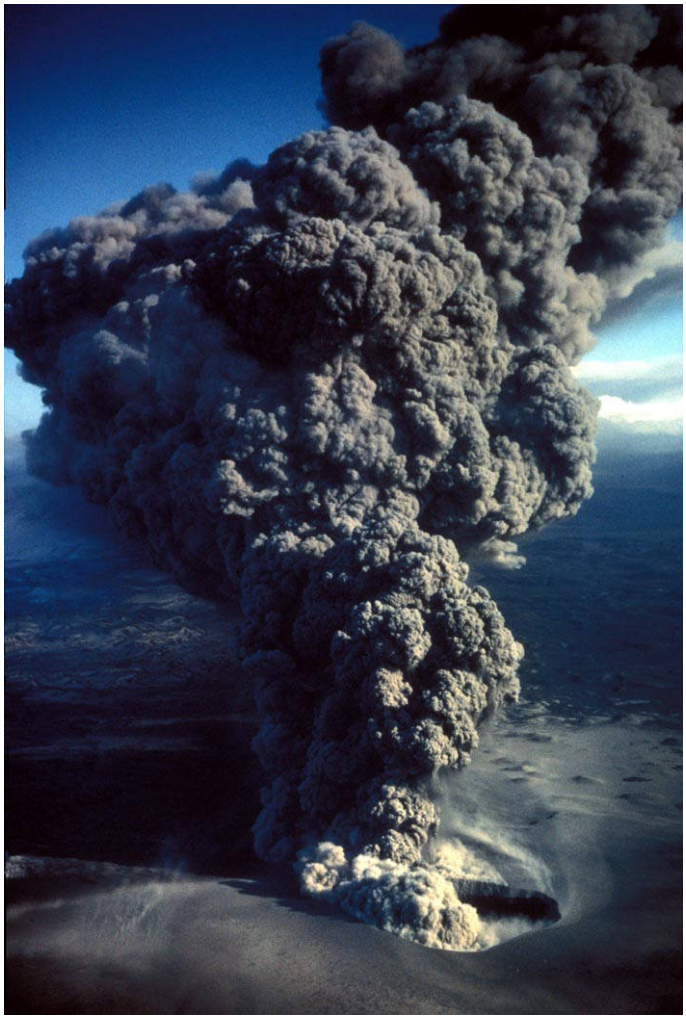
Incident Action Checklist – Volcanic Activity

The actions in this checklist are divided up into three "rip & run" sections and are examples of activities that water and wastewater utilities can take to: prepare for, respond to and recover from volcanic activity. For on-the-go convenience, you can also populate the "My Contacts" section with critical information that your utility may need during an incident.

Volcanic Activity Impacts on Water and Wastewater Utilities

More than 50 volcanoes in the United States have erupted one or more times in the past 200 years. Volcanic activity such as the ejection or flow of materials following eruptions, volcanic ash and potential tsunamis from eruptions near coastlines can endanger the lives of people and property. Volcanic activity can significantly impact drinking water and wastewater utilities, causing impacts that may include, but are not limited to:

- Utility infrastructure damage due to lava flow, debris flow and landslides
- Potential source water contamination by leachates (Over 55 soluble components have been detected in volcanic ash; those occurring at the highest concentrations are sodium, calcium, magnesium, chloride, sulphate and fluoride)
- Impacts related to volcanic ash and smog, which often covers a very large area following an eruption, may include:
  - Increased turbidity and acidity in source water and wastewater effluent (most water quality changes occur over a one-week time period following an eruption)
  - Damage to utility equipment, including pumping stations and vehicles (which may result in difficulty getting to work sites or customers)
  - Clogged or damaged filters that could disrupt service and air-filtration systems, causing engines to overheat and potentially fail
  - Reduced or halted oxidation process in secondary treatment of wastewater systems until the ash settles or is removed
  - Water shortages due to high usage for ash removal and cleanup
  - Limited communication capabilities, due to downed antennas or ash-covered satellite dishes



USGS

The following sections outline actions water and wastewater utilities can take to prepare for, respond to and recover from volcanic activity.

Example of Water Sector Impacts and Response to Volcanic Activity

1980 Mount St. Helens Eruption

The nine hour explosive eruption of Mount St. Helens in Washington State on May 18, 1980, spread volcanic ash over an area of 22,000 miles. The following examples represent impacts to and responses from drinking water and wastewater utilities in the area.

Drinking Water

The 1980 eruption of Mount St. Helens produced significant hydrologic and water quality effects in areas affected by ash fall. Ash contamination produced problems for a number of communities with excessive pH and turbidity levels reported in surface source water. Samples of ash were found to contain 0.25% water-soluble salts, mainly as sulphates and chlorides in the form of sodium salts. In laboratory experiments, distilled water became acidic when placed in contact with fresh ash but returned to normal pH within hours. No excessive chemical concentrations were found in the finished water supply in the ash-affected areas.

Increased water demand for ash cleanup was experienced in many ash affected communities. For example, in Ellensburg, Washington, demand during the first four days exceeded average demand 2.5 times.

Wastewater

Yakima, Washington, which is located 90 miles east of Mount St. Helens, received nearly half an inch of volcanic ash from the eruption, causing the sewage treatment facility to remove about 15 times the usual amount of solid matter in their pre-treatment processes. Ash was also observed in the raw sludge in the primary clarifiers. Two days after the eruption, strains on facility equipment from treatment of excessive ash were evident, such as vibrations in the grit classifier and in the gearbox of the mechanically cleaned bar screen. Additionally, raw sludge lines began to plug and pumping operations became difficult. Three days after the eruption, treatment facility equipment began to fail and shutdowns occurred.

In response, treatment facility personnel began conducting regular testing of the influent to determine when ash content was low enough to be handled by the plant. During the shutdown, lines and equipment were assessed, cleaned and readied for service. Primary treatment resumed one week following the eruption. Total damages were estimated at $4 million.

Source: USGS, "Volcanic Ash: Effects & Mitigation Strategies."

USGS

My Contacts and Resources

CONTACT NAME	UTILITY/ORGANIZATION NAME	PHONE NUMBER
	Local EMA	
	State EMA	
	State Primacy Agency	
	WARN Chair	
	Power Utility	

Planning

- Incident monitoring:
  - Current Volcanic Ash Advisories (National Oceanic and Atmospheric Administration [NOAA])
  - U.S. Volcanoes and Current Activity Alerts (U.S. Geological Survey [USGS])
  - Lahar Detection Systems (USGS)
- National Geophysical Data Center Volcano Data and Information (NOAA)
- Volcanic Ash Fall – A "Hard Rain" of Abrasive Particles (USGS)
- What are Volcano Hazards? Fact Sheet (USGS)
- Planning for an Emergency Drinking Water Supply (EPA)
- All-Hazard Consequence Management Planning for the Water Sector (Water Sector Emergency Response Critical Infrastructure Partnership Advisory Council [CIPAC] Workgroup)
- Vulnerability Self Assessment Tool (VSAT) (EPA)
- Preparing for Extreme Weather Events: Workshop Planner for the Water Sector (EPA)
- Tabletop Exercise Tool for Water Systems: Emergency Preparedness, Response, and Climate Resiliency (EPA)
- How to Develop a Multi-Year Training and Exercise (T&E) Plan (EPA)

Coordination

- Water/Wastewater Agency Response Network (WARN) (EPA)
- Community Based Water Resiliency (EPA)

Facility and Service Area

- Volcanic Ash: Effects and Mitigation Strategies for Water Supply (USGS)
- Volcanic Ash: Effects and Mitigation Strategies for Wastewater (USGS)
- Volcanic Ash Impacts on Critical Infrastructure (Wilson, 2011)

Power, Energy and Fuel

- EPA Region 1 Water/Wastewater System Generator Preparedness Brochure (EPA)

Documentation and Reporting

- Federal Funding for Utilities In National Disasters (Fed FUNDS) (EPA)

Actions to Prepare for Volcanic Activity

Planning

- [ ] Review and update your utility's emergency response plan (ERP), and ensure all emergency contacts are current.
- [ ] Conduct briefings, training and exercises to ensure utility staff is aware of all preparedness, response and recovery procedures.
- [ ] Identify priority water customers (e.g., hospitals), obtain their contact information, map their locations and develop a plan to restore those customers first.
- [ ] Develop an emergency drinking water supply plan and establish contacts (potentially through your local emergency management agency [EMA] or mutual aid network) to discuss procedures, which may include bulk water hauling, mobile treatment units or temporary supply lines, as well as storage and distribution.
- [ ] Conduct a hazard vulnerability analysis in which you review historical records to understand the past frequency and intensity of volcanic activity and how your utility may have been impacted. Consider taking actions to mitigate volcano impacts to the utility, including those provided in the "Actions to Recover from Volcanic Activity: Mitigation" section.
- [ ] Complete pre-disaster activities to help apply for federal disaster funding (e.g., contact state/local officials with connections to funding, set up a system to document damage and costs, take photographs of the facility for comparison to post-damage photographs).

Coordination

- [ ] Join your state's Water/Wastewater Agency Response Network (WARN) or other local mutual aid network.
- [ ] Coordinate with WARN members and other neighboring utilities to discuss:
  - Outlining response activities, roles and responsibilities and mutual aid procedures (e.g., how to request and offer assistance)
  - Conducting joint tabletop or full-scale exercises
  - Obtaining resources and assistance, such as equipment, personnel, technical support or water
  - Establishing interconnections between systems and agreements with necessary approvals to activate this alternate source. Equipment, pumping rates and demand on the water sources need to be considered and addressed in the design and operations
  - Establishing communication protocols and equipment to reduce misunderstandings during the incident
- [ ] Coordinate with other key response partners, such as your local EMA, to discuss:
  - How restoring system operations may have higher priority than establishing an alternative water source
  - Potential points of distribution for the delivery of emergency water supply (e.g., bottled water) to the public, as well as who is responsible for distributing the water
- [ ] Understand how the local and utility emergency operations center (EOC) will be activated and what your utility may be called on to do, as well as how local emergency responders and the local EOC can support your utility during a response. If your utility has assets outside of the county EMA's jurisdiction, consider coordination or preparedness efforts that should be done in those areas.
- [ ] Ensure credentials to allow access will be valid during an incident by checking with local law enforcement.
- [ ] Sign up for mobile and/or email alerts from your local EMA, if available.

Actions to Prepare for Volcanic Activity *(continued)*

Communication with Customers

- [ ] Develop outreach materials to provide your customers with information they will need during and following a volcanic eruption (e.g., clarification about water advisories, instructions on how to properly clear their property of ash).
- [ ] Review public information protocols with local EMA and public health/primacy agencies. These protocols should include developing water advisory messages (e.g., boil water) and distributing them to customers using appropriate mechanisms, such as reverse 911.

Facility and Service Area

- [ ] Inventory and order extra equipment and supplies, as needed:
  - Motors
  - Fuses
  - Chemicals (ensure at least a two week supply)
  - Cellular phones or other wireless communications device
  - Emergency Supplies
    - Tarps/tape/rope
    - Cots/blankets
    - First aid kits
    - Foul weather gear
    - Plywood
    - Flashlights/flares
    - Sandbags (often, sand must be ordered as well)
    - Bottled water
    - Batteries
    - Non-perishable food
- [ ] Ensure communication equipment (e.g., radios, satellite phones) works and is fully charged.
- [ ] Develop a GIS map of all system components and prepare a list of coordinates for each facility.
- [ ] Document pumping requirements and storage capabilities, as well as critical treatment components and parameters.

Personnel

- [ ] Identify essential personnel and ensure they are trained to perform critical duties in an emergency (and possibly without communication), including the shut down and start up of the system.
- [ ] Establish communication procedures with essential and non-essential personnel. Ensure all personnel are familiar with emergency evacuation and shelter in place procedures.
- [ ] Pre-identify emergency operations and clean-up crews. Establish alternative transportation strategies if roads are impassable.
- [ ] Consider how evacuations or limited staffing due to transportation issues (potentially all utility personnel) will impact your response procedures.
- [ ] Identify possible staging areas for mutual aid crews if needed in the response, and the availability of local facilities to house the crews.

Actions to Prepare for Volcanic Activity *(continued)*

Power, Energy and Fuel

- [ ] Evaluate condition of electrical panels to accept generators; inspect connections and switches.

- [ ] Document power requirements of the facility; options for doing this may include:
  - Placing a request with the US Army Corps of Engineers 249th Engineer Battalion (Prime Power): http://www.usace.army.mil/249thEngineerBattalion.aspx
  - Using the US Army Corps of Engineers on-line Emergency Power Facility Assessment Tool (EPFAT): http://epfat.swf.usace.army.mil/

- [ ] Confirm and document generator connection type, capacity load and fuel consumption. Test regularly, exercise under load and service backup generators.

- [ ] Fill fuel tanks to full capacity and ensure that you have the ability to manually pump gas in the event of a power outage. Ensure this equipment and other hazardous materials are located in a safe zone.

- [ ] Contact fuel vendors and inform them of estimated fuel volumes needed if utility is impacted. Determine your ability to establish emergency contract provisions with vendors and your ability to transport fuel if re-fueling contractors are not available. Develop a backup fueling plan and a prioritization list of which generators to fuel in case of a fuel shortage.

- [ ] Collaborate with your local power provider and EOC to ensure that your water utility is on the critical facilities list for priority electrical power restoration, generators and emergency fuel.

NOAA

Notes:

Actions to Respond to Volcanic Activity: Pre-Eruption Activities

Planning

- [ ] Volcanic activity is known to trigger earthquakes; review the Earthquake Incident Action Checklist for more information on how to respond to an earthquake.

Communication with Customers

- [ ] Instruct customers to disconnect stormwater gutters and downspouts until ash is removed from roofs of homes and buildings to reduce adverse effects on the stormwater system.

Facility and Service Area

- [ ] Cover all critical external equipment with plastic.
- [ ] Shut down all equipment not absolutely required, such as biofilters and ventilation equipment.
- [ ] Grease everything subject to a dusty atmosphere and used to pump gritty material.

FEMA

Notes:

Actions to Respond to Volcanic Activity: Post-Eruption Activities

Coordination

- [ ] Notify your local EMA and state regulatory/primacy agency of system status.
- [ ] Identify lab capacity for increased sampling requirements, due to suspected maximum contaminant level exceedance.
- [ ] If needed, request or offer assistance (e.g., water buffalos, water sampling teams, generators) through mutual aid networks, such as WARN.
- [ ] Assign a representative of the utility to the incident command post or the community's EOC.

Communication with Customers

- [ ] Notify customers of any water advisories and consider collaborating with local media (television, radio, newspaper, etc.) to distribute the message. If emergency water is being supplied, provide information on the distribution locations.
- [ ] Wastewater utilities should alert the public about the potential consequences to the treatment plant should ash be introduced into the sewer system; instruct customers where to deposit ash cleared from their property.

Facility and Service Area

Overall

- [ ] Conduct damage assessments of the utility to prioritize repairs and other actions.
- [ ] Check that back-up equipment and facility systems, such as controls and pumps, are in working order, and ensure that chemical containers and feeders are intact.
- [ ] Monitor source water and wastewater effluent quality (e.g., pH, turbidity; suspended solids), develop a sampling plan and adjust treatment as necessary.
- [ ] Monitor all processes for introduction of grit and ash; ensure an adequate supply of extra parts and filters due to potential clogging and damage from ash.
- [ ] Use dry methods, like hand sweeping, to clear streets and parking areas of ash prior to cleaning with water.
- [ ] When possible, disconnect downspouts from residential and commercial building roofs until ash is removed in order to minimize ash discharge into the stormwater system.

Drinking Water Utilities: Surface Water Systems

- [ ] Notify regulatory/primacy agency if operations and/or water quality or quantity are affected.
- [ ] Utilize pre-established emergency connections or setup temporary connections to nearby communities, as needed. Alternatively, implement plans to draw emergency water from pre-determined tanks or hydrants. Notify employees of the activated sites.

Wastewater Utilities

- [ ] Pump all grit and ash into one digester until conditions improve (i.e., ash settles or is removed), then properly dispose of in accordance with state requirements.
- [ ] Place all pre-treatment equipment into operation and adjust for maximum removal rates.
- [ ] Place all primary clarifiers into operation and increase pumping rates.
- [ ] Monitor torque or current on all motor-driven devices, as volcanic ash and grit accumulations can cause equipment and operational failures.
- [ ] Filter or change out gear, lube weekly and flush with solvents recommended by the manufacturer.

Actions to Respond to Volcanic Activity: Post-Eruption Activities
(continued)

- [ ] Place sandbags around or over manhole covers when hosing streets to clear ash and prevent it from entering the collection system.
- [ ] Notify regulatory/primacy agency of any changes to the operations or required testing parameters.

Documentation and Reporting

- [ ] Document all damage assessments, mutual aid requests, emergency repair work, equipment used, purchases made, staff hours worked and contractors used during the response to assist in requesting reimbursement and applying for federal disaster funds. When possible, take photographs of damage at each work site (with time and date stamp). Proper documentation is critical to requesting reimbursement.
- [ ] Work with your local EMA on the required paperwork for public assistance requests.

Personnel

- [ ] Account for all personnel and provide emergency care, if needed. Caution personnel about known hazards resulting from volcanic activity.
- [ ] Deploy emergency operations and clean-up crews. Identify key access points and roads for employees to enter the utility and critical infrastructure; coordinate the need for debris clearance with local emergency management or prioritize it for employee operations.

Power, Energy and Fuel

- [ ] Use backup generators, as needed, to supply power to system components.
- [ ] Monitor and plan for additional fuel needs in advance; coordinate fuel deliveries to the generators.
- [ ] Maintain contact with electric provider for power outage duration estimates.

Notes:

Actions to Recover from Volcanic Activity

Coordination

- [ ] Continue work with response partners to obtain funding, equipment, etc.

Communication with Customers

- [ ] Assign a utility representative to continue to communicate with customers concerning a timeline for recovery and other pertinent information.

Facility and Service Area

- [ ] Complete damage assessments.
- [ ] Complete permanent repairs, replace depleted supplies and return to normal service.

USGS

Documentation and Reporting

- [ ] Compile damage assessment forms and cost documentation into a single report to facilitate the sharing of information and the completion of state and federal funding applications. Visit EPA's web-based tool, Federal Funding for Utilities—Water/Wastewater—in National Disasters (Fed FUNDS), for tailored information and application forms for various federal disaster funding programs: http://water.epa.gov/infrastructure/watersecurity/funding/fedfunds/
- [ ] Develop a lessons learned document and/or an after action report to keep a record of your response activities. Update your vulnerability assessment, ERP and contingency plans.
- [ ] Revise budget and asset management plans to address increased costs from response-related activities.

Mitigation

- [ ] Identify mitigation and long-term adaptation measures that can prevent damage and increase utility resilience to volcanoes (e.g., identify areas where lava flows could impact your area, inquire about lahar detection systems [More information about lahar detection systems can be found in the USGS references]).

Notes: