

HAZARD IDENTIFICATION AND VULNERABILITY ANALYSIS (HIVA)

Walla Walla County, Washington

VOLCANO ASH FALL

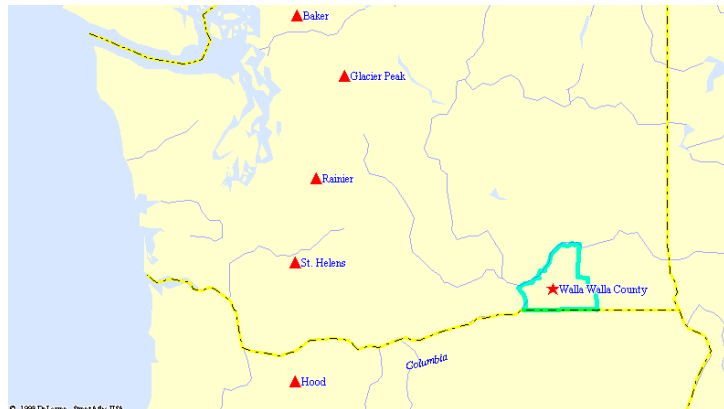
Hazard Overview

A volcano is a vent in the earth's crust through which magma (molten rock), rock fragments, gases, and ashes are ejected from the earth's interior. A volcanic mountain is created over time by the accumulation of these erupted products on the earth's surface.

Scientists define a volcano as active if it has erupted in historic time or is seismically or geothermally active. By this definition the Cascades Mountains: Mount Rainier, Mount Baker, Mount Hood, Mount Jefferson and Mount St. Helens are active volcanoes. Even Glacier Peak has erupted as recently as a thousand years ago and possibly even as late as the 17th century. Mount Adams is also capable of renewed activity.

History and Probability of Occurrence

In the last 200 years, seven volcanoes in the Cascades have erupted. Of those, five are in Oregon and Washington and present a threat of ash fall to Walla Walla County.



Washington

Mount Baker erupted in the mid-1800's for the first time in several thousand years. Activity at steam vents (fumaroles) in Sherman Crater, near the volcano's summit, increased in 1975 and is still vigorous, but there is no evidence that an eruption is imminent.

Glacier Peak has erupted at least six times in the past 4,000 years. An especially powerful series of eruptions about 13,000 years ago deposited volcanic ash at least as far away as Wyoming.

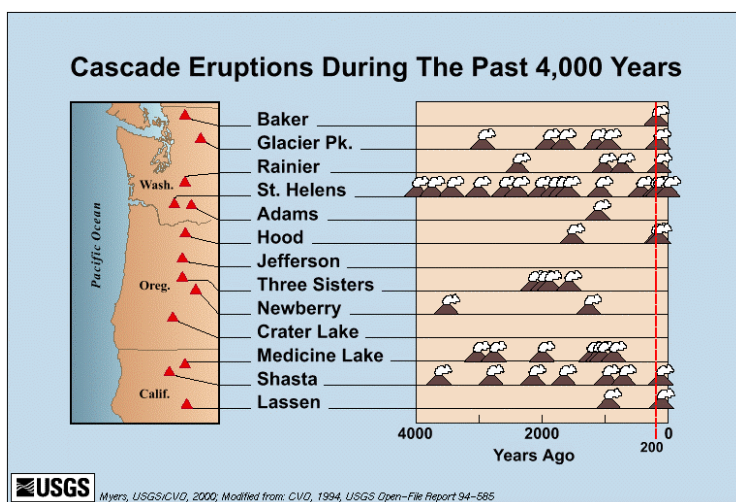
Mount Rainier has produced at least four eruptions and numerous lahars in the past 4,000 years. It is capped by more glacier ice than the rest of the Cascade's volcanoes combined, and Rainier's steep slopes are under constant attack from hot, acidic volcanic gases and water. These factors make this volcano especially prone to landslides and lahars.

Mount St. Helens is the most frequently active volcano in the Cascades. During the past 4,000 years, it has produced many lahars and a wide variety of eruptive activity, from relatively quiet outflows of lava to explosive eruptions much larger than that of May 18, 1980.

Walla Walla County HIVA – VOLCANO ASHFALL

On May 18, 1980 at 8:32 a.m., Mount St. Helens erupted killing 57 people. After a 5.1 magnitude earthquake, the volcano's summit slid away in a huge landslide, the largest in earth's recorded history. The landslide depressurized the volcano's magma system, triggering a powerful explosion that ripped through the sliding debris. Rock, ash, volcanic gas, and steam were blasted upwards and outward to the north.

The lateral blast produced a column of ash and gas that rose more than 15 miles into the atmosphere in 15 minutes. From a second eruption, magma erupted explosively from the newly created crater. Then avalanches of hot ash, pumice, gas, and pyroclastic flows poured out of the crater and spread five miles to the north. Over the course of the day, prevailing winds blew 520 million tons of ash eastward across the United States and caused complete darkness in Spokane and other communities. During the first minutes of the eruption, parts of the blast surged over the new crater rim and down the west, south, and east sides of the



volcano. The hot rock and gas melted snow and ice, creating surges of water that eroded and mixed with loose rock and debris to form lahars (mudflows). The lahars poured into river valleys, ripping trees from their roots and destroying roads, bridges, and streambeds. The most destructive lahar was in the North Toutle River and increased in size as it traveled downstream

destroying bridges and homes. It reached maximum size in the Cowlitz River at midnight about 50 miles downstream from Mount St. Helens.

Mount Adams has produced few eruptions during the past several thousand years. This volcano's most recent activity was a series of small eruptions about 1,000 years ago.

Oregon

Mount Hood last erupted about 200 years ago, producing small pyroclastic flows, lahars, and a prominent lava dome (Crater Rock) near the volcano's summit. Most recently, a series of steam blasts occurred between 1856 and 1865.

Mount Jefferson last erupted more than 20,000 years ago. However, eruptions nearby have produced several lava flows and small volcanic cones in the past 10,000 years.

Three Sisters Volcanic Center in central Oregon includes five large volcanoes: North Sister, Middle Sister, South Sister, Broken Top, and Mount Bachelor.

Walla Walla County HIVA – VOLCANO ASHFALL

South Sister is the youngest volcano in the group; its most recent eruption was about 2,000 years ago. Middle Sister and Mount Bachelor have not erupted in the past 8,000 years, and North Sister and Broken Top have probably been inactive for 100,000 years.

Newberry Volcano, a broad shield covering more than 500 square miles, is capped by Newberry Crater, a large volcanic depression (caldera) 5 miles across. Its most recent eruption was about 1,300 years ago.

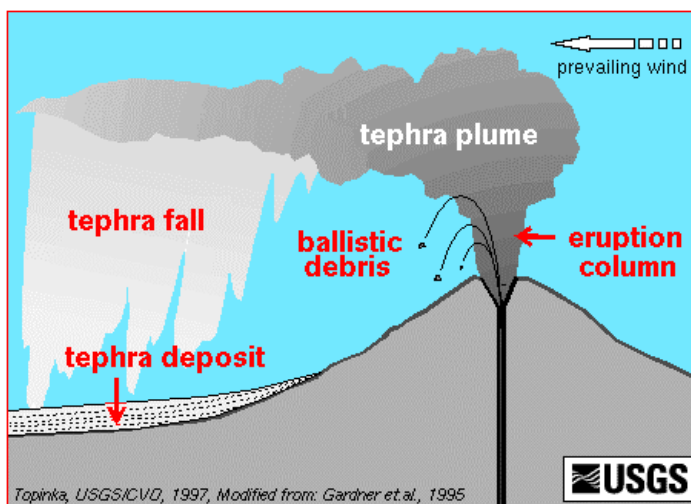
Crater Lake occupies a 6-mile-wide caldera formed 7,700 years ago when the summit of an ancient volcano (referred to as Mount Mazama) collapsed during a huge explosive eruption. More than 10 cubic miles of magma was erupted, ten times as much as in any other eruption in the Cascades during the past 10,000 years. Smaller eruptions about 5,000 years ago formed Wizard Island and a lava dome on the lake floor.

Volcanoes commonly repeat their past behavior. It is likely that the types, frequencies, and magnitudes of past activity will be repeated in the future. Volcanoes usually exhibit warning signs that can be detected by instruments or observations before erupting. However, explosions caused by heated material coming into contact with ground water can happen without warning. In the future Washington State can expect volcano's avalanches, lahars (mudflows), lava flows, pyroclastic flows, and tephra falls, and collapse of a sector of a volcano within the Cascade Range. Valleys are vulnerable to lahars, volcanic debris flows, and sedimentation, which can destroy lakes, streams, and structures. Areas downwind of a volcano eruption are vulnerable to reduced visibility, ash fall, and caustic gases. Some of the after effects of a volcanic eruption are:

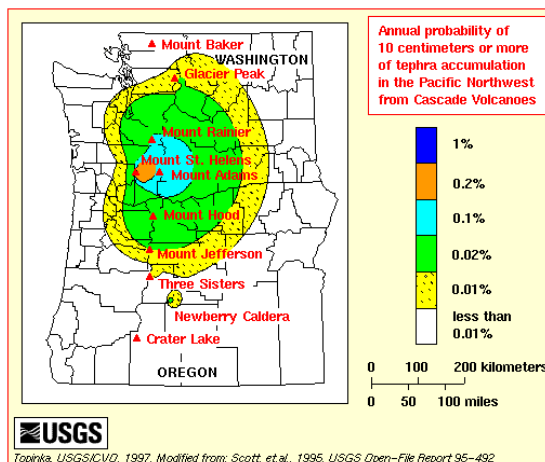
- Avalanches of glacial ice, snow, rock, and debris from volcanic mountains cause damage down slopes and in valleys. Avalanches can occur without warning, travel rapidly, and carry large amounts of material.
- Lahars or volcanic mudflow originate from volcanic landslides or from the eruption of melted water. Lahars move faster on the steep slopes nearest their source, and attain speeds of 15 to 60 miles per hour. The highest speed measured on the slopes of Mount St. Helens was 90 miles per hour. Lahars attain depths of hundreds of feet in the canyons near their origin and spread out over valleys downstream. A large volume lahar may overtop or destroy a dam by suddenly displacing water or creating huge waves.
- Magma or molten rock or lava originates from the main cone or cinder cone of a mountain. Cascade Range volcanic magma flows have been short and slow moving. The heat of the magma may start forest or grass fires. Flows bury roads and escape routes. Magma flows bury roads and escape routes.
- Pyroclastic flows are hot avalanches of lava fragments and gas formed by the collapse of thick lava flows and eruption columns.

Walla Walla County HIVA – VOLCANO ASHFALL

- Tephra falls are from explosive eruptions that blast fragments of rock and ash into the air. Large fragments fall to the ground close to the volcano. Small fragments and ash can travel thousands of miles downwind.
- Steam and gas explosions containing pulverized lava and rock fragments bombard areas as far away as 10 miles. Steam explosions occur any time that hot material comes into contact with water, glacial ice, or snow. No eruptive activity is necessary for this to occur.



- Clouds of carbon dioxide and toxic gases kill vegetation and animals with chemical poisons, internal or external burns, and asphyxiation.
- Ash falls are harsh, acidic, gritty, smelly, and causes lung damage to the young, old, or people suffering from respiratory problems. When atmospheric sulfur dioxide combines with water it forms diluted sulfuric acid that causes burns to skin, eyes, mucous membranes, nose, and throat. Acid rains affect water supplies, strip and burn foliage, strip paint, corrode machinery, and dissolve fabric. Heavy ash falls blot out light. Heavy demand for electric light and air conditioning cause a drain on power supplies. Ash clogs waterways and machinery. It causes electrical short circuits, drifts into roadways, railways, and runways. Very fine ash is harmful to mechanical and electronic equipment. The weight of ash causes structural collapse, particularly when it becomes water saturated. Because it is carried by winds it continues as a hazard to machinery and transportation systems for months after the eruption.
- Volcanic earthquakes occur within a volcano. Earthquakes from local tectonic sources or shallow faults in the earth's crust can also shake a volcano. Examples of such earthquakes include the "St. Helens seismic



Walla Walla County HIVA – VOLCANO ASHFALL

zone" and "West Rainier zone." All Washington State volcanoes are situated close to shallow crustal fault zones.

The probability of an eruption of a Cascade Volcano having an effect on Walla Walla County is LOW. The likelihood of a lahar, avalanche, magma flow, volcanic earthquake or toxic gases from a volcano is very low, but the likelihood of ash fall or tetra is possible. As shown on the USGS map, the annual probability of 10 centimeters (about four inches) of tephra reaching Walla Walla County is .01% or one in ten thousand. Hence, the probability of 10 cm of tephra reaching Walla Walla County in the next 25 years is .25% (one quarter of one percent) or one in four hundred.

Vulnerability

Walla Walla County is moderately vulnerable to ash fall from several volcanoes in the Cascade Mountains because prevailing winds would likely carry tephra to the east of these volcanoes. Tephra fallout produced by future eruptions of Cascade Mountains poses little threat to life or structures in Walla Walla County. But tephra clouds can create darkness as they pass over a downwind area, even on sunny days, and reduce visibility on highways. Tephra ingested by vehicle engines can clog filters and increase wear. Deposits of tephra can short-circuit electric transformers and power lines, especially if the tephra is wet and thereby highly conductive, sticky, and heavy. This effect could seriously disrupt hydroelectric power generation and transmission along the Columbia River and power line corridors north and east of the volcano. Tephra clouds often spawn lightning, which can interfere with electrical and communication systems and start fires. A serious potential danger of tephra stems from the grave effects of even small, dilute tephra clouds on jet aircraft that fly into them. Major air routes pass downwind of Cascade Volcanoes, and tephra clouds produced repeatedly during an eruptive episode would interfere greatly with air traffic.

Walla Walla County is rated as a low vulnerability to tetra fall from Cascade Volcanoes. A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worse case scenario there could be a disaster of minor to moderate proportions. Experience with ash-fall conditions from Mount St. Helens validates a low vulnerability rating. Disruption of transportation, electrical power, visibility, damage to engines and other equipment is rated a LOW vulnerability.

Risk Rating

The overall risk in Walla Walla County is rated as LOW. There is little potential for a volcano ashfall disaster during the next 25 years. The threat is such as to warrant little special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the county's emergency management training and exercise program except as generally dealt with during hazard awareness training.

This page left blank intentionally.