WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

DGER NEWS

DIVISION OF GEOLOGY AND EARTH RESOURCES
"Washington State's Geological Survey since 1890"

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RESPONDING TO MOUNT ST. HELENS ACTIVITY, 2004

After an 18-year hiatus, Mount St. Helens volcano awakened in late September and began a new phase of eruptive activity. Before this latest activity, the most recent extrusion of lava had taken place in October of 1986, when a new lobe was added to the summit of the Lava Dome in the 1980 Crater. That eruption was the last in a series of 22 eruptive events that took place from 1980 to 1986 and included the cataclysmic eruption of May 18, 1980, five major explosive eruptions later that year, and 17 "dome-building" eruptions that constructed the ~80 million cubic meter 1980-86 Lava Dome (Tilling and others, 1990; Pringle, 2002). In this article we summarize the key events of the first six weeks of this most recent activity as well as the role played by the Department of Natural Resources (DNR) Division of Geology and Earth Resources (DGER) in the emergency response to the volcanic activity.

Mount St. Helens crater with the Pumice Plain in the foreground. USGS photo taken on Oct. 11, 2004, by Mike Poland.

RESPONSE PLANS AND ALERT LEVELS

Following the May 18, 1980, eruption of Mount St. Helens, accurate warnings were issued hours to weeks before 17 of 21 subsequent eruptions by scientists of the U.S. Geological Survey (USGS) Cascades Volcano Observatory (CVO) and the University of Washington Geophysics Program. During the 1980s, most of these warnings consisted of a series of information statements and staged alert levels (Table 1). Response plans[1] were already in place for possible renewed activity at Mount St. Helens and other nearby Cascade Range volcanoes. The plans specified agency roles and response activities and were scaled to the level of alert at any given time during eruptive activity.

The main alert levels (Table 1), used in addition to simple Information Statements, are typically accompanied by an explanation to clarify hazard implications as fully as possible. Updates are commonly issued to supplement any alert-level statement. Alert-level assignments depend upon observations and interpretations of changing volcanic phenomena such as increases in seismicity, deformation (ground swelling), or discharge of volcanic gases. Some volcanic events may not be preceded by obvious changes, or the observed changes may not be well enough understood; thus, surprises are possible, and uncertainty about the timing and nature of anticipated events is likely.

THE INCIDENT COMMAND SYSTEM

Response to the current volcanic activity was handled under the Incident Command System, which is a management tool consisting of procedures for organizing personnel, facilities, equipment, and communications at the scene of an emergency. It allows multiple agencies to efficiently manage a crisis. The Unified Command for this incident was run by the USDA Forest Service, which coordinated the

Table 1. Major levels for notification (abbreviated) of volcanic events in Washington (after USGS)

Information Statement – provides information about an assortment of volcanic and other, typically short-lived, events (slash burning, etc.) that often attract media and public interest and inquiry

Volcano Alert Levels

Level 1. *Notice of Volcanic Unrest* – first recognition of conditions that could lead to a hazardous event

Level 2. *Volcano Advisory* – hazardous event likely, but probably not imminent

Level 3. *Volcano Alert* – hazardous event imminent or underway

The warning scheme for Cascade Range volcanoes can be found at: http://vulcan.wr.usgs.gov/Volcanoes/Cascades/CurrentActivity/volcano_warning_scheme.html.

For additional information about the current activity at Mount St. Helens, visit: http://vulcan.wr.usgs.gov/News/framework.html.

For seismic information, visit: http://www.pnsn.org/HELENS/welcome.html.

[1] Response plans for the various volcanoes can be found online at http://emd.wa.gov/site-general/menu/plans.htm.

emergency response plan with federal, state, and local authorities listed in Table 2.

The Incident Command System was developed in the 1970s in response to wildfires in southern California. It addressed recurring problems with multi-agency responses, such as nonstandard terminology among responding agencies, nonstandard and nonintegrated communications, lack of consolidated action plans, and lack of designated facilities. It has now evolved into an all-risk system that is appropriate for all types of emergencies.

This was the first time the Incident Command System had been fully implemented for a volcanic crisis in Washington. When put into effect at Mount St. Helens, it immediately enhanced communication among the agencies and local governments involved. Much of the credit goes to the Unified Command under the direction of Incident Commander David Johnson of the Forest Service. Johnson, as well as several other members of the Unified Command, had previous experience working with the Incident Command System on forest fires and participated in the working group that wrote the response plan for eruptive activity at Mount Baker and Glacier Peak.

DGER AND THE VOLCANO

DGER's first response to the renewed volcanic activity was participating in conference calls with other DNR staff, the USGS, the Washington Emergency Management Division, the Forest Service, and affected counties. These calls made sure everyone was connected to the same source of information about the volcano. The most recent (1995) USGS Mount St. Helens hazard map files were then loaded into the DNR Geographic Information System (GIS) to allow DNR personnel to evaluate the hazards to State lands.

On Oct. 3, Assistant State Geologist Dave Norman and geologist Sammantha Magsino were the first from DGER to join the Incident Management Team, which was called in when the alert level was elevated to Level 2, 'Volcano Advisory' on Sept. 29. The Incident Management Team is the group that implements emergency response to a crisis under the Incident Command System. State Geologist Ron Teissere and volcanologist Pat Pringle joined the team on Oct. 5.

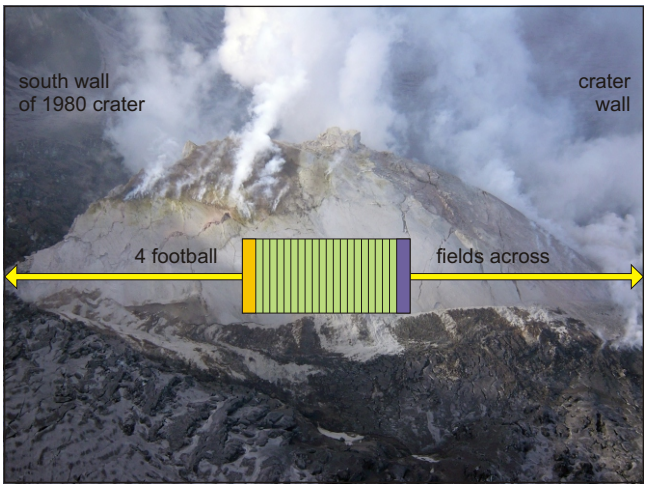
The Incident Management Team was headquartered at the Joint Operations Center (JOC), part of the Unified Command Post organized at the Washington Department of Transportation building in Vancouver. A Joint Information Center (JIC), set up in the Forest Service building, handled media relations. Before the JIC went operational on Oct. 2, press conferences were held at CVO, and USGS scientists had the difficult task of trying to get their work done while also briefing the media.

DGER geologists served as liaison between the Incident Management Team and CVO and as consultants providing geological expertise to the team, which was made up primarily of nongeologists. DGER geologists attended CVO press conferences, consulted daily with USGS scientists, and passed the information on to the Incident Management Team. It was their job to answer questions and to clarify and expand the updates into language the team could understand. Magsino commented that it was important to use the same vocabulary as CVO because it confused people when different terms were used. For example, volcanologists think of an eruption as anything coming out of the volcano; the public thinks of it as an explosive event.

"We also did some rumor control. I heard a newscaster on television describing deformation on the southern flanks of the volcano when the deformation was really on the lava dome contained in the crater. I brought this to the attention of USGS

OVERVIEW OF THE FIRST SIX WEEKS OF VOLCANIC ACTIVITY

9/23-24	Swarm of small shallow earthquakes begins
9/24, 10:00	Information Statement issued by U.S. Geological Survey (USGS) and Pacific Northwest Seismic Network (PNSN)
9/25	Earthquake swarm starts to die out; then intensifies
9/26-30	Increasing rate of shallow (less than Magnitude 2) earthquakes; no volcanic gas detected by USGS
9/26	Notice of Volcanic Unrest issued by USGS and PNSN (Alert Level 1)
9/29	Deformation first noted as GPS stations on the 1980-86 Lava Dome move a few centimeters northward over a few days; also, an area on south side of the 1980-86 Lava Dome and adjacent glacier begins fracturing and rising
	Volcano Advisory (Alert Level 2) issued by USGS and PNSN
9/30	Earthquakes grow as large as M3.3
10/1-5	Small steam and ash emissions; increasing rate of M>3 earthquakes; upwarping and cracking of glacier on crater floor; first volcanic gases noted
10/2	Volcano Alert (Alert Level 3) issued
10/6	Ongoing seismicity; lidar shows that lava extrusion at rates of 4 to 8 m^3/sec is deforming the glacier upward;
	Volcano Advisory issued by USGS and PNSN (Alert Level lowered from 3 to 2)
10/12–	First exposure of new lava pokes through upwarped area south of the 1980-86 Lava Dome. Pasty lava pushes up as a giant tower and deformation of the new glacier and crater floor continues to spread. Seismicity is low. By Nov. 20, the "welt" or deformed area is impinging on the south crater wall and reaches an approximate volume of 20 million cubic meters, about the size of 30 Tacoma Domes.



Panoramic view of the new dome on Mount St. Helens as seen from the east, with a football field for comparison. The new lava dome is currently about four football fields wide. USGS photo taken on Nov. 12, 2004, by Willie Scott.

Table 2. Agencies with representatives working the Incident Command System

USDA Forest Service
U.S. Geological Survey
Federal Emergency Management Agency
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
Clark, Cowiltz, Lewis, Pierce, and Skamania Counties—emergency managers, sheriffs, and fire departments
Washington State Emergency Management Division
Washington State Department of Transportation
Washington State Department of Natural Resources
DNR Division of Geology and Earth Resources
DNR Pacific Cascade Region representing landowners
Washington State Department of Agriculture
Washington State Department of Fish and Wildlife
Washington State Department of General Administration
Washington State Department of Health
Washington State Department of Information Services
Washington State Department of Parks and Recreation
Washington State Department of Revenue
Washington State Patrol
The Washington State Governor's Office
U.S. Bureau of Land Management
U.S. Coast Guard
City of Portland
Oregon Department of Geology and Mineral Industries
Oregon Department of Corrections
Clackamas County Sheriff
Tualatin Valley Fire and Rescue

media liaison Tina Neal, and she immediately called the network and also clarified it in the next press conference. The network quickly retracted their incorrect statement," Magsino said.

DGER geologists sometimes took calls at the JIC after a press conference, particularly if a CVO geologist wasn't available or if calls couldn't be answered with talking points. They also did a number of press interviews—Magsino had a radio interview with ABC News and Pringle had interviews with the *Seattle Times*, the Tacoma *News Tribune*, and the Portland *Oregonian*.

Each afternoon, the Incident Management Team put together a situation report that covered what went on during the day. Magsino and Pringle compiled the geology portion. On a typical day, DGER geologists worked from 7:00 am to 9:00 pm; meetings of the Incident Management Team were held at 7:00 am and 7:00 pm.

Within the first few days, the Incident Management Team realized the need for situation-specific maps covering the types of volcanic processes that could be expected for the current eruptive episode, such as explosions, lava flows, pyroclastic flows (hot, fast moving clouds of rock, ash, and gases), debris avalanches, and lahars (volcanic debris flows). The most recent hazard maps (1995) delineated the probable maximum extent of the affected areas based on the entire history of the volcano, but the currently expected eruptive scenarios were smaller and the affected areas not as extensive.

To expedite the production of new maps, a series of four meetings was held. More than 40 representatives of the counties and other agencies attended the third meeting on Oct. 8 at Ridgefield. DGER geologist Pat Pringle made a presentation on the history of the volcano, typical geologic processes, and the extent of impacts to be expected, and USGS geologist Tom Pierson discussed new draft eruptive scenario maps produced by the USGS that showed the likely extent of areas impacted by eruptive activity of various scales and the possible effects of such variables as changing snowpack in the crater.

The Incident Commander asked Laurie Cox of DNR to facilitate a fourth meeting near Battleground. Volunteers had to decide where to draw the restricted areas on the new maps. They chose a provisional set of boundaries based on eruptions similar to the ones in the summer of 1980 with a volcanic explosivity index (VEI) of 3. (The 1980 blast had a VEI of 5.) For these scenarios, impacted areas would likely be limited to within a 5-mile radius of the volcano. The group delineated restricted areas for each of several possible scenarios, taking into account that law enforcement needed restricted areas that were defensible and that reduced the risk to their officers. The boundaries also had to be relatable to landmarks on the ground.

A small steam eruption, with minor ash, issuing from a vent just south of the 1980-86 Lava Dome. USGS photo taken at 12:13:01 PDT on Oct. 1, 2004, by John Pallister.

DGER geologist Sammantha Magsino was impressed by the cooperation at the last meeting. "These people put the map down on the table and started drawing circles at 3 miles, 5 miles, and 7 miles and then modifying the circles to take topography and the road systems into account. They worked so well together that they got it done right there. It was a draft but there were very few changes for the final," she said.

When seismicity at the volcano began to stabilize and the probability of an imminent explosive eruption waned, the alert level was downgraded from a Level 3 Volcano Alert to a Level 2 Volcano Advisory on Oct. 6. The Incident Management Team was transitioned to a smaller team consisting mainly of members of the Forest Service on Oct. 16.

Before the first team disbanded, they finished a report about if, when, and how to ramp up the level of response in the event that volcanic activity returned to more elevated levels or a similar situation arose at another volcano. Pringle and Magsino reviewed a draft of the plan and made sure someone from DGER was included as the contact person for volcano emergencies. They also helped create and edit a manual of operating and initial response procedures for future teams who would work on a volcanic crisis like this.

LESSONS LEARNED

This first effort by State and Federal agencies to use the full Incident Command System in response to a volcanic event was reasonably successful. Because it was the first time, there were some rough edges. USGS scientists were not familiar with this approach, which made initial communication cumbersome. DGER's role was not initially recognized as necessary by the USGS and FEMA, but it was embraced by the Forest Service and the Incident Management Team.

Several things became clear as a result of our experiences. First, new technologies such as on-site communications and use of GIS need to be written into the State's emergency response plans. There were problems with not being able to access DNR's e-mail from the remote location and with e-mail boxes on-site being too small to handle data from parent agencies. The value of on-the-fly situation maps has been proven in the fighting of forest fires, and a mobile GIS unit like the one DNR takes to fires should be available for other types of emergencies as well. It would also benefit the various agencies to have an on-site GIS liaison to make sure data from those agencies gets to the remote location without a hitch.

Second, the role of the Incident Command System needs to be expanded. It has worked well in this and other crises. DNR will be asking the USGS Volcano Program for a Memorandum of Understanding (MOU) to define communication channels and DGER/USGS cooperation in response to future events. DGER will be recognized as the volcano science lead in the State response plans being updated by the Emergency Management Division of the Washington Military Department.

REFERENCES

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MARVIN HOWARD BEESON, 1937–2004

by Michael L. Cummings
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Marv was known to the Pacific Northwest geologic community as Mr. Columbia River Basalt. His research led to many important, fundamental breakthroughs in our understanding of the geology of the Columbia River Basalt Group and the geologic history of Washington. He authored numerous research papers and geologic maps and was widely considered the foremost expert on the geology of the Columbia River Basalt Group. The DGER library holds 36 of Marv's publications.

—Dave Norman

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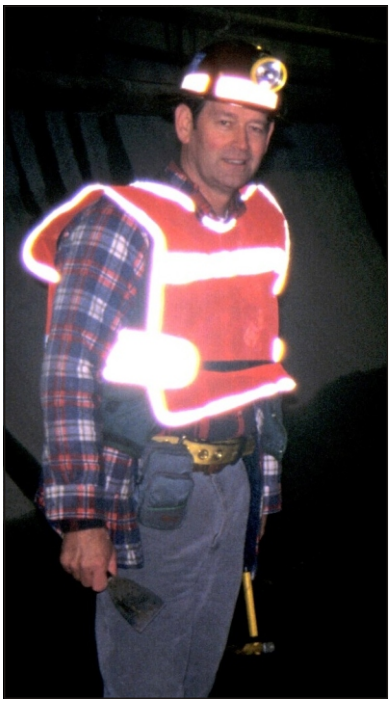
On May 18, 1980, the spring field trip to central Oregon was in full swing. We had just pulled into Fossil [Oregon] and were unloading the bus when we heard this muffled rumble. "There goes St. Helens" was the immediate comment. And it had. When word was received on the truck radio, things moved into a controlled panic as decisions were made about what to do with the field trip. Marv, Gene Pierson, and Dick Thoms headed back to PSU in a pickup to help the public relate to this northwest marvel. The public's right to reliable geologic information was important to Marv throughout his career.

Marv shaped the intellectual environment of the PSU Geology Department through the courses he taught, the graduate students he advised, and the research he conducted. When project-based learning in classes was beginning to sweep higher education, Marv had already been doing it for years. Graduate students benefited greatly from his insightful questioning, support, and encouragement. His graduate students were his colleagues—an enviable model for helping students develop the confidence and connections they need to launch their careers. He felt that students should be treated with dignity and respect and engaged in the process of knowing and learning.



Marv working on a gravity survey through the Portland West Side Light Rail tunnel in 1996. Photo courtesy of the Portland State University Department of Geology.

Marv was dedicated in his research. He worked through data with intense interest. He was never satisfied with what appeared to be the easiest answer. He posed questions and came up with creative ways to investigate them. Virginia Rohay (Pfaff), Marv, and Ansel Johnson worked against considerable opposition to link the coastal basalts of northwest Oregon to the Columbia River Basalt (CRB). Marv and Terry Tolan struggled with the distribution of the CRB in the Willamette Valley and examined model after model to explain the patterns they observed. The research Marv produced has stood the test of time.

Marv served on many University committees. He was known to be principled in his positions, consistently well prepared to discuss complex issues, and knowledgeable about the internal working of the institution. Because of his work, Portland State University is a better institution.

Marv was a firm believer in the role of the faculty in guiding the education of our students and in formulating the policy and ground rules by which the institution functions fairly and humanely for its students, staff, faculty, and administration.

I can go on for a long time relating examples of the leadership Marv provided, but the ultimate test lies in the lives he touched, the dreams he encouraged, and the vision by which he lived. The Department of Geology has renamed the Undergraduate Research Award Endowment in the PSU Foundation as the Marvin H. Beeson Undergraduate Research Award Endowment. We wish to remember what he did for us and to recite his contributions to future generations of students. You can make a donation in Marv's name at the website http://www.geol.pdx.edu/SpecialEvents/Beeson/Donationform.pdf. ■

When I was at the University of Oregon [as a graduate student] . . . my thesis area [was] on basalt. Everybody would say "Why would you do that?" There is no petroleum under basalt. (Most people went to work in the petroleum industry then.) "Why would you want to study something like the Columbia River Basalt?" What I decided is because, in a way, it is there. . . and there, and there, and there, and there [pointing to various areas on a map of Oregon and Washington]. It covers such a large area and it involves . . . a lot of problems. . . . We could do a lot about paleotopography . . . [and] structure. It is a tremendous tool for looking at the geologic history of this entire area.

Marv Beeson, Portland State University, May 23, 2001

EARTHQUAKE HAZARD MAPS NOW ONLINE

Earthquake hazard maps are now available for download in PDF and Geographic InformationSystem (GIS) formats. Every county in the state has both a NEHRP (National Earthquake Hazards Reduction Program) site-class map, which outlines areas where soils amplify ground shaking, and a liquefaction-susceptibility map, which outlines areas where water-saturated sandy soil loses strength during earthquake shaking. Regional earthquake hazard maps such as these support hazard mitigation, emergency planning and response, planning of local zoning ordinances, and building code enforcement. They can be downloaded from http://www.dnr.wa.gov/geology/hazards/hmgp.htm. More information can be found in the Spring 2004 edition of DGER News (http://www.dnr.wa.gov/geology/pubs/dgernews/dgernews_v1no1.pdf). ■

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