

Shelters & Construction

MISCELLANEOUS

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PLACEMENT, EXCAVATION & BACKFILL

Placement

Careful consideration must be given to your shelter location. Shelter entrances from the home are convenient but you must also place an entrance to the outside. It is also possible that debris from explosions may block the inside entrance. The door to your inside entrance must have a good, gas tight gasket, as gas and noxious fumes could enter if the home should burn.

Your shelter should be placed in a location that has good drainage. Never place your shelter into the water table, as it compromises your blast protection. Corrugated steel shelters will leak if placed into standing water. Do not place your shelter near rivers, lakes, or canals. Do not place your shelter under your garden, as irrigation water may penetrate the seams.

There are many unique and interesting shelter designs which have been constructed from this basic plan. Sometimes several tanks are welded or bolted together in varying arrangements. This can be done end to end, perpendicular, or in a parallel configuration. Connecting end to end in corrugated steel shelters can sometimes be facilitated with a simple banding kit. Longer shelters in this configuration may require smaller diameter walkways between the two tanks.

To receive maximum overpressure protection, earth arching is obtained by separating parallel tanks by at least the diameter of the largest tank. These two parallel tanks can then be connected by a smaller diameter entrance.

Outside entrances are not required for every tank. However, each tank should have an entrance and an exit allowing for two ways in or out of every room. If more than one tank is used, the exits to the outside should be on separate tanks.

Excavation

It is essential that the correct equipment be used, both for safety and economic reasons. It is recommended that a trackhoe be used for excavating holes over 10 feet deep. Shelters weighing over 2,000 lb. and / or with lengths over 20 ft. should be lowered into the hole with a mobile crane with a minimum capacity of 75 tons. While the shelter itself may not weigh more than 10,000 lb., the extra

capacity of the crane will allow it to operate further from the edge of the hole. Frequently, the crane is not able to operate near the excavation because of debris or fill material remaining on the job sight.

Backfill

Backfill with 1/2" or 3/4" minus crushed rock to at least half the radius of the tank. This material should be rock only and completely devoid of soil. This size rock flows easily around and under the tank to fill all voids and properly support the tank when backfilled. No compacting is necessary. Do not use engineers fill, road base, or earth for this application because in a deep hole it is very difficult and dangerous to compact this material properly. Likewise, pea gravel is unacceptable, because it does not arch properly and could allow the tank to collapse catastrophically under blast loading. Approximately 70 tons of crushed rock is needed to backfill a 40 ft. shelter to the radius. The crushed rock should also be placed over and around the horizontal runs of the entrances.

The 6" diameter steel air pipes are usually placed on the end plates of the shelters. These air pipes protrude downward about 2 feet from where they enter into the shelter body. They have an open end at the bottom for drainage and condensation. The crushed rock should cover the vertical downward portion of the airvent to at least one foot to provide the proper drainage. Exhaust pipes may also be placed near the top of the shelter entrance.

After the crushed rock is in place, carefully continue backfilling with soil taken from the hole. Remove large rocks that could damage or scratch the shelter. Compact as it is safe to do so. Do not use clay type soil to back fill your shelter. If your soil contains clay, make sure you provide a good drain field leading away from the excavation site. Otherwise, the excavation site will hold water coming from the surface, even though the water table is well below the bottom of your excavated site.

Earth arching is obtained by burying the shelter at twice the depth of the diameter of the tube. It is possible to obtain proper earth arching at shallower depths by backfilling with crushed rock to nearly the full diameter of the shelter. In areas unlikely to receive initial radiation and blast effects, a depth of 4 feet of soil over the top of the shelter may be adequate.

EXCAVATION

Ground shock is accentuated by wet soil. If the water table is high, place the shelter above the damp soil level. Be sure to allow for the possibility that the water table may rise due to seasonal changes or other conditions beyond your control. This may require burming or mounding of the soil over the shelter to achieve the desired level of protection. If your soil does not drain well, after heavy rains you may also find that water will accumulate at the bottom of the excavation after backfilling. If you are prone to heavy rains, you may wish to protect your shelter with a heavy gauge plastic cover. Do this by backfilling to within 2 feet of the surface. Place the heavy plastic in a mounded configuration over the soil. Let the plastic reach well beyond the sides of the excavated area. Your excavator will need to clear an area for you. Continue backfilling to grade. The water should then find the plastic and be deflected away from your excavation. In heavy soil, you should consider placing drains into the bottom of the excavation. We do not recommend settling your excavation area with water after the shelter has been covered. The water will find its way down through the disturbed soil and may pool at the bottom of the hole.

For protection against excessive reflective pressure when mounding above grade, care should be taken that the slope of the mound is no greater than a rise to run ratio of 1 to 3 (33 degrees from grade).

POWER

Diesel generators require the storage of thousands of gallons of fuel, as it is unlikely that the fuel could be replenished for some time after a nuclear war. Non acid batteries are expensive, but well worth the price. We recommend gel cell batteries as they have very little out-gassing problems during the charging cycle. Deep cycle RV batteries are more economical than gel cell batteries and also fairly easy to manage. All these batteries are kept charged with a battery chargers. Gel cell batteries usually require a special charger and can be damaged by a deep cycle battery charger. When charging lead acid batteries, care should be taken to avoid buildup of hydrogen gas within the shelter. Exhaust the area carefully. House current can be brought into the shelter in buried conduit. However, AC power will only be available in peace time. You may wish to consider a renewable energy source such as hydro power or wind turbines. There are nice hydro-power generators that require very little head.

Energy efficient lights should be chosen to conserve power. Use a bulb similar to the Sylvania 12 RB. It draws 170 milliamps at 12 volts and has a reflector base that distributes light where it is most needed. It utilizes a standard bayonet base, readily available at Radio Shack stores. There are other highly efficient bulbs on the market that will serve as well, but care should be taken to consider estimated lamp life, power consumption and lumen output. LED lights have a long life, but are very expensive and vulnerable to the electro magnetic pulse associated with all nuclear weapons.

Solar panels may be used to recharge the batteries, but when not in use they should be stored inside the shelter for maximum protection from blast and EMP. They should be placed outside only after all danger of blast has passed. They may adversely be affected by the EMP. If in a remote area, consider purchasing extra solar panels. Wrap these panels in aluminum foil for 'EMP' protection, and keep them inside your shelter.

SANITATION

We recommended that chemical toilets be used for sanitation purposes. The waste material can be emptied after 2 or 3 days when radiation levels have decreased. Chemical toilets are a simple and practical solution. If you are in an area of a low blast zone, you may wish to install a septic tank or holding tank and use a hand pump for waste removal. The storage tank should be placed at least 3 to 4 feet underground. If the tank is above the shelter, ground shock and earth movement could force the waste back into the shelter, so use great caution. If your system requires a vent, be sure to incorporate a blast valve on the vent. Ask us for the ESV SAN 100. It runs about \$600 including transport. It protects against a reflection pressure of 9 bar and has a 3 bar rating.

A small hand pump is available through US Plastics Online. It has a 2"OD with a 14" handle stroke. It is made of aluminum, weighs about 5 1/2 pounds and costs \$312. You can reach them at 800-769-2242.

For large capacity shelters, we are offering a Swiss made sewage hand diaphragm pump for the delivery of sewage and wastewater to a storage area. The pump is mounted on a solid base plate. The pump body

as well as the inlet and outlet are of cast iron. The inlet is integrated into the base plate. The two valve globes are made of rubber with an iron core. The weight is 70 kg. Total delivery head is 15 meters. The Suction head maximum is 8 meters. This pump runs about \$3,250, including transport. Please contact us for more information on this pump.



Cutting into sewer lines is risky and could cause flooding. It is also possible that high overpressures could enter the tank through the ventilation pipes. Septic tanks are inexpensive but collapse at relatively low overpressures.

EQUIPMENT AND SUPPLIES

There is no end to the list of supplies that would be needed during and after a nuclear war. Steel shelters have ample room for storage. At least one year's supply of food, clothing, and medicine should be stored for every occupant. Include special prescription medicines needed by your family and extra prescription glasses. It is suggested that unprocessed foods such as rice, wheat, beans and corn be the basis for the long term storage. Dr. Arthur Robinson has researched the minimum basic requirements of foods and vitamins necessary for long term survival. "*Nuclear War Survival Skills*" is an excellent resource book and should be found in every shelter. Find more information on this book on our home page under 'Publications'.

A two week's supply of easily prepared food should be stored for each occupant. MREs (meals ready to eat) are very practical and require no cooking.

A minimum of 20 gallons of water per occupant should be stored in the shelter. Redundant methods of water purification should be available. The Katadyne line of water filters comes highly recommended.

Disease control would be one of our largest problems. Radiation sickness and emotional trauma can cause vomiting and intestinal disorders. Blood and other bodily fluids must be cleaned immediately. Food spills will encourage rodent and insect infestation. Kitty Litter, newspaper, rubber gloves and cleaning supplies are necessary supplies for these eventualities.

Radiological monitoring equipment can be expensive to buy. There are some good sources for surplus FEMA meters on the internet. Check your search engines. They should run under \$50. The book, *Nuclear War Survival Skills*, referred to previously, shows a simple and inexpensive meter which you can build yourself. We have tested it and are impressed with the level of accuracy it provides. Levels of radiation may be low enough to survive outside within a few days, but without these meters you must assume worst case scenario and stay inside your shelter for at least two weeks.

Clothing should be stored which would allow for outside excursions for short periods. Easily decontaminated materials such as rain coats, ponchos and irrigation boots are recommended. Radio communication capabilities, both ham and citizens band would be desirable. VHF ham radios require a relay station and would probably not do you much more good than a CB. Relay stations are vulnerable to EMP damage. We recommend the HF frequency radios. Be sure you protect all your radios and sensitive equipment in faraday cages. A metal garbage can makes a good cage. Place your equipment inside the garbage can. Fold a 6 inch wide strip of metal screen around the entire circumference of the can. Force the lid over the screen. This will assure a good, tight metal to metal contact.

First aid supplies, tools, duct tape, bedding, flashlights, batteries, spare bulbs, toilet paper, feminine supplies, soap, needles, books (scriptures, nuclear war survival, first aid, disaster preparedness, gardening, self-sufficiency, construction, etc.). Provide items for infants.

It would be wise, if room allows to store a fire extinguisher, solar shower, shovel, construction tools, gardening tools and seeds, survival knife, matches & ax.

BASIC PREPARATIONS

Our '**complete corrugated shelter**' comes with two entrances, two blast doors, all needed airpipe, goosenecks welded, interior paint, exterior epoxy on end plates, all flooring with removable center panels, two ladders, ac and dc wiring with fixtures, complete ventilation and filter system, and 5 lengths unistrut.

We are also offering the corrugated steel shelter in a '**basic form**'. You will need to complete some items. This will save you about \$9,000 on the purchase price. Most people have been able to complete their 'basic' corrugated steel shelter in about 3 weeks. This is a brief order of events for the 'basic shelter':

Instructions for completing your 'basic' shelter: Some of these instructions will also apply for the

'complete shelter system'.

Three Weeks Before Desired Finish

- Apply for building permit and arrange for delivery of LUWA ventilation system.
- Buy vent pipes (5 ft. lengths are manageable) and wide diameter extension.
- Weld the 'goose neck' vent pipe portions together into a 180 degree angles.
- Purchase inside latex paint (we recommend white).
- Build or purchase steel ladders.
- Purchase wiring and light fixtures.
- Order magnesium anodes if needed.

One Week Before Desired Finish

- Reserve trackhoe, crane, crushed rock, and concrete
- Purchase & cut wood for floor (we will send you a pattern)
- Purchase wood or corrugated steel pipe for framing concrete pad and rock crib blast valve
- Find large rocks for rock crib
- Purchase food and other equipment

Day before Delivery

- Excavate early in morning
- Deliver crushed rock

Day of Delivery

- Deliver (in early morning)
Time delivery of crane & backfill with delivery of shelter (crane should be on site to remove shelter from truck and lift shelter into hole)
- Attach magnesium anodes before shelter is placed in hole
- Place all large equipment (barrels, LUWA, flooring) into shelter before attaching entrances
- Place shelter in hole; attach entrance, & backfill

Day After Delivery

- Lift door into place with tractor, and frame concrete pad.
- Tie or weld rebar into curtains
- Weld goose neck onto vertical air pipes and frame rock crib area.

Second Day after Delivery

- * Pour concrete pad & frame rock crib blast pit
- * Place rocks in rock crib
- * Install floor and paint interior

NOTES OF INTEREST

Water problems

1. Sometimes water levels fluctuate. Corrugated steel pipes are not completely water tight even with the neoprene gasket. Do not place these shelters into the water table.

2. Sometimes water comes in through entrances. Make sure your concrete pad slants away from your door. If this is done correctly, water will not come into your entrance.

(a) Order the vertical run of your entrances with a 3 ft. extension on the end, forming a T with the horizontal run. Leave the end of the extension open. Fill the extension with gravel. This will allow any water entering through your entrance to drain into the ground before entering your shelter. It is also a good place for an expedient shower.

(b) Change the horizontal run of your entrance to a slight upward angle towards the shelter body. This way, any water entering through the entrance will pool at the bottom of the vertical run.

(c) Make sure your door has a good water tight gasket. Change your gasket regularly.

(d) Make sure the cement pad is graded away from the door.

(e) Cover the door with heavy plastic during winter or rainy seasons.

(f) Cover the entrance with a small outbuilding.

3. Sometimes water pools at the bottom of the excavation.

(a) If your soil contains a lot of clay and there is water from above, it will act like a large pond. *Do not settle your soil with water, for compaction!* Wet compacted clay will also cause problems with earth arching.

(b) Widen the excavation and place a layer of 6 mil plastic about 3 feet below grade before completing burial. This directs the water away from you shelter.

☞ **Fire in the Hole**

The only fire that has been reported to us was caused by welding inside the shelter. Clothing and other supplies were ignited by the sparks. We highly discourage welding inside the shelters. We also discourage cooking with fuels such as white gas or propane. Be sure to keep a fire extinguisher readily available. Do not store fuel in your shelter.

☞ **Rodents and Snakes**

1. Keep all food where possible in metal containers. (This poses a slight problem because we like to keep rice in our alternate exits).

2. Keep rodent traps and ECON on shelter floor.

3. Seal outside pipes for electrical wires with foam.
4. Keep doors shut.
5. Put 90 degree turn on air vents and cover the opening with small mesh wire.
- ⚡ 6. Do not leave your doors open.
- ⚡ **Spiders and Insects**
Watch for brown recluse and black widows. Spray around shelter doors.
- ⚡ **Condensation**

You may see condensation on the underside (inside) of your doors, if you leave plastic, dirt, or other covers on the outside of your doors. Remove these covers.

We have not had complaints about condensation on the air pipes. Condensation can occur as the warm air hits the cool air pipe underground. However, our air pipes all have an extension on the end of the vertical run which allows the condensed water to drip into the crushed rock that surrounds the shelter. This also acts as a drain in case someone should force liquids into your air pipes.

Check under your floor regularly. If there is any water, vacuum or mop it up immediately. Damp shelters can cause mold.

Carbon Dioxide/Monoxide

Do not burn kerosene lamps and do not cook with any fuel except cooking alcohol. Do not rely on normal air convection for fresh air. Freshen the air regularly by running your ventilation system. Compressed air tanks can become missiles if their seal is broken. Oxygen tanks can cause explosions. We have a CO2 filter available. Ask about item # CD 150 E. They run about \$2200 including transport.

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