What You Need to Know About Generators. Is Your Waterworks Prepared?

Loss of electricity quickly becomes a major challenge during natural disasters and could raise public health concerns. Without backup power for an extended period, many water supply services cannot be provided. However, as demonstrated during incidents such as hurricanes and recent ice storms, not all waterworks are prepared to restore their systems to operational status in a timely manner. This brochure provides you information to better prepare for your emergency generator needs, provides tips on operating and maintaining generators, and includes an easy-to-copy form to determine and document backup power needs.

How do I know what my backup power needs are?

1. Classify the electrical needs at your waterworks:

- *Critical need.* Equipment essential to maintain public health protection (e.g., pumps).
- *Secondary need.* Equipment that would enhance operation, but is not critical (e.g., SCADA components).
- *Noncritical need.* Equipment provided for convenience/comfort, but not essential (e.g., pump house lights).

Only consider needs critical to maintaining an acceptable level of service during power outages at your utility.

2. Identify the electrical equipment within the critical needs at your waterworks and determine their voltage, phase configuration, and horsepower/amperage requirements. Remember, electrical equipment starting power demands are usually two to three times higher than their running demands, which may dictate a larger generator. A licensed electrician can provide assistance in determining your backup power needs.

3. List all your critical electrical equipment and their starting order to determine your required starting power. At a minimum, your generator(s) must have the capacity to supply the maximum starting power demands and the running demands of the connected equipment.

***4.* Determine** your generator needs. Make it easy by using the attached form.

"Having a backup generator is essential, but ours failed when we needed it most. It is critical to keep your generator maintained and to test it regularly under its operating load. Our lesson learned? Make sure you get to know your local emergency planners and have a plan for backup power."

Office of Drinking Water
Safe Drinking Water for a Healthy Virginia

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment
www.vdh.virginia.gov

What other considerations are there?

1. Fuel Type - Fuel type greatly influences emergency generator(s) selection. Diesel generators are the most common, and offer the largest selection, availability, and power range (from 5 kilowatts [kW] to over 2,000 kW). To select an appropriate fuel supply, consider:

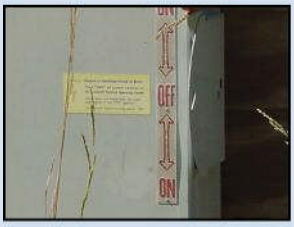
	Diesel[1]	Natural Gas[2]	Propane[3]	Gasoline
Fuel Storage	+	+	+	-
Fuel Delivery Method	-	+	-	-
Generator Availability	+	-	-	+
Generator Portability	-	-	-	+

[1]Assume a consumption rate of 0.07 gallons per hour for every 1kW of power generated.
[2] Assumes access to a natural gas supply.
[3] Can use propane as a backup fuel, but requires an adapter. Use the generator specification sheet to calculate expected runtime for a given load and propane tank capacity.

Also check any local or state regulations regarding air quality, as these may affect the generator(s) selection.

2. Hook-Up Method - Generators do not simply plug into a piece of equipment that you would like to power. You have to install a connection that will enable you to rapidly hook up the generator to your well or sewer lift station pumps, and not accidently "backfeed" electricity into utility company lines, which could electrocute a line worker. Connection methods include transfer switches and camlocks.

Transfer switches can be either automatic or manual, and will let you easily switch back and forth between commercial and generator power sources. These switches are typically installed close to your main breaker box.



Transfer Switch

Camlocks are connectors that can be used to connect a generator directly to a critical piece of equipment, such as a pump at a wellhead or lift station.


Camlock

You will need a licensed electrician to help you determine which method is best for you and to assist with installation. A licensed electrician can also help you size the connector and ground cables.

3. Location - Emergency generators must be able to withstand climate extremes and be able to operate under all conditions. Things to consider when locating a backup generator include:

Environmental considerations

It is important to prevent source and finished water contamination by fuel, so check state requirements, such as containment measures. Also generators and their fuel storage tanks must be located above potential floodwater levels. Generators should also be protected by using a weatherproof enclosure. Check with your locality for other requirements and the Department of Environment Quality on emissions.

Site Selection

A flat surface (e.g., concrete slab) without obstacles is needed for a portable generator. In addition, be sure that the generator is in a well-lit and secured area to allow servicing at night and to deter theft and vandalism.

4. Other Options - For added flexibility, consider a variable frequency drive (VFD). The VFD is easy to operate, can convert single-phase power from small generators to three-phase power, and can supply power under a variety of horsepower demands.

Small, portable generators that can be used with a VFD are readily available from the nearest hardware supplier. Consult a licensed electrician to learn if a VFD is right for your waterworks.


VFD mounted in box

Should I purchase, rent, borrow, or share?

Many factors affect the decision to buy, rent, borrow, or share a generator(s). Funding, maintenance requirements, rental availability, and mutual aid and assistance agreements should all be considered. If you are sharing, who gets the generator first? It is probably easiest to make the decision by considering the advantages and disadvantages of having a generator onsite (purchase) versus obtaining a generator offsite (rent, borrow, or share).

The tables shown here highlight some of the advantages and disadvantages of each option.

Onsite Generator (Purchase)	
Advantages	***Disadvantages***
Immediate start-up during a power failure, as it's already at your utility and ready to go	Up-front capital investment could be costly
You are familiar with the generator and its operation	Long-term maintenance is required
Can be any size	A disaster that damages your plant may also damage your generator

Offsite Generator (Rent/Borrow/Share)	
Advantages	***Disadvantages***
No large up-front capital cost if rented, or, if purchase cost shared with other utilities	Travel time delays to get generator to your site, especially if roads are impassable
Flexibility in where you get it from, could have multiple sources	May require special equipment (e.g., crane) and extra personnel (e.g., electrician) to install
Shared (or no) long-term maintenance costs	In a large incident, may be hard to locate a generator due to competing demands

Unique circumstances at your utility will ultimately determine whether purchasing, renting, borrowing, or sharing a generator will work best. Regardless, once you have determined your backup power needs, you should communicate those needs to your Local Emergency Planning Committee (LEPC)/Local Emergency Management Agency (LEMA) or emergency management director. This allows them to be aware of the generator resources that you already have (if any) and what generator resources you will need during a power outage and any possible **public** health impacts related to power loss.

Operation and Maintenance Tips

- Exercise your generator periodically under the actual electrical load required of the unit to keep it ready for use;
- Develop a "start and connect" checklist specific to each individual generator and keep it where staff can easily find it;
- Do not operate the generator in excess of its rated capacity;
- Be sure the generator is properly grounded; see OSHA fact sheet on grounding at http://www.osha.gov/OshDoc/data_Hurricane_Facts/grounding_port_generator.pdf
- Keep portable generators outside and at least 10 feet away and downwind from inhabited, enclosed areas to prevent the buildup of carbon monoxide fumes;
- Maintain 3 to 4 feet of clear space on all sides and above a generator for adequate ventilation;
- Perform scheduled maintenance as recommended by the generator manufacturer;
- Incorporate fuel management into the maintenance schedule to ensure availability of clean, reliable fuel;
- Do not refuel the generator while it is running, turn it off first and let it cool, especially if the generator uses gasoline;
- Keep the generator dry by keeping it elevated and away from possible flooding;
- Support electrical cords off the ground and do not let cords run through low-lying areas or puddles;
- Replace any cords with damaged insulation;
- Train all staff on how to operate the generator safely; and
- Wear hearing protection if you have to work close to a generator.

Where can I go to find out more about generators?

Emergency Response Portal, U.S. Army Corps of Engineers (USACE) https://eportal.usace.army.mil/sites/ENGLink/EmergencyPower/default.aspx	Information sharing tool to build federal, state and local capabilities to respond to disasters. Contains links to documents on Standard Operating Procedures of the Temporary Emergency Power Mission
Electrical Generating Systems Association (EGSA) http://www.egsa.org/Home.aspx	Association dedicated to on-site power generation that includes over 500 companies that make, sell, distribute, and use onsite power generation technology and equipment.
Water & Wastewater Mutual Aid & Assistance Resource Typing Manual www.nationalwarn.org	This manual provides guidance to water and wastewater utilities when they request and provide mutual aid and assistance resources (such as generators) during and after an emergency.
CDC Worker Safety in a Power Outage http://www.bt.cdc.gov/disasters/poweroutage/workersafety.asp	This site discusses worker safety for the emergency use of generators during a power outage discussing the dangers of backfeed to workers on site and people in neighboring buildings.
FlaWARN Best Management Practices For Water and Wastewater Systems http://www.flawarn.org/resources/uploads/public/Documents/BMPs.pdf	Guidance document produced by the Florida WARN including Best Management Practices for water facility emergency preparedness and response.

"When the power went out, we couldn't pump and pressurize our system. But we are a small utility, and can't afford a generator. We joined the WARN as one way to locate a generator the next time we need one

Whom should I contact?

Call your consulting engineer or licensed electrician if you have specific questions regarding a generator(s) at your waterworks. Each waterworks is unique in its critical treatment processes and its design, and you will want your own experts to help you answer any questions you may have regarding backup power generation.

TIP: Joining the Virginia Water/ Wastewater Agency Response Network (VA WARN) is one great way to borrow or share generators.

www.vawarn.org

TIP: Joining into a Mutual Aid Agreement with neighboring waterworks or jurisdictions is another way to borrow or share generators.

EMERGENCY GENERATOR INFORMATION FORM – Side 1 (complete prior to an emergency)

Instructions

- Get a licensed electrician to help complete this form.
- Fill out a copy of the form for each generator location.
- Store copy in multiple safe places (EMP, ERP, truck, offsite file).
- Share the form with your LEPC or LEMA, VA WARN and mutual aid partner(s).
- Update form periodically.

Contact Information

Name: _____

Title: _____

Day Phone: _____

Cell Phone: _____

Emer Phone: _____

E-mail: _____

Waterworks Name: _____ PWSID: VA _____

Street Address _____ _____ City: _____ Zip: _____

Max Daily Demand _____ (*) Avg. Daily Demand _____ (*)

** Specify units: Million Gallons per Day or Gallons per Day*

Critical Utility Electrical Needs: (copy form as necessary for each location)

Location (Name/#): _____

Location (Name/#): _____

Location (Name/#): _____

Generator Needs: (copy form as necessary for each location)

Location (Name/#): _____

Existing transfer switch: ☐ Yes ☐ No Existing 'add-a-phase' or 'roto-phase' unit: ☐ Yes ☐ No

(These units convert a single phase line to a three-phase line)

Size of electrical main breaker: _____ Amps

System Voltage: ☐ 240 volt single phase ☐ 240 volt three phase ☐ 208 volt three phase ☐ 480 volt three phase

Major motors, in starting order, used for facility operations: (example: 75 HP 2 Quantity 460 Volts 3 Phase)

_____ HP _____ Each _____ Volts _____ Phase

_____ HP _____ Each _____ Volts _____ Phase

_____ HP _____ Each _____ Volts _____ Phase

_____ HP _____ Each _____ Volts _____ Phase

Note: at a minimum, a generator must have capacity to supply maximum starting power demands and running demands of connected electrical equipment.

Existing concrete pad to locate generator? ☐ Yes ☐ No Distance of pad to connection point (ft): _____

Off loading capabilities? ☐ Yes ☐ No System meter kilowatt reading: _____

Generator Type (from AWWA Water & Wastewater Mutual Aid & Assistance Resource Typing Manual: _____

http://www.awwa.org/files/WARN/AWWA%20Resource%20Typing%20Manual%20Final%20-%20April%202,%202008.pdf)

Additional comments: _____

Existing Generators: (copy side 2 of form as necessary for each existing generator)

On-site generator location (name/#): _____

Is on-site generator portable? ☐ Yes ☐ No

Existing transfer switch: ☐ Yes ☐ No AND, if yes, is switch manual? ☐ or automatic? ☐ If automatic, what brand is the switch and how many wires are required to start? _____

Size of generator: _____ kilo Volt Amperes (kVA) _____ Kilowatts (kW)

Configuration: (Wye or Delta): _____ (A Wye configuration is in the shape of a "Y"; a Delta configuration is in the shape of the Greek letter delta "Δ", a triangle)

Load cable length: _____ (ft) Required Load: _____ [refer to National Electric Code]

Cable size: _____ Thousand Circular Mils (MCM) or _____ American Wire Guage (AWG)

Ground cable length: _____ (ft) Ground cable size: _____ ☐ MCM ☐ AWG

Generator connection point: _____ Fuel tank size:

Fuel type: ☐ diesel ☐ natural gas ☐ propane gas ☐ gasoline ☐ other: _____

Fuel available on-site? ☐ Yes ☐ No If yes, how much? _____ ☐ gals ☐ lbs How is fuel stored? _____

_____ Is liquid fuel tank double walled? ☐ Yes ☐ No If No, is there full capacity containment for fuel leak? ☐ Yes ☐ No If Yes, is there a leak detection alarm? ☐ Yes ☐ No

Is liquid fuel line to generator above ground? ☐ Yes ☐ No If underground, is fuel line in a casing? ☐ Yes ☐ No

Is liquid fuel storage at least 50 ft from nearest well? ☐ Yes ☐ No Is there a refueling pad? ☐ Yes ☐ No

What is the testing cycle and last test date? _____

Does utility have access to an electrician? ☐ Yes ☐ No Number of onsite power utility transformers: _____

Transformer size(s) painted on front of the unit(s): _____ kVA _____ kVA _____ kVA _____ kVA

Generator Type (from AWWA Water & Wastewater Mutual Aid & Assistance Resource Typing Manual: _____

http://www.awwa.org/files/WARN/AWWA%20Resource%20Typing%20Manual%20Final%20-%20April%202,%202008.pdf)

Does waterworks belong to VA WARN /mutual aid agreement and has access to member resources? ☐ Yes ☐ No

If waterworks facility has another source of off-site generator(s) available for use in an emergency, what is the source/location of the generator(s)?

Site location /source name : _____

Site location /source name: _____

Site location /source name :; _____

Additional comments _____

_____

: _____

_____