Volcanic Ash Fall—A "Hard Rain" of Abrasive Particles

Volcanic ash consists of tiny jagged particles of rock and natural glass blasted into the air by a volcano. Ash can threaten the health of people and livestock, pose a hazard to flying jet aircraft, damage electronics and machinery, and interrupt power generation and telecommunications. Wind can carry ash thousands of miles, affecting far greater areas and many more people than other volcano hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic hazard.

On the morning of May 18, 1980, many people in eastern Washington noticed dark, threatening clouds approaching from the west. Most thought the clouds were part of one of the enormous thunderstorms common in late spring. However, what they did not know was that at 8:32 a.m. Mount St. Helens had erupted explosively, blasting an enormous column of volcanic ash and gas more than 60,000 feet into the air.

As the clouds drifted overhead, a rain of ash began to fall, plunging much of the region into darkness that lasted all day. Homes, farms, and roads were quickly covered by as much as 4 inches of gritty ash. The smallest ash particles penetrated machinery and all but the most tightly sealed structures. By the end of the day, more than 500 million tons of ash had fallen onto parts of Washington, Idaho, and Montana. The ash prevented travel throughout much of eastern Washington because of poor visibility, slippery roads, and ash-damaged vehicles, stranding more than 10,000 people and isolating many small communities.

More than $1 billion in property and economic losses was caused by Mount St. Helens’ 1980 eruption—much of it by ash. Future large explosive eruptions in the United States are certain to produce widespread ash falls and are likely to cause even greater losses. Since 1980, rapid population and economic growth in the Western United States, widespread use of computers and electronics, and the dramatic increase in jet-airline traffic, especially over the North Pacific, have made more people and property in the Nation vulnerable to the effects of volcanic ash. Knowing the characteristics of volcanic ash and being prepared when a volcano shows signs of restlessness can significantly reduce the potential economic and health impacts of airborne and falling ash.

What is Volcanic Ash?

Small jagged pieces of rocks, minerals, and volcanic glass the size of sand and silt (less than 1/12 inch or 2 millimeters in diameter) erupted by a volcano are called volcanic ash. Very small ash particles can be less than 1/25,000th of an inch (0.001 millimeter) across.

Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet.

Volcanic ash is formed during explosive volcanic eruptions. Explosive eruptions occur when gases dissolved in molten rock (magma) expand and escape violently into the air, and also when water is heated by magma and abruptly flashes into steam. The force of the escaping gas violently shatters solid rocks. Expanding gas also shreds magma and blasts it into the air, where it solidifies into fragments of volcanic rock and glass.

Once in the air, hot ash and gas rise quickly to form a towering eruption column, often more than 30,000 feet high. Larger rock frag-
VOLCANIC ASH FALL FROM SOME ANCIENT AND MODERN ERUPTIONS IN THE WESTERN UNITED STATES

Some Effects of Volcanic Ash

When volcanic ash accumulates on buildings, its weight can cause roofs to collapse, killing and injuring people. A dry layer of ash 4 inches thick weighs 120 to 200 pounds per square yard, and wet ash can weigh twice as much. The load of ash that different roofs can withstand before collapsing varies greatly—flat roofs are more likely to collapse than steeply pitched ones.

Because wet ash conducts electricity, it can cause short circuits and failure of electronic components, especially high-voltage circuits and transformers. Power outages are common in ashfall areas, making backup power systems important for critical facilities, such as hospitals.

Eruption clouds and ash fall commonly interrupt or prevent telephone and radio communications in several ways, including physical damage to equipment, frequent lightning (electrical discharges), and either scattering or absorption of radio signals by the heated and electrically charged ash particles.

Volcanic ash can cause internal-combustion engines to stall by clogging air filters and also damage the moving parts of vehicles and machinery, including bearings and gears. Engines of jet aircraft have suddenly failed after flying through clouds of even thinly dispersed ash. Roads, highways, and airport runways can be made treacherous by slippery ash, and dropping ash can cause roadways to shut up thick clouds of ash, reducing visibility and causing accidents.

Ash also clogs filters used in air-conditioning systems to the point that air flow often stops completely, causing equipment to overheat. Such filters may even collapse from the added weight of ash, allowing ash to invade building interiors and damage computers and other equipment cooled by circulating outside air.

Agriculture can also be affected by volcanic ash fall. Crop damage can range from negligible to severe, depending on the thickness of ash, type and maturity of plants, and timing of subsequent rainfall. For farm animals, especially grazing livestock, ash can lead to health effects, including dehydration, starvation, and poisoning.

Like airborne particles from duststorms, forest fires, and air pollution, volcanic ash poses a health risk, especially to children, the elderly, and people with cardiac or respiratory conditions, such as asthma, chronic bronchitis, and emphysema.

The best time for communities, businesses, and homeowners to make preparations for a rain of volcanic ash is before an eruption occurs. When an explosive eruption occurs, warning of advancing ash clouds may precede actual ash fall by only minutes or hours. By developing community emergency-response plans that can be activated when a volcano is threatening to erupt, the harmful and disruptive effects of ash can be greatly reduced. So that the public can be warned of impending eruptions and advancing ash clouds, the U.S. Geological Survey (USGS) and cooperating organizations operate instrument networks that monitor more than 40 active volcanoes in the United States.