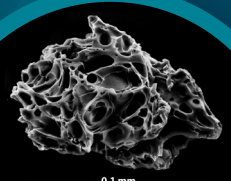


VOLCANIC ASH IS: HARD, HIGHLY ABRASIVE, MILDLY CORROSIVE & CONDUCTIVE WHEN WET.

VOLCANIC ASHFALL

ADVICE FOR **WATER SUPPLY MANAGERS**

Ash Impacts On Drinking Water Treatment

A VOLCANIC ASHFALL CAN:

- Increase turbidity in raw water sources.
- Create high water demand during the cleanup 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.

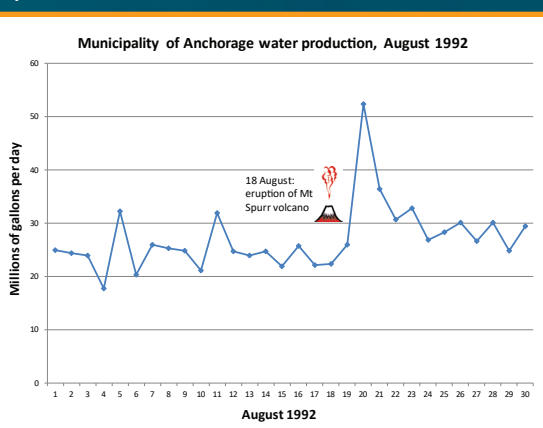
Effects of ashfall on raw water quality

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 remobilised 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 become unpalatable due to discolouration or a metallic taste before it becomes a health hazard.

Water Demand

HIGH DEMAND FOR WATER TYPICALLY OCCURS AFTER AN ASHFALL DURING THE CLEANUP PHASE.

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



The 18 August 1992 eruption of Mt Spurr volcano, Alaska, deposited around 3 mm 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.

Recommended Actions

WHERE TO FIND WARNING INFORMATION

See **www.geonet.org.nz** for ashfall forecasts in the event of a volcanic eruption.

HOW TO PREPARE

At-risk water treatment plants should ensure that their Water Safety Plans include provision for ashfall events, including site clean-up. The plan should have procedures for incorporating up-to-date ash fall forecast information from GeoNet into operational decisions.

For at-risk plants, 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 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 rather than hoses. Advise the public to practice water conservation.

Anticipate increased maintenance schedule; review stocks of essential items.

Ensure access to back-up power generation.

HOW TO RESPOND

Take precautions to exclude ash:

- 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 or N95 dust masks).

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.

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 Drinking-Water Assessor at the Public Health Unit of your local DHB.

FURTHER RESOURCES:

http://www.geonet.org.nz (volcano monitoring information)

http://www.gns.cri.nz/volcano (general information on volcanic hazards)

http://volcanoes.usgs.gov/volcanic_ash (volcanic ash impacts and mitigation encyclopedia)

http://www.ivhhn.org (information on volcanic health hazards)

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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 abstracting surface waters may be vulnerable to accelerated wear and tear damage to impellers and motors.
- Uncovered pump motors used for abstracting 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:

- Intakes being closed due to high turbidity levels.
- Electrical power outages, if there is no back-up generation.

Ash can enter sand filters both by direct airfall and through intakes. Cleaning of filter beds may create heavy additional labour demands, such as at Bariloche's main water treatment plant following the June 2011 eruption of Cordon Caulle volcano, Chile, which deposited ~30-45 mm of ash across the city.

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