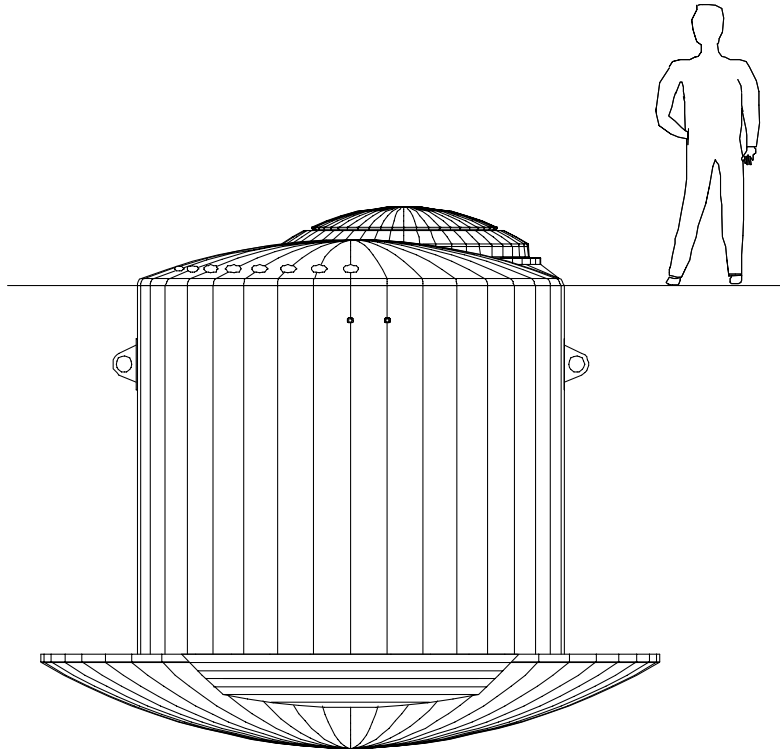


**S.C.U.P.P. 2000**  
**SELF-CONTAINED UNDERGROUND POWER PLANT**



- **Long-Term Electric Power**
- **No Danger From Poisonous Carbon Monoxide Fumes**
- **No Danger of Fire in Building**
- **No Danger of Explosion in Building**
- **No Noise Or Vibration in Building**
- **Safe Underground Double Wall Fuel Storage**
- **10-Year Warranty**

US Patent 6,335,919 B1, Others Pending

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## S.C.U.P.P. 2000

### SELF-CONTAINED UNDERGROUND POWER PLANT

The **S.C.U.P.P. 2000** is a completely self-contained underground fiberglass electric power generation plant designed to provide prime power for critical systems. The S.C.U.P.P. 2000 is composed of a fiberglass housing, gravity dish, hatch dome at ground level made of Combat Composite™, and a double wall 2000-gallon diesel tank. The SCUPP is sold two models. Direct power where the generator is able to run continuously for 4-8 months (SCUPP 2000D). The SCUPP 2000V comes with battery banks, battery chargers, inverter, and generator. This unit will supply power for 6-12 months. Unlike conventional electric generating plants, the whole unit is below ground and designed to work in severe climates and disaster conditions. The hydraulic hatch is aerodynamically designed to resist flying debris in up to 300-mph winds from weapons blasts, tornados, and hurricanes. In addition, it can withstand an earthquake measuring 8.5 on the Richter scale with no damage and can survive 5-psi negative pressure from a nuclear blast or tornado and 20-psi overpressure from modern weapon detonations.

The S.C.U.P.P. 2000 can accept generators from 10 KW to 150 KW and is shipped completely assembled and can be installed in one day. Installation requires a hole that is 10 feet deep with a base dimension of 14 ft x 14 ft. The hydrostatic pressure (buoyancy) generated in a water table reaching the ground surface with an empty fuel tank is 37,877 lbs. The gravity generated by the submerged earth over the gravity dish, and weight of the 10 KW generator and fiberglass structure is 48,072 lbs. resulting in a 1.27 safety factor. This design meets the American National Standards Institute (ANSI A58.1) requirements for buoyancy and the Fire Codes (NFPA 30) for a tank of this size. This size fuel tank allows approximately 3600 hours of operation at 50% load for a 10 KW generator. The fuel tank is 6 feet below the ground, which keeps the stored fuel temperature well below the outside air temperature and usually above freezing temperatures. Fungicides are added to the diesel fuel each year.

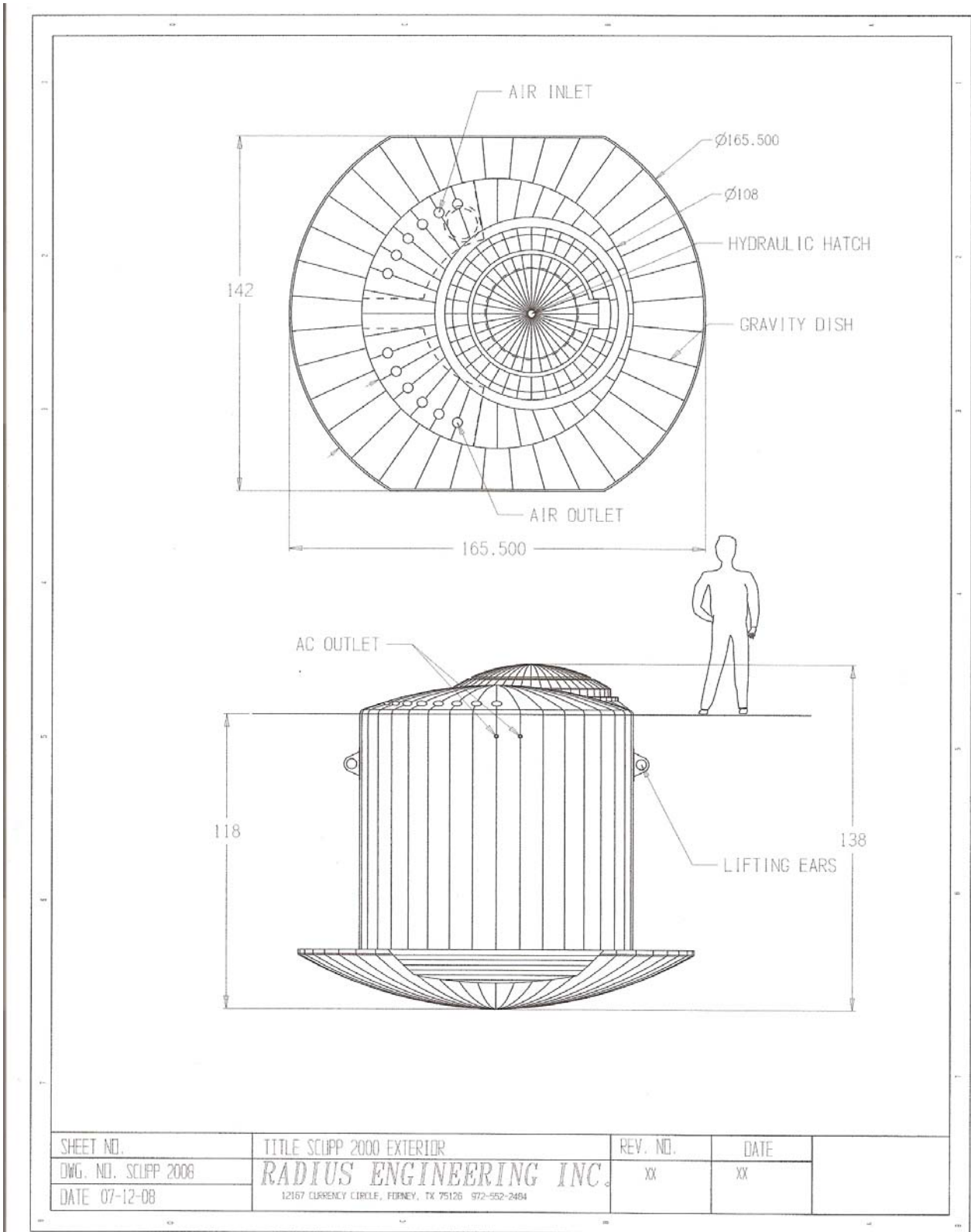
The S.C.U.P.P. 2000 should be installed 2 feet above the 100-year flood plain. A local surveyor can determine this level. The generator can also be removed by unbolting the hatch. The generator exhaust is connected to the air plenum under the hatch dome and does not exhaust into the generator chamber. This keeps the engine compartment cool and clean. A high pressure centrifugal blower forces 1000-4000 cfm into the generator housing chamber for combustion and cooling air.

#### Fuel Consumption in Gallons/Hr

<b>%Max Capacity</b>	<b>10Kw</b>	<b>20Kw</b>	<b>60Kw</b>	<b>100Kw</b>	<b>150Kw</b>	<b>200Kw</b>
100%	1.1	2.0	5.0	7.0	10	13.2
75%	0.8	1.5	3.8	5.0	7.7	9.7
50%	0.55	1.1	2.8	3.4	5.4	6.7
SCUPP Weight-lbs	3900	4200	5200	5700	6400	6800

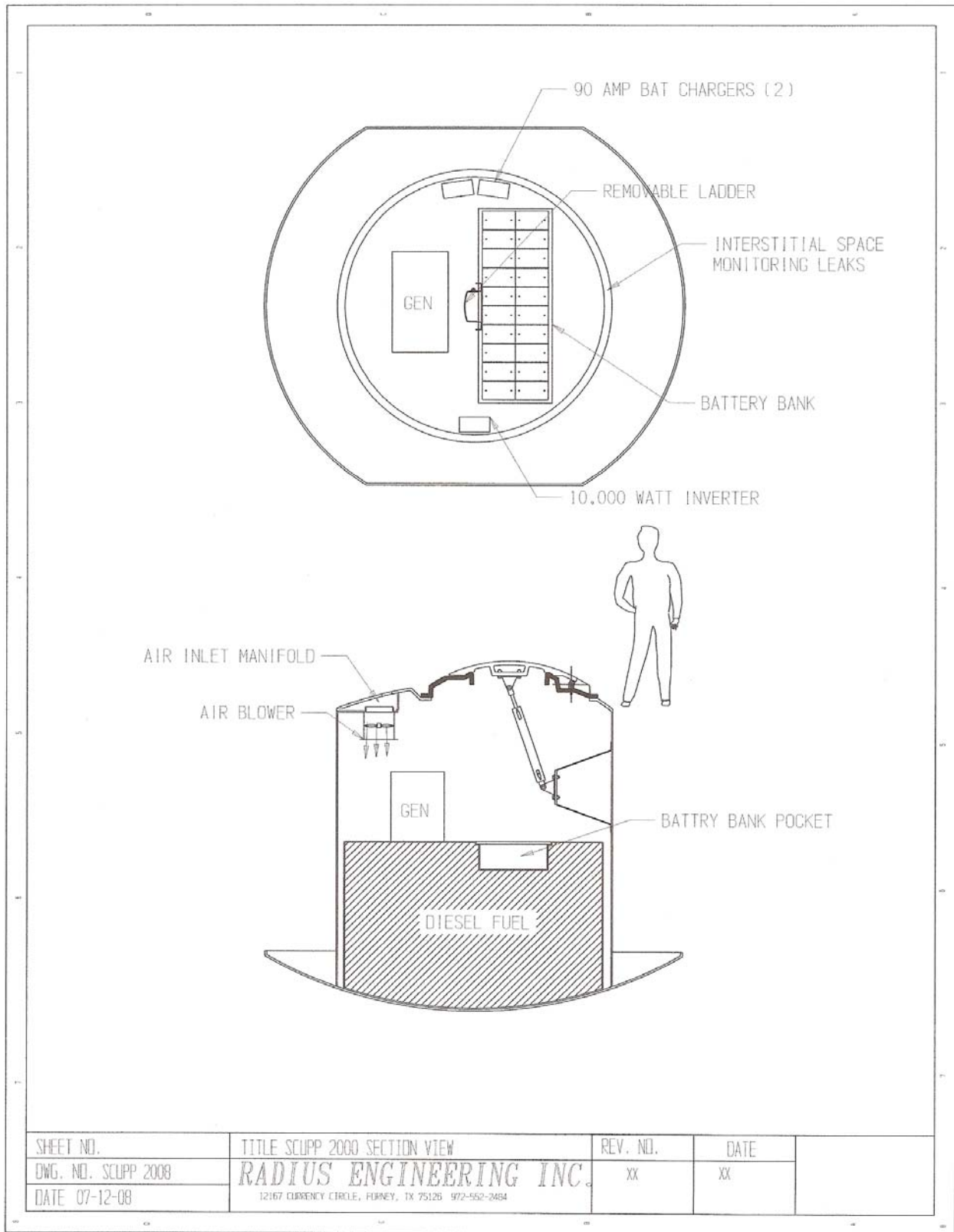
The 10 KW slow speed diesel generator supplies 40 amps @230 VAC, single phase, 60 Hz power or 80 amps @ 115 VAC single phase 60 HZ. The SCUPP 2000V has two 90 amp hour battery chargers located at one end of the battery bank. The battery chargers are designed to use a tapered charge to prevent over charging. With 180 amp/hr of battery charging, the generator needs to operate for 12 hours to recharge the battery bank. At the opposite end of the battery bank is an inverter converting 12 volt DC power to 115/230 volt AC 60 Hz single phase power. The inverter has a continuous rating of 10,000 watts and a 10 second surge rating of 15,000 watts. The battery bank stores 24,960 at 80% capacity and with the inverter is able to supply sine wave power to the circuit breaker of a house or other structure. When the batteries run down to approximately 20% of their capacity, the generator automatically turns on. The deep

**S.C.U.P.P. 2000**  
**SELF-CONTAINED UNDERGROUND POWER PLANT**



SHEET NO.	TITLE SCUFP 2000 EXTERIOR	REV. NO.	DATE
DWG. NO. SCUFP 2008	<b>RADIUS ENGINEERING INC.</b>	XX	XX
DATE 07-12-08	12167 CURRENCY CIRCLE, FORNEY, TX 75126 972-552-2484		

**S.C.U.P.P. 2000**  
**SELF-CONTAINED UNDERGROUND POWER PLANT**



## S.C.U.P.P. 2000 SELF-CONTAINED UNDERGROUND POWER PLANT

cycle lead acid batteries used in this way can be discharged and recharged for approximately 400 cycles before requiring replacement. The battery banks are located in pockets molded into the fiberglass floor and covered by composite floor boards. This keeps the batteries in a non-conductive housing where they are maintained at a stable low temperature with little vibration resulting in a very long battery life. In compliance with the Radius Viral Cocooning Operations, the SCUPP 2000 with a 10 KW slow speed diesel can supply power for 6 + months based on the following electrical loads:

APPLIANCE	OPERATING HRS/DAY	WATTS/HR	DAILY LOAD-WATTS
MCAS-120	24	21	504
Water pump	1	1050 (1/2 HP)	1050
Lighting	16	13 watt FL bulbs (4)	832
Refrigerator	4 (normal operation)	800	3200
Clothes Washer	1	1150	1150
Dishwasher (no drying)	1	700	700
TV-color 23 in.	6	300	1800
Vacuum	0.5	600	300
Laptop Computer	6	100	600
			10,136 watts/day

Power for air conditioning can be supplied with basic power management of other appliances.

**Power Storage** = 20 - 130 AH batteries @ 80%= 2080 amps = 24,960 watts

**Charging** = 2 x 90 amp battery chargers= 180 amps/hr = 2,160 watts/hr charging = 11.6 hours to recharge battery bank.

Unlike conventional electric generating plants, everything is below ground and designed to work in severe climates and disaster conditions. The Meridian Hatch Dome System is remotely hydraulically controlled operated and is aerodynamically designed to resist flying debris in up to 300-mph winds from a tornado or hurricane. The S.C.U.P.P. 2000 is shipped completely assembled and can be installed in one day. The S.C.U.P.P. 2000 can be started remotely by an underground 50 ft control cable. The generator can be serviced by using the wireless remote transmitter which opens the hatch dome cover at ground level and climbing down a ladder into the engine compartment.

### Historical Overview

Common gasoline and diesel generators pose significant health dangers. Carbon monoxide poisoning is the number one cause of accidental poisoning in the U.S. During the past decade many people were hospitalized for breathing carbon monoxide as a result of fuel-powered generators operating either in the basement or in the garage even with the garage door open. Buildings are not airtight. When the wind blows or bathroom and kitchen exhaust fans operate, negative pressure is created in the building drawing in fumes from the generator. Carbon monoxide fumes are odorless and deadly because they interfere with the human body's ability to process oxygen. Also during this time period, many people suffered injuries from fires or explosions as a result of generators operating unsafely. Power lines, solar panels, and wind generators are usually the first structures damaged during high winds, which carry flying debris and are therefore not dependable during emergency situations. It is this history that created the need to develop the S.C.U.P.P. 2000. Radius Engineering Inc. has been engineering and supplying *high tech* underground and self-sufficient products for over 30 years using modern state-of-the-art computer aided drafting (CAD), computer aided engineering (CAE), and Finite Element Analysis (FEA).

# **S.C.U.P.P. 2000**

## **SELF-CONTAINED UNDERGROUND POWER PLANT**

### **Disasters**

Between 1997 and 2007 presidents of the United States signed 629 major disaster declarations for territories in the United States. This has averaged more than 5.2 major disasters each month affecting millions of people. Since 1990 the number and severity of disasters has risen, due to global warming. The aftermath of disasters such as earthquakes, tornadoes, blackouts, fires, and hurricanes have created tremendous hardships on people who were forced to live without electrical power for long periods of time.

#### **Without electrical power:**

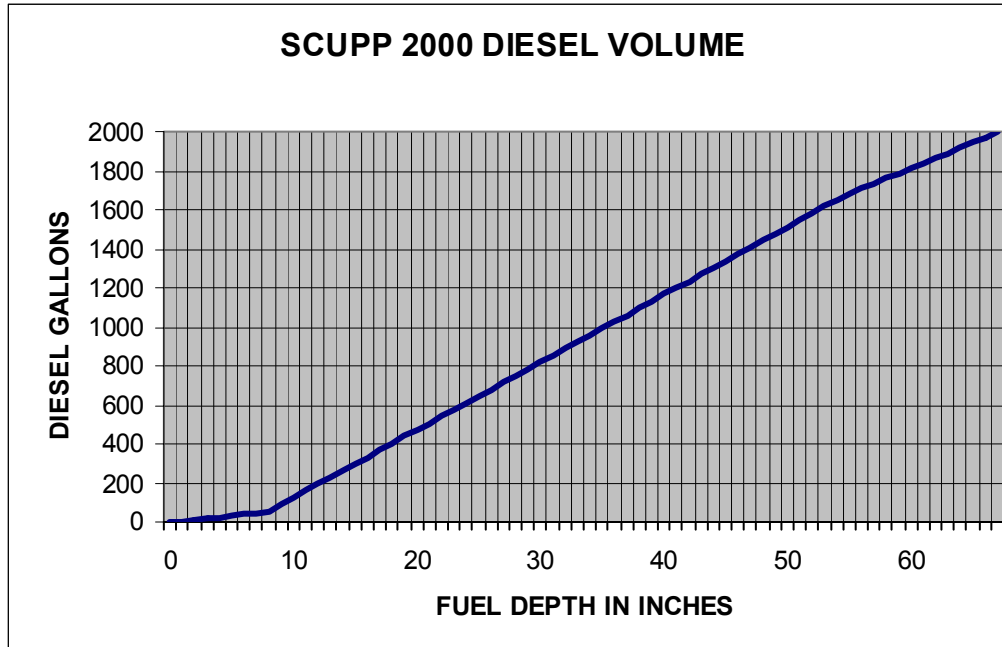
- There is no running water because water pumps require electricity.
- There are no operable toilets, sinks, or showers because there is no running water.
- There is no way of using heating furnaces because they require electricity to fire burners and operate blowers. Refrigerators and freezers also will not work.
- There are no lights to allow normal living in the nighttime. Common flashlights and camping lights are only able to operate for a matter of hours.
- Driving is extremely dangerous because traffic lights may not be operating. If the roads are free of fallen debris, and it is possible to drive to a fuel station, there is no way of getting fuel out of the ground because fuel pumps require electricity. So it is not always possible to just drive over to the next town and get the necessary supplies.
- The traditional portable generator placed outside the building is not weatherproof and not designed to resist fallen or flying debris. If it survives the disaster, it is not designed to operate for more than a few hours because the fuel tank is so small. If it operates inside, it often creates severe problems due to exhaust fumes, heat, vibration, noise, and overheating.

Rebuilding after disasters has been severely hampered by lack of electrical power. The buildings where power is available, are the first to get rebuilt, simply because electrical power is available making it possible to operate construction tools and equipment.

### **Fuel Tank**

The S.C.U.P.P. 2000 contains a 2000 gallon fiberglass tank located within the engine housing chamber. There is a 2 inch space around the tank where any leak in the fuel tank can be contained and visually noticed without electronic equipment. It is the customer's responsibility to monitor the fuel tank for any leaks by visually checking the space surrounding the fuel tank. The top of the fuel tank is the floor on which the generator is located and the battery box pockets serve as structural beams to carry the load of the generator. The fuel volume in the S.C.U.P.P. 2000 fuel tank is determined by a fuel gage mounted by the generator. There is also a supplied stick gage. The stick gage is inserted into the 2-inch fill cap in the top of the tank. The depth of the fuel in inches is related to the *available* gallons remaining in the tank.

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Example: If the stick gage indicates that the fuel depth is 30 inches deep, there are approximately 800 gallons remaining in the tank.

### Air Manifolds

Air for combustion and cooling enters through the *air inlet* in the hatch dome and is exhausted through the *air outlet* in the hatch dome. The mechanical configuration of the air inlet system will allow rain to be sucked through the air inlet hole into the hatch dome plenum where the rain will drop prior to entering the air blower. The air inlet hole is large enough to allow a person's hand to enter to clear away any debris. This is particularly important in tornado and hurricane disasters where the driving wind and water result in mud being packed in every opening.

### Fill Fuel Tank

1. Extinguish all cigarettes and turn off generator.
2. Open the access cover.
3. Remove the 2-inch fill cap on the top of the fuel tank.
4. If the generator will not be operating for long enough periods to consume most of the fuel within a year, add fuel antibacterial liquid for 2000 gallons of fuel. One bottle is provided with the S.C.U.P.P. 2000. This should be added every year or two.
5. If the S.C.U.P.P. 2000 is installed in a cold climate, No. 1 diesel should be used or No. 2 diesel with diesel antifreeze for 2000 gallons of fuel. This can be purchased locally.
6. Insert the fuel nozzle into the fill port and refuel, checking visually to see where the level of fuel is. Do not completely fill the tank to allow for adding fuel biocides each year.

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**Generator Housing Hatch Dome and Cover**

When the S.C.U.P.P. 2000 is properly installed, all that can be seen on the ground is the hatch dome and hatch cover. The hatch dome contains the air inlet and air outlet openings. The generator housing and tank are both vented to the hatch dome.

**Operating Capacity**

To determine the size generator required, add up all the running watts of all appliances that are expected to start and run at the same time. Electric motors require 2 to 3 times the name plate wattages created during the 1- to 2 second starting surge. If the S.C.U.P.P. is intended for residential use, the governing appliances are usually the well water pump, refrigerator, and furnace. The battery bank option eliminates the surge requirement.

<b>Equipment</b>	<b>Running Watts</b>	<b>Starting Watts</b>
Air Conditioner –Central	2000-5000	3000-6000
Clothes Washer	1150	3450
Coffee Maker	1750	1750
Dishwasher no heat drying	700	2125
Electric Range 6 element	1500	1500
8 element	2125	2125
Furnace Blower	1/8 HP 300	800
	1/6 HP 500	1250
	1/4 HP 600	1600
	1/3 HP 700	2125
	1/2 HP 875	2350
Light Bulb (125W)	125	125
Oven	6000	6000
Radio	50-200	50-200
Refrigerator or freezer	800	3125
Shelter 45 Amp Bat charger	600	600
Television -color	300	300
Toaster 2 slice	1050	1050
Vacuum Cleaner	600	1800
Water Well Pump	1/3 HP 800	2125
	1/2 HP 1050	3200

**Air Blower**

Ventilation of the generator housing is necessary to remove heat generated by the engine and any fumes, and supply combustion air for the engine. The air blower is sized to limit the engine room temperature to 120°F at 100% capacity in warm climates. The 230 volt centrifugal blower has an average life of 10,000 hours. It is activated as soon as the generator starts.

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**Snow**

During very heavy snows, the air inlet, and air outlet holes may need to be cleared. Once the generator is operating, it will suck in blowing snow and exhaust it through the air outlet. Should either become blocked, the generator will overheat and automatically stop before damage results.

**Flood**

The S.C.U.P.P. 2000 should be installed 2 feet above the 100-year flood plain. A local surveyor can determine this level. The generator can also be easily removed.

**Generator Exhaust**

The generator exhaust is connected to the air plenum under the hatch dome with a thermally broken stainless steel exhaust pipe. Combustion and cooling air exit through the hole around this exhaust connection keeping it cool.

**Automatic Off**

The generator is equipped with a thermal switch, which will turn the generator off when it exceeds its maximum operating temperature. This may happen as a result of the blowers malfunctioning, low oil level, or if the air inlet/outlet manifolds becoming clogged.

**Maintenance**

- Air manifolds - Make sure that the air manifolds and insect screens are clear from animal nests, bee nests, grass, snow, mud, etc.
- Fuel - Use diesel anti-gel additive (or No. 1 diesel) and anti-bacterial additive as necessary.
- Starting - Start the generator each month and run for at least 15 minutes.
- Check interstitial space of the double wall tank visually for leaks.
- Check oil level.
- Check generator air filter.
- Replace the fuel filter as required based on engines owner's manual.
- Check water level of battery.

**Conforming Standards**

The S.C.U.P.P. 2000 conforms to the applicable portions of the following partial list of engineering standards.

NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Automotive and Marine Service Station Code
ANSI A58.1	Minimum Design Loads for Buildings and Structures
ANSI B1	American National Standards Code for Pressure Piping
ANSI B31.3	Petroleum Refinery Equipment
ANSI B31.4	Liquid Petroleum Transportation Piping Systems
ASTM D 256-81	Impact Resistance
ASTM D 396	Specification for Fuel Oils
ASTM D 790-81	Flexural Strength
ASTM D 543-87	Tests for Resistance of Plastics to Chemical Reagents
ASTM D 581	Chemical Resistance
ASTM D 2584	Material Composition

# **S.C.U.P.P. 2000**

## **SELF-CONTAINED UNDERGROUND POWER PLANT**

ASTM D 4032-1    Tank Material  
U.L. 1316        Glass Fiber Reinforced Plastic Underground Storage Tanks  
                         for Petroleum Products

### **Security**

When the S.C.U.P.P. 2000 is not being used or during operation, the cover is hydraulically locked from the inside with no visual exterior lock. The wireless remote pocket transmitter is used to open or close the hatch.

### **Shipping**

The S.C.U.P.P. 2000 weighs approximately 4000 pounds and can be shipped by common carrier on a double drop trailer. The S.C.U.P.P. 2000 will require an excavator to lift off the truck with a pick height of 14 ft. The customer is responsible for arranging equipment to off-load the S.C.U.P.P. 2000 at its destination.

### **Decontamination**

The S.C.U.P.P. 2000 can operate in NBC (nuclear-biological-chemical) warfare environments. The inside of the S.C.U.P.P. housing and generator will become contaminated only if the generator is operating in an NBC environment. NBC contaminants do not affect the generator's performance unless an extreme amount of dust and fallout clog the air intake filter.

Decontamination is performed in two phases.

**Phase 1** In the first phase, a spray bottle with DSM 200 solution supplied with the SCUPP 2000 is sprayed into the air inlet of the hatch dome and all over the exterior of the hatch dome while the generator is operating. It will require approximately 1 quart of this solution for this phase.

**Phase 2** In the second phase, a person wearing a simple paper suit, gas mask, and rubber gloves does the following:

1. Open the hatch cover and turn the generator off.
2. Wait about one hour until the generator cools down.
3. A second quart of the DSM solution is then directly sprayed onto all areas inside the S.C.U.P.P. housing and generator.
4. Remove the air blower cover and spray all parts of the air blower.
5. Replace the air blower cover.
6. Remove the air filter and spray with DSM solution. Squeeze out all the moisture in the sponge air filter.
7. After a few minutes the generator can be turned on and the hatch cover closed.
8. The generator should operate with the access cover in place for 15 to 30 minutes to dry all surfaces.

# **S.C.U.P.P. 2000**

## **SELF-CONTAINED UNDERGROUND POWER PLANT**

### **Warranty**

RADIUS ENGINEERING INC. Guarantees that the fiberglass parts of the S.C.U.P.P. 2000 will not leak, corrode, or structurally fail for a period of 10 years provided that 1) the S.C.U.P.P. 2000 is not modified 2) the S.C.U.P.P. 2000 is properly inspected, off-loaded, and installed. 3) the S.C.U.P.P. 2000 is properly operated and maintained.

This warranty does not apply to the engine or generator. These items are covered by individual manufacturers. RADIUS ENGINEERING INC. reserves the right to change any specification without notice.

Our liability under this warranty shall be limited to, at our option, repair of the S.C.U.P.P. 2000, or delivery of a replacement unit to the point of original delivery, or refund of the original purchase price. We shall not be liable for any indirect or consequential damages, labor, or installation costs.

### **Installation Procedures**

1. **Check For Damage** (Inspect the S.C.U.P.P. 2000 for damage, which may have occurred during shipping. Report any indication of damage immediately to the shipper and Radius Engineering.
2. **Excavation-** (a) Stake out the corners of the hole and ditch to be excavated. The S.C.U.P.P. must be at least 20 feet away from any building. (b) Confirm the absence of power lines, gas lines, telephone lines, water pipes, sewer pipes, etc. (c) Excavate a hole that is 14 feet wide by 14 feet long and 10 feet deep. This hole usually requires approximately one hour to dig depending on the size of the excavator. (d) For the power lines from the generator, excavate a ditch that is 12 inches deep and as narrow as possible from the hole to the underground shelter and building.
3. **Pea Stone Bed-** (a) Build a bed of pea stone that is 6 inches deep on the floor of the excavated hole. (b) Check the height from the pea stone bed to the surface of the ground. The height should be 117 inches. The installation will require approximately 10 yards of pea stone including the pea stone bed.
4. **Off Loading Into Hole-** (a) Attach a chain sling that is at least 8 feet long through the lifting ears on the SCUPP unit. **DO NOT LIFT S.C.U.P.P. 2000 WITH FUEL IN THE TANK.** (b) Lower the S.C.U.P.P. 2000 into the hole and set on gravel bed.
5. **Leveling-** (a) Place a level across on the generator floor. (b) Shovel stone under the base of the tank until it is stable and level. (c) Check to make sure that the hatch dome is at or above the surrounding ground level.
6. **Backfill Base-**Continue to shovel stone under the base of the tank in 6-inch lifts or increments all around the tank. It is very important that there be no gaps or voids under the base of the S.C.U.P.P. 2000. Continue backfilling to the top of the fuel tank.
7. **Backfill-** (a) Continue to backfill the S.C.U.P.P. 2000 with pea stone in 6-inch increments evenly around the entire S.C.U.P.P. 2000 to within 6 inches of ground level. (b) Use the surrounding soil to backfill the last 6 inches and taper out so water drains away from the generator-housing ring.

## **S.C.U.P.P. 2000**

### **SELF-CONTAINED UNDERGROUND POWER PLANT**

- 8. Power Cable Connection-** The S.C.U.P.P. 2000 comes with two through hull pipe couplings through which one underground electrical cable is connected to the shelter and one is connected to a house or other equipment. Employ a licensed electrician to connect the power cable to the building main electrical line using a transfer switch (not supplied). This usually requires approximately two hours.