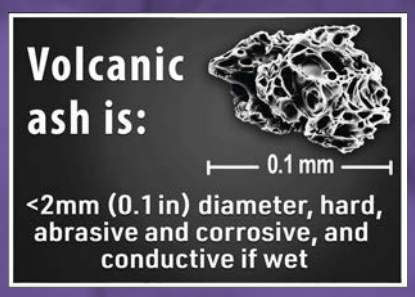

VOLCANIC ASHFALL

ADVICE FOR: **POWER TRANSMISSION AND DISTRIBUTION SYSTEM OPERATIONS**

ASH IMPACTS ON TRANSMISSION & DISTRIBUTION NETWORKS

- ***INSULATOR FLASHOVER:*** Ash contamination of station and line insulators can lead to flashover–the most common and widespread impact (see below).
- ***MECHANICAL BLOCKAGE:*** Ash accumulation on mechanical systems can block or disrupt operation.
- ***DISRUPTION TO CONTROL SYSTEMS:*** Ash ingress into heating, ventilation and air-conditioning (HVAC) systems can block intakes leading to reduced performance, and affect dependent systems. This is possible during any thickness of ashfall.
- ***STAFF ACCESS AND HEALTH HAZARD:*** Visibility reduction, disruption of transport networks and health hazards can inhibit staff accessing sites.
- ***STATIC LOAD DAMAGE:*** Ash accumulation may overload lines, weak poles and light structures, and cause additional tree-fall onto lines. Precipitation will exacerbate the risk due to the increased weight of ash when wet or embedded in snow.
  - » Static load damage typically occurs with >100 mm (>4 in) ash accumulation.
  - » Induced tree fall from ash static load generally occurs with thicknesses >10 mm (>0.4 in), although this value may be lower depending on vegetation type and environmental conditions (e.g. snow fall)
- Ash may reduce the resistivity of substation ground gravel cover, reducing tolerable step and touch voltages.

ⓘ ***See companion Operators of Generators and HVAC Systems poster.***

INSULATOR FLASHOVER

Flashover likelihood is controlled by ash resistivity and coverage of insulators.

- Protected leakage (creepage) distance of insulators influences flashover likelihood.
- Dry ash is highly resistive. Wet ash can be highly conductive.
  - » Light precipitation (dew, fog, drizzle or light rain) wets ash which initiates a leakage current, leading to flashover.
- Heavy rain will wash off contaminants, and high winds will clean non-cemented dry ash from insulators.
  - » The likelihood of flashover increases significantly once >40% of the insulator leakage (creepage) distance is coated in wet ash.
- Ash adherence is often variable, ranging from non-binding to cementing. Fine ash particles (<0.5 mm/0.02 in diameter) adhere and cement to insulators more readily.
- Insulator profile, orientation and material will influence its ability to shed or retain ash:
  - » ***MATERIAL:*** Non-ceramic (e.g. polymer) insulators generally outperform ceramic designs and have smaller shed diameters which appear to shed ash more effectively.
  - » ***DESIGN:*** Anti-pollution insulator designs can increase performance.
  - » ***ORIENTATION:*** Evidence suggests suspension (vertical) insulator strings are generally more vulnerable, but this depends on the direction of falling ash and weather conditions.
- Different mitigation strategies for ashfall should be considered in conjuction with other possible hazards and continued day-to-day operations.

ⓘ ***See "IEC TS 60815 - Selection and Dimensioning of High-Voltage Insulators for use in Polluted Conditions."***

Flashover across a glass insulator string contaminated with 3 mm (0.1 in) of wet ash. Note the arc propagation over and through the conductive ash deposit. Photo by Johnny Wardman.

Ash from the 1995 eruption in New Zealand being cleaned from a 220 kV strain insulator. Photo by Transpower, New Zealand.

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.
- Cleaning ash contaminated sites and components, especially insulators, is commonly required after an ashfall. Ensure availability of both live-line and de-energized clean up plans which include:
  - » Prioritize scheduling for inspecting/cleaning essential sites and circuits. Increased inspection and preventive maintenance may be prudent.
  - » Establish requirements for cleaning support systems and equipment (air compressors, water-blasters, personal protective equipment (PPE), gear, vehicle air filters, etc.).
- Coordinate with local, regional and national emergency planning, as appropriate.
- A proactive communication campaign for customers/public covering your response, expected outages/restoration times and recommended actions aids awareness and good will.

HOW TO RESPOND

- Advise customers not to clean electrical equipment and to be careful when using hoses near electrical equipment.
- For insulator cleaning guidance, ⓘ ***See IEEE Std 957 "Guide for Cleaning Insulators",*** which suggests:
  - » Ensure all insulator surfaces are cleaned, including undersides of weathersheds.
  - » Select the insulator cleaning method based on strength of ash adherence.
- Specialist inspection and cleaning procedures may be required for substation insulators, power transformer HVAC systems and control systems.
- Ensure staff have adequate personal protective equipment (long-sleeved clothing, heavy footwear, fitted goggles and a properly-fitted P2, N95 or FFP2 dust mask). Masks should be changed when clogged.
- If industry-certified masks are not available, other masks may provide partial protection. For more information: https://www.ivhhn.org/index.php/ash-protection

• FURTHER RESOURCES •

https://volcanoes.usgs.gov/volcanic_ash/transmission_distribution.html

www.ivhhn.org (volcanic health hazards information)

Content by Tom Wilson, Johnny Wardman, Carol Stewart, and Daniel Blake. Layout by Lisa M. Faust. Version 1 of International Volcanic Ash Impacts Posters, November 2020.

Auckland Lifelines · DEVORA · USAID FROM THE AMERICAN PEOPLE · VDAP Volcano Disaster Assistance Program · VISG · USGS science for a changing world