

2012 Shelters Guide



It is important to remember that this 2012 Underground Shelter guide is only a **starting point** in the comprehensive development of a **Client Specific** 2012 Shelter Protection Program.

To discuss your specific requirements, please call us for a free confidential consultation.

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While there are different people have different threat level predictions, all Hardened Structures Shelters generally function as a stand-alone fortress. Self Rescue supplies and Emergency Escape man-ways are included in the basic design as to allow radical movement of the structure and extreme surface conditions. If this shelter is forced to the surface it will be capable of surviving all of the above threats absent the protection of earth coverage. Post Attack Recovery Plans and resources are incorporated to be utilized during the anticipated after-effects of the 2012 Threat Event Scenario.

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PROTECTION PROGRAMMING FOR A 2012 EVENT

Threat Assessment:

A Hardened Structures 2012 Shelter is typically designed and constructed to mitigate the following Threats.

- 1. 3-Bar Blast Overpressure of 45 psi**
- 2. Force 10 Earthquake in successions**
- 3. 450 MPH winds**
- 4. Extreme Gamma & Neutron attenuation from a 100 megaton air burst detonated 20 miles away**
- 5. Solar Flares with 1,000,000 volt (EMP)**
- 6. Flooding (submersion for 500 hours)**
- 7. Extreme External Fires at 1250 F for 10 days**
- 8. Magnetic Pole Shift**
- 9. Chemical, Biological, Radiological, Nuclear (CBRN) Weapons**
- 10. Forced Entry and Armed Assaults**
- 11. 12' of snow and 10' of rain**
- 12. 97 lb Hail Stones at a speed of 100 mph**

General Space Requirements:

The shelter is anticipated to incorporate the following spaces: Bedrooms, Bathrooms, Air Locks, 1-Decontamination Room, 1-Kitchen, 1-Den, 1-Communal Space, 3- Store Rooms, HVAC Equipment Room, Battery Room, 2-Emergency Escape Tunnels, Power Control Room with Generator, Firearms/Ammunition Vault and required fresh air intakes and exhausts.

Structural Requirements:

The shelter shall be designed to withstand 3-Bars, or 45 psi of applied overpressure. All penetrations thru the shelter envelope must utilize blast valves and blast doors. Concrete admixtures for moisture control and water penetration will be required as well as additional reinforcing detailing at all penetrations. A Mat-type 4000 psi cast-in-place concrete foundation is envisioned with concrete walls between 1'-4" to 2'-2" thick. A cast in place concrete ceiling approximately 2'-4" to 3'-6" thick is anticipated. A Blast suspension system typically will not be incorporated.

Mechanical Requirements:

1. The shelter shall be designed to operate "off the grid" without outside utility support. The shelter will be connected to the existing electrical service and shall operate using utility electrical power when available.
 - a. The main electrical power should be used to keep the Facility ready for occupation
 - b. Primary power of approximately - 16 to 25Kw is required and should be geothermal water or radiator cooled generators. Possible future surface installations may need power for development, generator size determined after component selection.
 - c. Small scale power generation will need to be provided to keep the Battery Banks charged during lock down
 - d. Alternative Energy production shall be included i.e., P.V. Wind .etc...
 - e. All internal systems that can be run on 12-24or 48 Volt D.C should be designed accordingly and where possible, appliances should be dual fuel.
 - f. All Power transfer, Generation and Inverters and Batteries must be protected by a Ferias cage from EMP surge of 1,000,000 volt minimum. All these components and internal appliances must be surge protected
 - g. All Critical systems shall have a manually operated Back up.
 - h. Dehumidification of the air within this facility is the first consideration in all design and equipment choices. Humidity will degrade NBC and CO2 air supply filters at a ratio of 10to1, a filter good for 90 days at 5% humidity will only work at 95% humidity for as little as 9 days

- i. All external Ducts, Cables and Pipes need to be bonded into the ground system before any wall penetrations to protect internal environments and equipment from EMP Surge.
 - j. Manual power generation capabilities shall be incorporated into the design.
 - k. Independent Isolated Battery Backup system shall be designed into the system
2. Air from external sources must be assumed to not always be available
- a. During a closed circuit operation CO2 absorption will require an internal recirculation system to return air to HVAC room for treatment. "90Day"
 - b. All internal air is to be Heated, Cooled, Dehumidified, Filtered, HEPPA and or UV
 - c. All valves must have a fast acting closure mechanism capable of protection during complete submersion. Drainage for all system enclosures shall be provided.
 - d. All air within the shelter should be capable of being completely replaced within a 5 min period for evacuation after a possible internal fire.
 - e. All air locks are to have less than a 4 min cycle rate - 4 Full volume Exchanges
 - f. Two supply systems will be required One during NBC Lockdown Fully Protected, this system should have the option of CO2 exchange. The second system will be for Non – NBC filtered air. This system is for Blast protected and Filtered air for those times when the external air is suitable for breathing.

Sensors will need to be installed to immediately close this system as soon as a threat is perceived. **NOTE:** It is cost prohibitive to provide NBC protected air for a full year without considerable expense.
 - g. 10Cm Per Hour is the recommended minimal air required for each inhabitant.
 - h. Ambient temperatures of 72 to 78 Deg should be used as a goal
 - i. We do not recommend that any air be introduced into the living spaces above 36" from floor height
 - j. Air exchange Valves between rooms are recommended to be between Head height and lowest ceiling level.
 - k. Air pick-ups for recirculation of air recommended to be within the Drop ceiling

- l. Relative humidity is recommended to be kept under 10% at all times and 5% during Lockdowns
 - m. If heat exchange wells can't be installed then adequate coils will be placed on the uphill side of the structure during backfill for HVAC systems.
 - n. All external Ducts, Cables and Pipes need to be bonded into the ground system before any wall penetrations to protect internal environments and equipment from EMP Surge.
 - o. The Cooling and Aspiration air required by the Generator must be kept completely separate from that of the shelter areas especially during discharge
 - p. There shall be secure access to the generator room for maintenance and repairs.
3. Potable/Drinking water will be supplied from a deep well within the Structure
- a. All internal systems should be operated on 12-24 or 48 Volt D.C whenever possible.
 - b. Internal and external Water Supply tanks should be considered for heat exchangers to bring water supply closer to a useful temperatures
 - c. Hand operated backup systems should be included during design , for supply
 - d. Filtration and treatment equipment is to be included in the design of the water supply system in case future contamination occurs
 - e. A minimum of 5 Gallons per person per day is recommended
 - f. Sewer pipes and air vents are to be protected from back pressure
 - g. Grey water is recommended to be used to improve grounding potential of soils surrounding shelter
 - h. All external Ducts, Cables and Pipes need to be bonded into the ground system before any wall penetrations to protect internal environments and equipment from EMP Surge.
 - i. 30 Days of Water should be stored in an external tank allowing gravity feed into shelter for use during power outages. Hand pumping must be an option.
 - j. Water will be monitored for contamination: Radiological Chemical and Biological before storage and distribution network.

- k. Drinking water wells will not be used for, or encroached on within 40' of Geo Thermal wells. If available a different depth for Drinking water (The Deepest) should be used from those of equipment cooling
- l. All sewer drain lines shall be located below structure for gravity feed.
- m. An option of a secondary Grey water disposal system for backup which should include a water treatment system for use in toilets and for wash down requirements if water becomes in short supply.

Electrical Requirements:

Main Power will not be available for the duration of occupation.

1. Main power will be used to keep the Facility ready for occupation.
2. Primary power of approximately - 16 to 25Kw is required and should be Geothermal water or radiator cooled generators. Possible future Surface installations may need power for development (Generator size determined after component selection).
3. Small scale power generation will need to be provided to keep the Battery Banks charged during lock down.
4. Alternative Energy production will be included for possible use (i.e.: P.V., wind, etc.).
5. All internal systems that can be run on 12-24 or 48 Volt D.C should be used and where possible appliances should be dual fuel.
6. All Power transfer, Generation and Inverters and Batteries must be protected by a Faraday cage from EMP surge of 1,000,000 volt minimum. All these components and internal appliances must be surge protected.
7. All critical systems will have a manually operated back up.
8. All external ducts, cables and pipes need to be bonded into the ground system before any wall penetrations to protect internal environments and equipment from EMP Surge.
9. Manual power generation capabilities should be included.
10. Independent Isolated Battery Back ups are required.
11. Provide UL listed and labeled products where possible.

12. All work to comply with NEC standards.
13. Coordinate required wall penetrations and cable trays spaces with plumbing to take advantage of duct hangers for cable tray support. The wall penetrations must have a minimum of 6" of clearance from each penetration.
14. Monitor all critical system components power signatures to diagnose and identify possible failures of these electrical components before failure occurs allowing possible maintenance and repairs before failure.
15. Copper wiring only - no aluminum.
16. All systems components to be fit with soft start when possible.
17. Hook up 25kw and 5kw generator sets into inverters system of matching KVA rating.
18. 12v lighting system as shown on drawings. 12v motor control panel in shelter master. 24 or 48v Jet pump. 48v water pump with high/low float switches and manual bypass on/off switches.
19. All systems, controllers, blowers and components to be 12, 24, or 48v unless otherwise specified on drawings.
20. Low voltage startups as preferred option when batteries require charge. These systems will require timers on the blowers and louvers to allow them to open and close up to 60 seconds before startup and shutdown of generator sets.
21. Only one generator will be allowed to charge the batteries at a time; they will need to be wired with a controller. Priority for charging should be the smaller generator set. This will require separate inverters for each generator.
22. Install inverter system and battery banks immediately adjacent to power generator room with air extraction hood for removal of off gassing during battery charging.
23. Wire P.V. system to Outback with 1,000,000v surge suppressor or disconnect P.V. system isolated and grounded separate from that of in-shelter system.
24. Wire wind generator system to internal system with 1,000,000v surge suppressor or disconnect wind generator system isolated and grounded separate from that of in-shelter system.
25. All external supply systems to have isolators and/or disconnects suitable for a 1,000,000v surge minimum.
26. Low voltage sensor alarms into shelter control panel for Battery systems. All systems require manual bypass and on/off switches.

Electrical Components:

1. 110V -220 v Blowers:

- a) One blower 3,000 cfm on 25kw generator set.
- b) One blower 900 cfm on 5 kw generator set.
- c) One blower air intake variable speed as specified on drawings.
- d) One blower air exhaust variable speed as specified on drawings.
- e) One NBC rated 110v blower manufactured by Temet.
- f) Two fire dampers on 25kw generator set.
- g) One fire damper on 5kw generator set.

2. 110V – 220 V System:

- a) 110v lighting system; 1 in each room
- b) 110v wall sockets; 1 in each room
- c) Two 110v freezers.
- d) One 110v refrigerator.
- e) One 110v washer/dryer.
- f) One 110v dishwasher.
- g) One 110v stove.
- h) One 110v dehumidifier.
- i) Instant hot water points (electrical) in kitchen
- j) Satellite communications and internet with T.V.
- k) Long Range Ham Radio Transceiver
- l) CB Radio (2)
- m) CBRN sensors and security system

3. Low Voltage System:

- a) 12v lighting system (primary lighting) in every room as required for occupation.
- b) 12v Wall sockets in each room for lap tops, entertainment systems, portable lighting, etc.
- c) Smoke and fire detection system.
- d) Carbon dioxide sensing/monitoring and alarm system.
- e) One gas & air tight valve on air intake fit with pneumatic actuator..
- f) One gas & air tight valve on air exhaust fit with pneumatic actuator.
- g) Critical system air blowers in case of 110v power failure.

4. Radio transmitter, tower wiring and isolators and surge protectors.
5. All systems to be protected by surge protectors; 250,000v for internal systems and 1,000,000v external protection.
6. External sensors, lights and security systems.
7. Required EMP Grounding: PV, wind, antenna tower, internal electrical components, gen sets, inverters, battery, shelter rebar, water, EEM, fuel and sewer system grounding.
8. All blast doors to be grounded with ½” copper and frames as per Manufacturer’s recommendations.
9. All in-shelter systems to use Arc Fault Circuit Interrupters (AFCI).
10. One and two pole AFCI for stove and pumps to include homerun circuit. These are to be used in conjunction with GFCI receptacles.
11. A power manager to provide direct homeowner on/off remote control of specific circuits is required to perform automatic preprogrammed on/off control of specific circuits, (i.e. communications, monitoring, and control or air and water capabilities).
12. Power sensors need to be used to determine where power is being used. This will also allow early indication of major appliance failures and allow replacement in a non-critical situation.
13. All communication lines are to be fitted with CHSP surge protection.
14. All critical system and motor control circuits are to utilize CPS MAG suppressors located as close as possible to each component. AEGIS reflective wave trap cdv/d+ filters to protect motors.
15. All diagrams and equipment lists are from our preferred manufacturer of Cutler Hammer. Load characteristics and ease of systems integration make this the best option for product procurement.
16. Schematic wiring diagrams compiled for Owner’s Operations and Maintenance Manual.

2012 Shelter Reviews:

Hardened Structures is a Professional management construction firm specializing in Underground Shelter Systems. If you have your own plans or ideas, our team of Engineers will confidentially review your plans for life/safety issues, structural, mechanical and electrical engineering compliance, blast engineering, radiation shielding, and biological air filtration. We can also provide: Feasibility Studies, Site Assessments, Risk Assessments, Security Assessments, Alternative Energy Designs, Cost Estimating, Critical Path Scheduling, Shelter Dynamics/Management Plans, long term sustainability requirements and On-site Construction Management.

