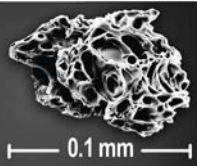


Volcanic ash is:



<2mm (0.1 in) diameter, hard, abrasive and corrosive, and conductive if wet

VOLCANIC ASHFALL

ADVICE FOR: WATER TREATMENT PLANT MANAGERS

ASH IMPACTS ON DRINKING WATER TREATMENT

Volcanic ashfall can:

- Increase turbidity in raw water sources.
- Create high water demand during the clean-up phase.
- Cause operational problems for water treatment plants.

EFFECTS ON RAW WATER SOURCES

In general, the major effect of ashfall on raw water sources is likely to be increased turbidity rather than changes in chemical composition.

TURBIDITY
Ash suspended in water will increase turbidity in raw water sources. Very fine ash may settle slowly and residual turbidity may remain in standing water bodies. In streams, ash may continue to be remobilized by rainfall events, and lahars may be a hazard in some regions.

ACIDITY
Fresh ashfall commonly has a strongly acidic surface coating. This may cause a slight depression of pH (not usually beyond pH 6.5) in low-alkalinity surface waters.

POTENTIALLY TOXIC ELEMENTS
Fresh ash has a surface coating of soluble salts that are rapidly released on contact with water. The most abundant soluble elements are typically Ca, Na, S and Cl, followed by Mg, K, Al, Si, Fe and F. Compositional changes depend on the ash surface chemistry, the amount of ashfall and the dilution volume.

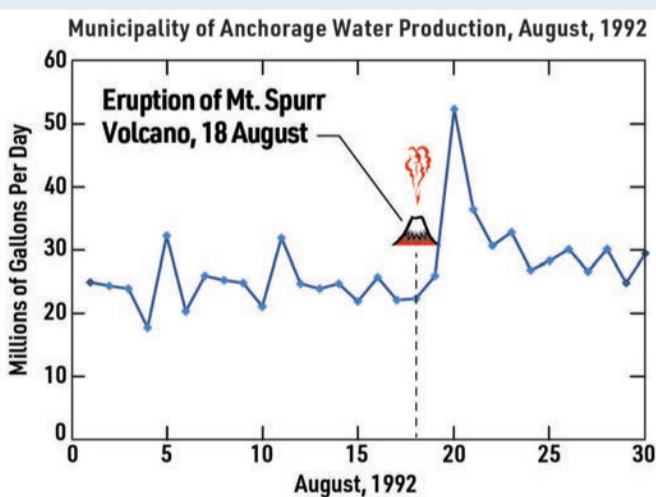
- In streams, there will be a short-lived pulse of dissolved constituents.
- In lakes and reservoirs, the volume of dilution is usually large enough that compositional changes are not discernible.

The constituents most likely to be elevated above background levels are Fe, Mn and Al. Thus water is likely to be come unpalatable due to discoloration or a metallic taste before it becomes a health hazards.

WATER DEMAND

High demand for water typically occurs after an ashfall during the clean-up phase.

Demand may remain high for months afterwards if water is needed for cleaning and to dampen down wind-remobilized ash.



The 18 August 1992 eruption of Mt. Spurr volcano, Alaska, deposited around 3 mm (0.1 in) of sand-sized volcanic ash on the city of Anchorage. The population used mostly wet methods to clean up the ash which doubled normal water demand. While the city had adequate water production capacity to meet this demand, bottlenecks in the distribution system caused reduced water pressure across the whole city, and parts of the city experienced water outages and inadequate supply to fire hydrants. This incident prompted a major upgrade of the city's water distribution network.

EFFECTS ON TREATMENT PLANTS

Volcanic ash can cause a range of operational problems for water treatment plants:

- Ash suspended in surface water sources can cause turbidity levels to exceed operating thresholds.
- Pumps used for extracting surface waters may be vulnerable to accelerated wear and tear damage to impellers and motors.
- Uncovered pump motors used for extracting groundwater may be vulnerable to airborne ash.
- Ash can enter open-air clarifiers and sand filters both by direct airfall and through intake.
- Fine ash may penetrate into sand filters; coarser ash may form a cap on sand filters.
- An ashfall may affect road transport, which may in turn affect staff access and deliveries of treatment chemicals.
- In general, a high level of increased maintenance may be expected following ashfall. The most common reasons for interruptions to water production following ashfall are:
 - » The need to close intakes due to high turbidity levels.
 - » Electrical power outages, if there is no back-up generation.

Ash at Bariloche water treatment plant, Argentina.



Ash entered open air sand filters, both by direct airfall and through intakes, following the 2011 eruption of Cordón Caulle volcano, Chile, which deposited 30–45 mm (1.2–1.8 in) of ash in the city. Cleaning of filter beds created additional labour demands. Photo by Departamento Provincial de Agua, Bariloche.

Correntoso Lake in Villa la Angostura, Argentina.



Water was pumped from an intake on the lake 80 meters (87 yd) uphill to a treatment plant using pressure filtration. The 2011 eruption of Cordón Caulle volcano in Chile deposited (170 mm/6.7 in) of ash in the area. The treatment plant kept operating but there was major wear and tear on the pumping equipment due to the high levels of suspended solids in the lake. Photo by Carol Stewart.

RECOMMENDED ACTIONS

WHERE TO FIND HAZARD & WARNING INFORMATION

Refer to the website of your local volcano observatory, national weather service and/or disaster management agency for warnings of ashfall.

HOW TO PREPARE

Operational plans should be developed well in advance for infrastructure at risk from volcanic ashfall.

- Coordinate plans with emergency management groups, scientists, and infrastructure providers.
- For plants at risk from ashfall, strategies to reduce vulnerability to ashfall include: installing automatic shutdown of intakes based on a turbidity threshold; covering open-air sand filters; and increasing treated water storage volume.
- Anticipate increased maintenance schedule; review stocks of essential items.
- Ensure access to back-up power generation.

HOW TO RESPOND

Take precautions to exclude ash from treatment plants:

- Close intake before turbidity levels become excessive.
- If necessary, adjust coagulant dosage to attempt to achieve satisfactory turbidity reduction.
- Consider installing temporary covers such as tarpaulins over open-air sand filters.
- Protect other exposed equipment such as electrical control panels and pumps.
- Ensure that staff working outdoors are supplied with adequate personal protective equipment (long-sleeved clothing, heavy footwear, fitted goggles and properly-fitted P2, N95 or FFP2 dust masks). Masks should be changed when clogged.
- If industry-certified masks are not available, other masks may provide partial protection. For more information: <https://www.ivhnn.org/index.php/ash-protection>
- In addition to the routine monitoring undertaken for compliance purposes, carry out more frequent checks on turbidity, pH and chlorine residuals in the distribution network. If necessary adjust chlorine dosing.
- Anticipate increased water demand following an ashfall. Where possible, use alternative non-potable sources of water for clean-up and firefighting. Do not use recycled wastewater (e.g. treated effluent) for these purposes. Encourage clean-up using brooms and shovels (with appropriate PPE) rather than hoses. Advise the public to practice water conservation.
 - » Be aware of the possibility of pH depression in low-alkalinity surface water sources and adjust any pH-sensitive treatment steps as required. Remind consumers of the need to flush their taps briefly before drawing water.
- Public anxiety about contamination of water supplies is common after a volcanic eruption. Refer concerns to the public health agency.

• FURTHER RESOURCES •

https://volcanoes.usgs.gov/volcanic_ash/water_supply.html
www.ivhnn.org (volcanic health hazards information)

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