

Technical Data Bulletin

#187 — PPE For Volcanic Ash Exposures

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Background

Volcanoes are found throughout the world. Typically they form where tectonic plates come together. Examples include the volcanoes in the area known as the Pacific Ring of Fire which encircles the Pacific Ocean basin. They also may form where thin spots occur in the earth's crust such as under Yellowstone National Park in the United States or under Iceland. Most of the world's volcanoes are considered to be extinct or dormant with only a few actively erupting. It is possible, however, for a dormant volcano to become active and erupt with little advance warning. A volcanic eruption can range from being relatively gentle such as Hawaii's Kilauea volcano, to causing widespread damage and effects such as when Mount St. Helens in Washington State and Mount Pinatubo in the Philippines erupted.

Hazards

Depending on the type of volcano and the force of the eruption a number of different hazards may be present. They can include mudflows and flashfloods, landslides and rock falls, earthquakes, lava flow, falling ash, and the release of potentially harmful gases. According to the United States Centers for Disease Control and Prevention (CDC) the most common cause of death from a volcanic eruption is suffocation.

The concentration and type of gases emitted by volcanoes can vary greatly from one eruption to the next. Typically the gases emitted dissipate quickly in the atmosphere. However, people located close to the volcano or in low-lying areas may be exposed to levels that could affect their health. In addition to water vapor, the type of gases that may be released include acid gases such as carbon dioxide, sulfur dioxide, hydrogen chloride, hydrogen fluoride and hydrogen sulfide.

Usually, the most visible evidence of a major eruption is the plume of ash released high into the atmosphere. This ashfall can travel long distances from the site of the eruption often causing health and safety issues along the way as it settles back to the ground. Ash is actually pulverized rock and can vary in size from a gritty, abrasive, sometimes corrosive particle to a fine powder. Ash can range in color from light grey to black.

Health Effects

Exposure to volcanic ash can cause irritation to the eyes as well as the respiratory system. The gritty ash particle can scratch the cornea of the eye and could cause conjunctivitis, an inflammation that leads to redness, burning of the eyes, and photosensitivity. It is also common for ash to cause bloodshot, itchy eyes that tear and for affected people to feel as though there are foreign objects lodged in the eye. For people with existing respiratory conditions such as asthma, emphysema or other chronic lung disease, exposure to ash

may pose serious health risks. Ash particles can irritate the airways causing them to contract more frequently which may make breathing more difficult in people with chronic lung conditions. Exposure to fine ash particles may also cause the lining of the airways to secrete more mucous causing people to cough and breathe more heavily. People with asthma may experience a tightening of the chest, wheezing, and coughing.

Personal Protective Equipment

The CDC and the International Volcanic Health Hazard Network (IVHHN) have both published guidance documents that provide information to help protect against the harmful effects from falling volcanic ash. These include:

- Stay inside, if possible, with windows and doors closed to avoid unnecessary exposures
- Use goggles to protect your eyes from the fine particles
- Contact lenses should be avoided to prevent eye irritation and corneal scratches
- Use a particulate filter on a half or full facepiece respirator or a disposable particulate respirator to help protect yourself while you are outdoors or while you are cleaning up ash that has gotten indoors. The particulate respirator or filter should be approved by the National Institute for Occupational Safety & Health (NIOSH) or meet the requirements of the European Standards (EN).
- Dry sweeping can produce high levels of ash in the air and should be avoided. Consider lightly wetting ash before shoveling or sweeping outside. Never soak the ash with water as it will cake into a heavy, solid mass which is harder to clean up and may overload structures such as a roof. For inside surfaces consider wiping with a damp cloth.
- Fine ash particles may make surfaces slippery so use caution to avoid slips and falls, especially when removing ash from a rooftop. Fall protection is highly recommended for licensed professionals while homeowners should only attempt ash removal with a roof rake from ground level.
- Wearing a light duty protective coverall while cleaning up ash outside can help prevent ash traveling indoors on clothing.
- Avoid driving in heavy ash fall. If you do have to drive, keep the car windows up and do not operate the air conditioning system.

3M Note: A NIOSH-approved or CE-approved particulate filter or respirator is capable of filtering volcanic ash which is a particulate. However, some people may also find the odors released during an eruption objectionable. In that case choosing an appropriate respirator or filter for the ash that also incorporates acid gas relief for the odors may be desirable.

People with pre-existing medical conditions should check with their physician to ensure that they are healthy enough to wear a respirator.

Additional Resources

For further information concerning the use of personal protective equipment for volcanic eruptions, contact 3M. For more information on volcanoes and the hazards associated with them, contact your local emergency management office or one of the following agencies:

- Centers for Disease Control and Prevention (CDC) (<http://emergency.cdc.gov/disasters/volcanoes>)



- Federal Emergency Management Agency (FEMA) (http://www.fema.gov/media-library-data/20130726-1622-20490-0808/volcanoesfactsheet_finalrev.pdf)
- U.S. Geological Survey (<http://vulcan.wr.usgs.gov/Hazards/framework.html>)
- World Health Organization (WHO) (<http://www.who.int/hac/techguidance/ems/volcanos/en/>)
- The Pan American Health Organization Regional Office of WHO (http://www.paho.org/english/dd/ped/te_volc.htm)
- International Volcanic Health Hazard Network (IVHHN) (http://www.ivhhn.org/images/pamphlets/Health_Guidelines_English_WEB.pdf)

