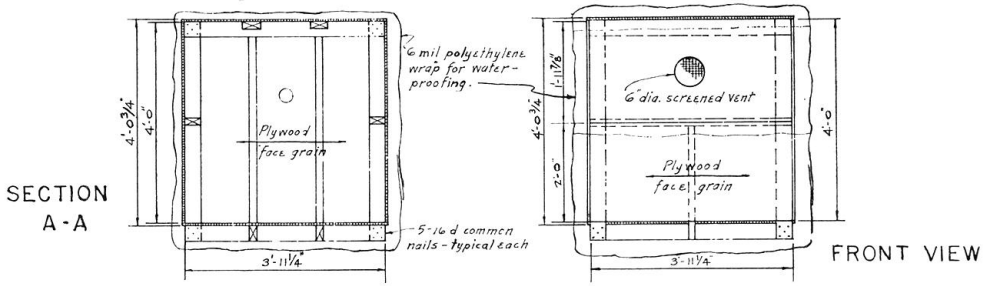
Availability and Cost of Materials.—Most of the materials needed to build this shelter are obtainable at lumberyards. The nationwide average for cost of materials is about $75 per shelter, not including ventilation equipment.

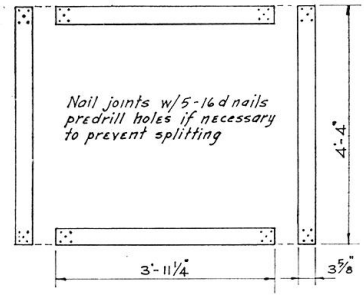
Fallout Protection Factor.—A protection factor of about 500 is obtained if the earth cover is 2 feet deep, and a 2-foot thick entranceway shield is formed with bags of sand.

Blast Protection.—The shelter should be able to withstand a limited blast overpressure of 5 pounds per square inch.

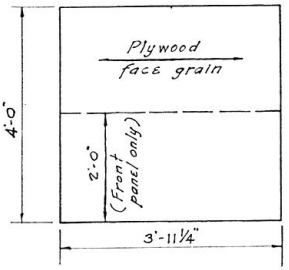

ISOMETRIC VIEW
Top blocking
Vent pipe
Typ. inside frame
Outside top corner
Rear frame
Stiffeners
Side blocking
Door
Front frame
Stiffener
Notched floor panel
NOTE: Blocking behind end frames only.
Floor blocking


Vent pipe hood
3" Vent pipe
2'-0" minimum
Sandbag retaining wall
A
NOTE: Blower optional for shelter of three persons capacity
Plywood drip cap
Top blocking
Plywood face grain
Blower
Ground surface
Ground surface
4'-0"
4'-4⅜"
2'-0"
Blocking
Frames
Nail plywood w/8d common nails spaced at 6" o.c.
Floor blocks
Sand
8'-0"
A
LONG SECTION

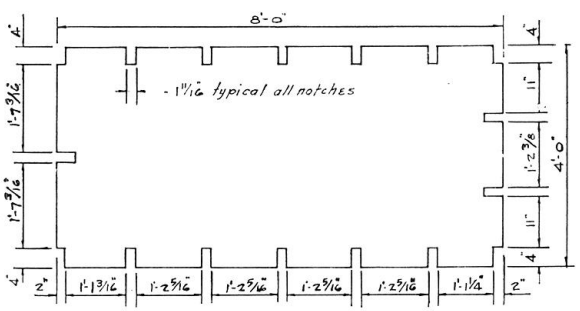

6 mil polyethylene wrap for water-proofing.
4'-0¾"
4'-0"
Plywood face grain
5-16 d common nails - typical each
3'-11¼"
SECTION A-A
1'-1⅞"
4'-0¾"
6" dia. screened vent
4'-0"
2'-0"
Plywood face grain
3'-11¼"
FRONT VIEW



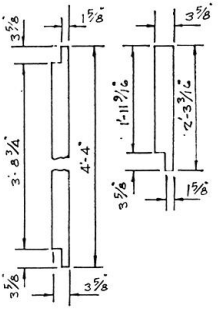
FRAME DETAIL



END PLYWOOD DETAIL



FLOOR PANEL DETAIL



STIFFENER DETAILS

Ventilation.—A 3-inch vent at the rear of the structure provides an essential opening to which a pipe extension can be attached. Hand-operated ventilation equipment should be used for more than three persons. The additional cost may be from $30 to $50. Air is exhausted through the airspace left in the entranceway closure.

Construction Time.—Tests have shown that one man working with simple excavating and construction tools can perform all necessary work in 20 man-hours. This time will be lessened by about 5 hours if lumberyards provide prefabricated plywood panels and sections.

Structural Life Expectancy.—The range is from 5 to 10 years depending on the humidity in the area, drainage characteristics of the terrain, and the effectiveness of the wood treatment (dip preferred) and the plastic wrapping.

CONSTRUCTION SEQUENCE

1. Cut plywood and lumber to size and notch before treating.
2. Dip lumber for 2 minutes or more in water repellent. A trough can be fashioned from a piece of polyethylene film and scrap lumber. Dip plywood in water repellent or give thorough brush treatment. Double brush-coat all cut edges.
3. Assemble the seven frames. (See longitudinal section drawing.)
4. Select a well-drained site. Excavate hole deep enough so that shelter floor will be at least 2 feet below ground surface and wide enough to permit nailing of plywood sides to frames from outside. Slope bottom of the trench so that shelter will be 2 inches higher at entrance than at rear. Lay a 2-inch sandbed for polyethylene moisture barrier.

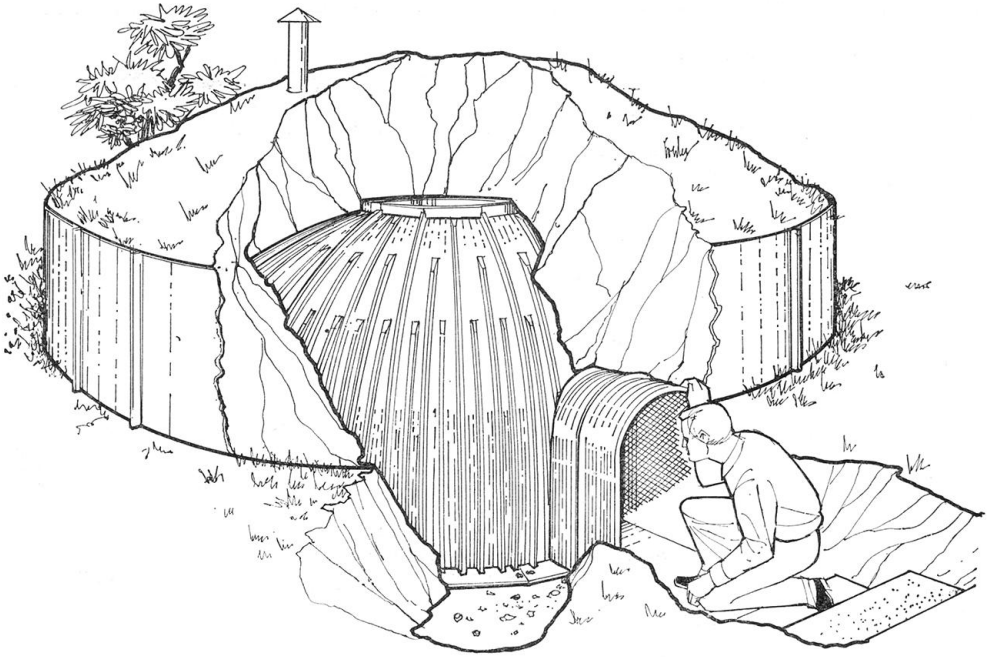
5. Place polyethylene moisture barrier in excavation and cover bottom with a 4-inch layer of sand to prevent frames from breaking barrier. (Sec. A–A, Front View.)
6. Cut three floor blocks to size and tack to underside of floor panel. Place the seven frames approximately in place, imbedded so that the sand will be flush with the underside of the floor panel. Then pass the floor panel inside the frames and nail in place.
7. Toe the end and side panels on the edges of floor panel and nail securely; then nail the side and top blocking, and finally, nail the top panel overlapping both the side and end panels.
8. Pad the outside top corners of the shelter to prevent damage to the polyethylene moisture barrier. Wrap the shelter with the polyethylene.
9. Backfill with 2 feet of earth cover after forming a sandbag retaining wall over the entrance (see longitudinal section) and alongside entranceway.
10. Provide enough filled sandbags or solid concrete blocks for a closure 2 feet thick in the entrance.
11. As an alternative to digging a large hole as described in step 4 above, a somewhat smaller hole can be used if the shelter is assembled above ground and lowered gently into the hole. The shelter weighs approximately 400 pounds complete, or 260 pounds without ends and top. Care must be taken to avoid puncturing the polyethylene moisture barrier.
12. If blower is installed, it should be supported by blocking, or by a frame attached to the end panel with 2″ x 4″ stiffeners.

NOTE: The size of the shelter may be increased in width and height. There is no arbitrary limit to length but the plywood sheets must butt each other at a frame. To increase the width from 4′ to 6′ use 2″ x 6″ ceiling joists. To increase the width from 6′ to 8′ use 2″ x 8″ ceiling joists. To increase the height from 4′ to 6′ use 2″ x 6″ wall studs and floor joists. When increasing height or width the ceiling joists should rest directly on the wall studs and be secured to them by means of nailed ⅜-inch plywood gussets. Ceiling joists require a gusset on one side only. Floor joists require a gusset on each side. Use 12 sixpenny nails in each gusset. Six nails should be used in each of the joined pieces.

BILL OF MATERIALS
(For 4′ x 8′ size)

Item	*Quantity*
⅜″ exterior plywood (Federal specification CS 45–60) or ½″ exterior plywood (Federal specification CS 122–60, group 1 or 2).	5 sheets.
2″ x 4″ x 10′ construction grade Douglas fir or equal	8 pieces.
2″ x 4″ x 8′ construction grade Douglas fir or equal	8 pieces.
4″ x 4′ plywood lumber (drip cap)	1 piece.
9 mil polyethylene film (16′ width)	20 feet.
Water repellent (5 percent pentachlorophenol or equal), toxic to wood-destroying fungi and insects.	2 gallons.
Eightpenny galvanized common nails	4 pounds.
Sixteenpenny galvanized common nails	3 pounds.
3″ diameter galvanized vent pipe	3½ feet.
Vent pipe cap	1.
3″ diameter 90° elbows	2.
Galvanized hinges	1 pair.
Flyscreen 7″ x 7″	1.
Sandbags	58.
Dry sand	3 tons.
Blower (optional, to be used with vent pipe, for 3-person size).	1.
Soil or sand (for shelter cover)	5 cubic yards.

Outside Semimounded Steel Igloo Shelter



GENERAL INFORMATION

This shelter is designed to provide low-cost protection from the effects of radioactive fallout. Its principal advantages are that it provides fallout and limited blast protection and is suitable for either indoor or outdoor installation, and is easily assembled.

TECHNICAL SUMMARY

Space and Occupancy.—The shelter type detailed in this design has about 80 square feet of area including the entrance space. The interior has about 260 cubic feet and will house six persons.

Availability and Cost of Materials.—This shelter is of the prefabricated type and is available at department stores, building supply outlets, and mail-order firms. Cost is about $175.

Fallout Protection Factor.—The protection factor should be about 500 with the prescribed thickness of covering and proper shielding of the entranceway.

Blast Protection.—This shelter could be expected to withstand a limited blast overpressure of 5 pounds per square inch.

Ventilation.—Ventilation is provided by a 3-inch intake pipe to which should be attached a hand operated blower. The air is vented through the airspace left in the entranceway.

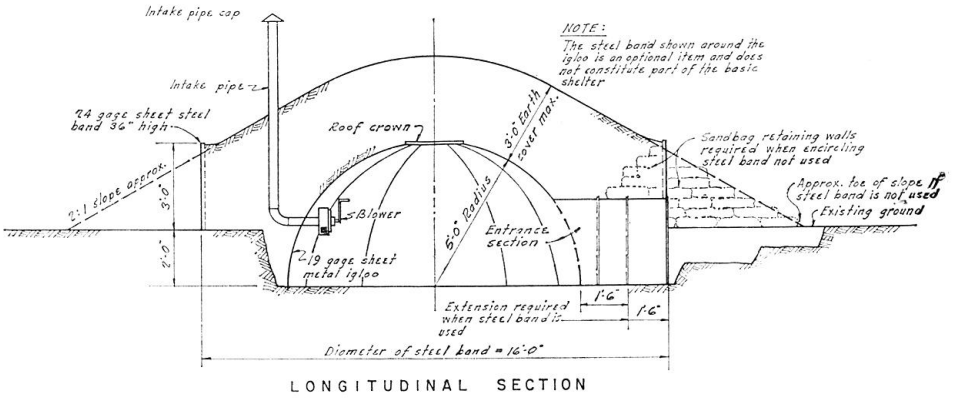
Construction Time.—The igloo steel shell requires 4 man-hours to assemble. Excavating and covering time should take 24 man-hours.

Structural Life Expectancy.—The igloo, when coated with mastic, has a life expectancy of at least 10 years.

CONSTRUCTION SEQUENCE*

1. Select well-drained site. The total area required, including the mounding, will be approximately 15′ x 20′.
2. Use stakes to mark the area, and excavate. The hole required for the main shell is 5′ x 12′ x 2′ deep, and the entranceway requires an additional 2½′ x 2′ x 6″.
3. Line hole with plastic film wrap.
4. Bolt one wall panel to the roof crown.
5. Bolt the next wall panel to the roof crown 180° from the first wall panel.
6. The third wall panel should be bolted to the crown and to a mating section. Repeat this step until all panels are bolted to mating panels and to the roof crown.
7. To complete the shelter, bolt the crawl entrance to the flanged lip on the entrance panel.
8. Cut 3″-diameter hole in wall opposite entrance. Mount ventpipe.
9. For outdoor installations, mound sand, earth, or bags of sand over the igloo shell to a covering height of 2 feet.
10. As an alternate installation in a basement, mound loose sand or sandbags to a covering height of at least 18 inches over the igloo shell.

*This is a generalized construction sequence for a prefabricated igloo shelter. Detailed instructions are provided with the construction kit.



LONGITUDINAL SECTION

BILL OF MATERIALS

Item	*Quantity*
Roof crown	1.
Wall panels	11.
Wall panel, with entrance opening	1.
Entrance, crawlway and door	1.
Sand or soil for cover	15 tons.
6 mil. polyethylene film (20′ wide)	30 feet.
Mastic	6 gallons
Ventpipe (3″ diameter) with ventpipe cap	6 feet.
Hand-operated blower (20 cubic feet per minute)	1.
Flyscreen 7″ x 7″ for ventpipe	1.
(Nuts, bolts, washers—as required.)	
Sandbags (to hold 15 to 20 pounds each) for entrance and retaining walls.	50.
Sandbags (to hold 75 to 100 pounds each)	30.