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EXPLANATION OF VOLCANO-HAZARDS ZONES

The volcano-hazards zonation map delineates the relative degree of hazard near Mount Adams and in adjacent volcanic fields from future eruptions and other hazardous volcano-related events. Most of these events involve various types of flows, of either lava or other volcanic debris. The hazard zonation here is based on two categories of events -- those related to eruptions and those related to landslides of altered rock debris from the summit and upper flanks of Mount Adams, which need not be accompanied by eruptions. Eruptive events are characterized by explosions that vent tephras and by extrusion of lava flows. Eruptions can also be pyroclastic flows and lahars and floods. Landslides of altered rock from high on Mount Adams can be triggered by eruptions, but also can occur without eruptive activity. The slides generate debris avalanches that can transform into lahars that flow far down valleys.

Boundaries between hazard zones do not represent sharp changes in hazard. Rather, the degree of hazard decreases gradually in a downvalley direction and as height above valley floors increases.

CONSTRUCTION OF HAZARD ZONE DL

Boundaries of the hazard zone for debris avalanches and lahars (Zone DL) are approximate and were defined using two methods, one for unchanneled volcano flanks and one for major river valleys that head on the flanks. Where major valleys are absent, debris avalanches are more likely than lahars. Such unchanneled avalanches spread laterally, lose energy rapidly, and come to rest relatively quickly. This limits the extent of the hazard zone. Maximum extents of unchanneled debris avalanches were estimated from the formula H/L = 0.2, where H is the elevation difference between Mount Adams' summit and the hazard boundary line, and L is the horizontal distance from the summit to the hazard boundary line. This method places the hazard boundary 10 to 15 km from Mount Adams' summit where flanks are not deeply channeled.

Avalanches that funnel into major river valleys or transform into lahars can travel much farther from the summit. In major valleys hazard zone DL extends downstream until the valleys reach large reservoirs. Within major river valleys, zone DL boundaries were defined by assuming that lahars maintain a constant volume (V) of 1 km3 as well as constant peak amplitude. The peak amplitude defines the cross-sectional area (A) of the portion of the valley inundated as the lahar passes. Data from historic and prehistoric lahars that apparently commenced abruptly as debris avalanches or pyroclastic flows at Mount Rainier and St. Helens show that the formula A (exp 3/2) = V/100 characterizes the relationship between V and A fairly well. For a hypothetical avalanche and lahar at Mount Adams with V = 1 km3, this formula yields A = 50,000 m2, approximately. Thus for major river valleys that drain away from Mount Adams' flanks, boundaries of hazard zone DL delimit valley cross sections with areas of about 50,000 m2. Where major valleys intersect the steep volcano flanks, above about 1000 m elevation, the hazard zones defined by the H/L = 0.2 and A = 50,000 m2 methods merge. These are areas where rock avalanches would funnel into major valleys and continue far downstream if they transform into lahars.

DEBRIS AVALANCHES AND LAHARS

Hazard Zone DL - Areas subject to inundation by debris avalanches and lahars with volumes of 1km3 (1/4 mi3). Such events are more than ten times larger than those that have occurred at Mount Adams during the past 10,000 years, but are similar to events that have occurred at Mount Rainier. A sufficient volume of weakened rock exists on Mount Adams' summit and upper flanks to generate an avalanche and lahar of this size in any of the major drainages. Smaller events that will affect only a part of zone DL within single drainage (for example, TL, the 6,000-yr-old Trout Lake Lahar) are more likely than large events.

Reservoirs that could be affected by lahars or sediment eroded from lahar - or eruption - impacted watersheds. All but the largest events could be contained by the usable storage in these reservoirs; the largest events could overwhelm the useable storage and threaten dams. Depending on lahar volume and speed, areas along shores could be subject to inundation and high waves.

Area of hydrothermally altered, weakened rock on summit and upper flanks of Mount Adams.

LAVA FLOWS AND PYROCLASTIC DEPOSITS

Hazard Zone LA - Areas subject to lava flows erupted from vents on the summit and upper flanks of Mount Adams. Also includes areas subject to pyroclastic flows and lahars initiated by melting of snow and ice by lava flows and pyroclastic flows. On the basis of past activity (table 1), estimated annual probability of a given point in zone LA being covered by a lava flow is about 1 in 30,000 to 1 in 100,000.

Hazard Zone LB - Areas subject to lava flows, pyroclastic flows, and thick near-vent tephra deposits erupted from vents at the north and south ends of the Mount Adams volcanic field and the Indian Heaven volcanic field. On the basis of past activity (table 1), estimated annual probability of a given point in zone LB being covered by a lava flow is about 1 in 100,000 to 1 in 1,000,000.

Hazard Zone LC - Areas subject to lava flows, pyroclastic flows, and thick near-vent tephra deposits erupted from vents in the Simcoe Mountains volcanic field and other parts of southern Washington Cascade Range exclusive of the Mount Adams and Indian Heaven volcanic fields. On the basis of past activity, estimated annual probability of a given point in zone LC being covered by a lava flow is less than 1 in 1,000,000.

Young volcano - includes cinder cones, shield volcanoes, lava domes, and lava-flow vents younger than 1 million years.

Approximate boundaries of vent areas of volcanic fields, vents on summit and upper flanks of Mount Adams are contained in enclosed area of Mount Adams volcanic field.

Volcano-hazards zones of Mount St. Helens
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SCALE 1: 200 000

5 0 5 MILES
5 0 5 KILOMETERS

Contour interval 100 meters

VOLCANO-HAZARD-ZONATION MAP OF MOUNT ADAMS, WASHINGTON

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