

overview of VOLCANIC HAZARDS

TEPHRA/ASH

All explosive volcanic eruptions generate tephra, fragments of rock that are produced when magma or rock is explosively ejected.

The largest fragments, blocks and bombs (>64 mm, 2.5 inches diameter), can be expelled with great force but are deposited near the eruptive vent.

Lapilli-sized material (6-64 mm, 0.24-2.5 inches diameter) can be carried upward within in a volcanic plume and downwind in a volcanic cloud, but fall to the ground as the eruption cloud cools.

The smallest material, volcanic ash (<2 mm diameter) is both easily convected upward within the plume and carried downwind for very long distances; as it falls out of suspension it can potentially affect communities and farmland across hundreds, or even thousands, of square kilometers (miles). Ash rarely endangers human lives, but can have devastating effects on aviation and infrastructure.



LAVA FLOWS



Lava flows typically move slowly enough to outrun them, but they will destroy everything in their path. Lava flows are streams of molten rock that pour or ooze from an erupting vent. Lava is erupted during either nonexplosive activity or explosive fountains.

The speed at which lava moves across the ground depends on several factors, including (1) type of lava erupted and its viscosity; (2) steepness of the ground over which it travels; (3) whether the lava flows as a broad sheet, through a confined channel, or down a lava tube; and (4) rate of lava production at the vent.

Deaths attributed to lava flows are often due to related causes, such as explosions when lava interacts with water, the collapse of an active lava delta that forms where lava enters a body of water, asphyxiation due to accompanying toxic gases, pyroclastic flows from a collapsing dome, and lahars from meltwater.

LAHARS

Lahars are mixtures of water and rock that flow down the slopes of a volcano and typically enter a river valley. Small seasonal events are referred to as *debris flows*, especially in the Cascades.

Moving lahars look like a roiling slurry of wet concrete, and as they rushes downstream, the size, speed, and amount of material carried can change. The initial flow may be small, but a lahar may grow as it incorporates anything in its path – rocks, soil, vegetation, and even buildings and bridges. Lahars often grow to 10 times their initial size as they move downslope. In steep areas, lahar speeds can exceed 120 mph, but as they move farther away from a volcano and decelerate in lowland areas, they eventually begin to shrink and lose speed.

Lahars can occur with or without a volcanic eruption. Lahars and excess sediment cause serious economic and environmental damage to river valleys and flood plains. Seasonal debris flows commonly occur on glacier-clad volcanoes.



types of VOLCANIC HAZARDS

VOLCANIC GAS

Volcanic gases can be harmful. Magma contains dissolved gases, which are a driving force causing most eruptions. As magma rises toward the surface, gases are released from the magma and continue to travel upward, and are eventually released into the atmosphere. Large eruptions can release enormous amounts of gas in a short time.

Water vapor is the most abundant volcanic gas, which is harmless. However, significant amounts of other, more harmful gases can be emitted by volcanoes. These emissions are all potentially hazardous to people, animals, agriculture, and property.

Carbon dioxide trapped in low-lying areas can be lethal. Sulfur dioxide is irritating to eyes, skin and respiratory system. Hydrogen sulfide is toxic in high concentrations. Hydrogen halides rapidly dissolve in water droplets, potentially causing acid rain. Sulfate aerosols cool the climate and harm the ozone layer, causing significant climate impacts.



PYROCLASTIC FLOWS



Pyroclastic flows contain a mix of hot lava blocks, pumice, ash and gas. They move at high speed down slopes, typically following valleys.

Most pyroclastic flows consist of two parts: a lower flow of coarse fragments that moves along the ground, and a turbulent cloud of ash that rises above the basal flow.

With rock fragments ranging in size from ash to boulders, and travelling at speeds over 50 mph, pyroclastic flows knock down, shatter, bury or carry away all objects and structures in their path.

The extreme temperatures of rocks and gas inside pyroclastic flows, generally between 390-1,300°F, can ignite fires and melt snow and ice. Pyroclastic flows vary in size and speed, but even relatively small flows that move less than 3 miles from a volcano can destroy. Pyroclastic flows can also lead to secondary hazards, especially flooding and lahars.

VOLCANIC LANDSLIDES

Landslides are large masses of rock and soil that fall, slide, or flow rapidly under the force of gravity. Landslides commonly originate as rock falls or avalanches, which disintegrate during movement into fragments ranging from particles to blocks hundreds of yards across.

If the landslide is large enough and contains a high enough percentage of water and fine material, it may become a lahar that can travel as much as 120 miles downstream.

Volcano landslides, also called debris avalanches, range in size from less than 0.24 mi³ to more than 24 mi³. Several conditions can trigger landslides, including intrusion of magma into a volcano, explosive eruptions, large earthquakes directly beneath a volcano or nearby (typically >M5), and heavy rainfall that saturates the ground.

Large landslides typically destroy everything in their path and may cause additional hazards.

