

# ASPR TRACIE Technical Assistance Request

**Request Receipt Date (by ASPR TRACIE):** 18 January 2022

**Response Date:** 28 January 2022

**Type of TA Request:** Standard

## Request:

The requestor asked ASPR TRACIE for resources related to the human health and environmental impacts of volcanic eruption.

## Response:

The ASPR TRACIE Team conducted a search of existing ASPR TRACIE resources, namely the [Natural Disasters Topic Collection](#). We also conducted a more general online search for additional related resources. Section I of this document provides a summary of key points for consideration that were compiled from the literature reviewed, and Sections II-IV include links to those resources.

## I. Key Points for Consideration

- If possible, evacuation is the best mitigation action a community can take against a volcanic eruption. Areas near an erupting volcano can experience clouds of ash; falling blocks of rock; pyroclastic flows or ash hurricanes; lava flows; and floods of debris; similar to landslides.
- Most deaths occur from volcanic landslides called lahars, and pyroclastic flows. Some may be killed by ash falls that is heavy enough to collapse roofs.
- Ongoing volcanic activity can threaten roadways, and ash in the air can severely limit air operations (both rotor-wing and fixed wing, rescue and commercial) for prolonged periods.
- Healthcare providers should be prepared to address crush and other traumatic injuries, respiratory symptoms, eye injuries and irritation, skin irritation, cardiovascular health problems, and burns.
- Volcanic ash has the potential to cause respiratory symptoms, though this depends on the composition of the ash, which can vary widely. Evidence suggests that an increase in particulate matter due to volcanic activity is associated with increased respiratory emergency department visits.
- Volcanic gases such as CO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S, and radon can cause asphyxiation, usually in closer proximity to the volcano.
- Many people seeking health care after experiencing injuries or respiratory irritation can lead to a surge in emergency department visits.

- Areas in the path of a pyroclastic flow or lahar, or covered in significant ash, may take years to recover and the population may need to be resettled. Long-term surveillance of the health impacts of the air and soil contamination may be warranted.
- Poor air quality, mudslides or debris, projectile rocks, or tsunami activity following a volcanic eruption can also cause illness, injuries, and death.
- Prolonged evacuation due to ongoing risk of volcanic eruption may lead to people returning to their homes when risks are still high. It may also disrupt access to healthcare.
- Crops and water supplies may also be affected by ashfall, toxic gases, or acid rain due to a volcanic eruption, which can contribute to illness and famine.

## II. Health Impacts of Volcanic Eruptions

American Thoracic Society. (2018). [Volcanic Eruptions and Threats to Respiratory Health](#). American Journal of Respiratory and Critical Care Medicine. 197:21-22.

This resource provides patient information on threats to respiratory health to volcanoes.

ASPR TRACIE. (2018). [Major Earthquakes & Cascading Events: Potential Health and Medical Implications](#).

This ASPR TRACIE resource provides an overview of the potential significant health and medical response and recovery needs facing areas affected by a major earthquake with or without additional cascading events. **NOTE:** Although this document focuses on earthquakes, Appendix A (Cascading Events—Potential Effects of Volcanoes, Hazardous Materials and Radiologic Material Releases, and Tsunamis) addresses the impacts of volcanoes.

Barclay, J., Few, R., Armijos, M.T., et al. (2019). [Livelihoods, Wellbeing and the Risk to Life During Volcanic Eruptions](#). Frontiers in Earth Science. 7:205.

This paper addresses the risks to life of volcanic activity, which can cause long-term displacement of evacuees during an eruption. During prolonged evacuations, displaced people may try to return to their homes despite continued health and safety risks in order to protect their assets.

Baxter, P.J., Jenkins, S., Seswandhana, R., et al. (2017). [Human Survival in Volcanic Eruptions: Thermal Injuries in Pyroclastic Surges, Their Causes, Prognosis and Emergency Management](#). Burns. 43(5):1051-1069.

Hospitals may experience patient surge due to volcanic activity, when affected people seek treatment for burns or inhalation injury from ash. This article advocates warnings, evacuation, and political coordination to help manage patient surge due to volcanic activity.

Brown, S.K., Jenkins, S.F., Sparks, R.S.J. et al. (2017). [Volcanic Fatalities Database: Analysis of Volcanic Threat with Distance and Victim Classification](#). *Journal of Applied Volcanology*. 6(15).

This article documents all data on fatalities due to volcanoes, ranging from 1500 AD to 2017. These deaths were attributed to ash clouds, mudslides or debris, projectile rocks, or tsunamis.

Cuthbertson, J., Stewart, C., Lyon, A., et al. (2020). [Health Impacts of Volcanic Activity in Oceania](#). (Abstract only.) *Prehospital and Disaster Medicine*. 35(5).

Volcanoes can impact communities by harming crops, affecting water supplies, and making air quality poor. Eruptions can also displace people and make healthcare less accessible, especially in low-income countries already facing health challenges. The authors discuss these factors and focus on risks specific to Oceania.

International Volcanic Health Hazard Network (IVHHN). (n.d.). [The Health Hazards of Volcanic Ash: A Guide for the Public](#). (Accessed 1/27/2022.)

This guide provides information on the potential health effects of volcanic ash. It also explains how individuals can be prepared for and protect themselves from volcanic ashfall.

Lombardo, D., Ciancio, N., Campisi, R., et al. (2013). [A Retrospective Study on Acute Health Effects Due to Volcanic Ash Exposure during the Eruption of Mount Etna \(Sicily\) in 2002](#). *Multidisciplinary Respiratory Medicine*. 8(51).

The authors analyzed the number and type of emergency department visits after Mount Etna deposited a large amount of ash on a densely populated region in Italy in 2002. The researchers found a significant increase in respiratory, cardiovascular, and ocular emergency department visits.

Loughlin, S.C., Sparks, S., Brown, S., et al. (2015). [Health Impacts of Volcanic Eruptions](#). *Global Volcanic Hazards and Risk*. Chapter 13:55-56. Cambridge University Press.

This book chapter offers a broad overview of health impacts due to volcanoes, including injury agents, volcanic gases (such as CO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S and radon), volcanic ash, and secondary effects when large groups of people are brought together during an evacuation (for example, communicable diseases might increase due to poor sanitation). The authors explain that crops may also be affected by ashfall, toxic gases, or acid rain due to a volcanic eruption, which can lead to famine.

Mueller, W., Cowie, H., Horwell, C.J., et. al. (2020). [Health Impact Assessment of Volcanic Ash Inhalation: A Comparison with Outdoor Air Pollution Methods.](#) GeoHealth, 4.

This article examines whether air pollution health assessments can be applied to volcanic ash and discusses documented health conditions associated with volcanic ash exposure. The study concludes that existing air pollution models can be used for volcanic ash, however there is uncertainty due to the differences in volcanic ash composition from different eruptions or volcanoes.

U.S. Geological Survey. (2011). [Volcano Hazards Program FAQs.](#)

This Frequently Asked Questions document provides information on volcanic hazards, among other topics.

### III. Lessons Learned from Volcanic Eruption Events

Baxter, P., Bernstein, R., and Buist, S.A. (2018). [Mount St. Helens Eruption \(1980\): A Severe Air Pollution Episode from Volcanic Ash.](#) Air Pollution Episodes. Chapter 5:73-99. World Scientific Publishing Europe Ltd.

The eruption of Mount St. Helens in 1980 exposed over 1 million people to particulate air pollution. This book chapter explores the scientific and public health response to this event.

Bernstein, R.S., Baxter, P.J., Falk, H., et al. (1986). [Immediate Public Health Concerns and Actions in Volcanic Eruptions: Lessons from the Mount St. Helens Eruptions, May 18-October 18, 1980.](#) American Journal of Public Health. 76: 5-37.

This paper aims to understand the health impacts of volcanic activity, through multiple public health actions and studies undertaken in response to the Mount St. Helens volcanic eruption of 1980. **NOTE:** Although this resource is outdated, it still provides valuable information for this technical assistance request.

Carlsen H.K., Gislason T., Forsberg B., et al. (2015). [Emergency Hospital Visits in Association with Volcanic Ash, Dust Storms and Other Sources of Ambient Particles: A Time-Series Study in Reykjavík, Iceland.](#) International Journal of Environmental Research and Public Health. 12(4):4047-4059.

The authors examine the association between volcano-related particulate matter air pollution in Iceland and emergency department visits from 2007 to 2012. Increased particulate matter from volcanic ash was associated with an increase in emergency visits.

Carlsen HK, Hauksdottir A, Valdimarsdottir UA, et al. (2012). [Health Effects Following the Eyjafjallajökull Volcanic Eruption: A Cohort Study](#). BMJ Open.

This cohort study found that residents living in an area exposed to an Icelandic volcano eruption in 2010 had increased prevalence of physical and psychological morbidities relative to a control population. Symptoms which showed increases in those exposed included chest tightness, cough, eye irritation, and respiratory symptoms.

Higuchi, K., Koriyama, C., and Akiba, S. (2012). [Increased Mortality of Respiratory Diseases, Including Lung Cancer, in the Area with Large Amount of Ashfall from Mount Sakurajima Volcano](#). Journal of Environmental and Public Health. Article ID 257831.

This study examined long-term respiratory disease mortality for people exposed to ash from Mount Sakurajima from 1968 to 2002. Compared with controls, people in the volcano's region had elevated standardized mortality ratios for chronic obstructive pulmonary disease and acute respiratory disease.

Hillman, S.E., Horwell, C.J., Densmore, A.L., et al. (2012). [Sakurajima Volcano: a Physico-chemical Study of the Health Consequences of Long-term Exposure to Volcanic Ash](#). (Abstract only.) Bulletin of Volcanology. 74:913–930.

This study analyzed the ash from the Sakurajima volcano to understand its potential for causing respiratory illness. The analyses found that the health risk of Sakurajima ash is low, but that affected populations should still be monitored for respiratory conditions.

#### **IV. Organizations and Agencies Addressing Volcanic Eruptions**

American Lung Association. (2022). [Volcanic Ash](#).

This website provides information for individuals related to protecting your lungs from volcanic ash.

American Red Cross. (2022). [Volcano Preparedness](#).

This website includes information on what individuals should do before, during, and after a volcanic eruption.

Centers for Disease Control and Prevention. (2022). [Volcanoes](#).

This website offers information on how to stay safe before, during, and after volcanic eruptions.

International Volcanic Health Hazard Network. (2022). [Hawaii Interagency Vog Information Dashboard](#).

The term "vog" refers to the hazy air pollution caused by volcanic emissions. This website provides advice and updates related to Hawaiian volcanoes for visitors and residents. It also includes information about the effects of vog on human health and plants and agriculture and provides tips on protecting oneself from vog.

International Volcanic Health Hazard Network. (2022). [IVHNN Homepage](#).

This website contains resources related to air quality data, advice for visitors, weather forecasts, and more.

Ready.gov. (2022). [Volcanoes](#).

This website provides preparedness information for individuals related to volcanoes.