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**Date:** March 11, 2015

Dear Interested Citizen,

The Mt. Hood National Forest and the U.S. Geological Survey–Cascades Volcano Observatory (USGS–CVO) have identified you as an individual, agency, or organization with potential interest in commenting on our proposal to install four new volcanic monitoring stations in the Mt. Hood Wilderness.

The monitoring stations would be installed on lands managed by the Mt. Hood National Forest, U.S. Forest Service. The stations would be assembled and maintained by USGS–CVO. The data streams would be monitored by USGS–CVO and the University of Washington’s Pacific Northwest Seismic Network. The data gathered at these new stations and from similar stations on and around Mount Hood would be used to assess volcanic activity and as a basis for communications regarding volcanic hazards and public safety. Public officials, emergency managers, aviation specialists, water bureaus, land-use managers, homeowners, wilderness visitors, and the broader public rely on the USGS to provide timely notifications of hazardous activity.

### **Introduction**

Mount Hood is a potentially active volcano close to popular recreation areas as well as the growing communities of The Villages at Mount Hood, Sandy and the Portland metropolitan area. As a potentially active volcano, Mount Hood poses significant volcano, landslide, flood, channel migration and earthquake hazards to nearby communities and community assets.

To address the hazards posed by Mount Hood, the USGS-CVO, as part of its mandate to mitigate volcanic hazards, has proposed to install and maintain four new volcanic monitoring stations on the flanks of Mount Hood, all located within the Mt. Hood Wilderness boundary. The proposed monitoring stations are intended to provide USGS scientists with real time early and adequate warnings of any changes in seismicity, gas emissions, and ground deformation that may signal an increase in volcanic activity on Mount Hood. Mount Hood was designated as a very high threat volcano by the USGS in its 2005 National Volcanic Early Warning System (NVEWS) assessment of volcanic threat and monitoring abilities in the United States.

Recent reports assessed the level of monitoring in the Cascades and concluded that most Cascade volcanoes are under-monitored given the threats they pose to communities downstream and downwind (USGS Open File Report 2005-1164<sup>1</sup> and USGS Scientific Investigations Report 2008-5114<sup>2</sup>). This includes the Mount Hood volcano. Based on this classification the USGS

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<sup>1</sup> An Assessment of Volcanic Threat and Monitoring Capabilities in the United States: Framework for a National Volcano Early Warning System, (USGS Open-File Report 2005-1164) is available at: <http://pubs.usgs.gov/of/2005/1164/>.

<sup>2</sup> Instrumentation Recommendations for Volcano Monitoring at U.S. Volcanoes Under the National Volcano Early Warning System (USGS Scientific Investigations Report 2008–5114 is available at: <http://pubs.usgs.gov/sir/2008/5114/sir2008-5114.pdf>.



recommends that Mount Hood be monitored at the highest of four monitoring levels. It has been determined that the number and type of monitoring stations is inadequate close to the summit. Currently, at Mount Hood, there is only one USGS operated seismic station located within 3 to 6 miles (5 to 10 km) of the summit. It is paramount that additional stations be installed on Mount Hood to improve the monitoring capability of USGS-CVO. The four proposed stations are within 3 miles distance from the summit of Mount Hood, would complement existing USGS operated stations and greatly increase the ability of USGS-CVO to carry out its delegated Federal responsibility to provide notification and warnings of volcanic activity.

The USGS–CVO’s mission is to give timely warning to officials and the public regarding volcanic activity in the Cascade Range. To accomplish this mission, USGS–CVO monitors Cascade volcanoes; studies their eruptive histories (frequency, style and magnitude); assesses hazards; conducts basic research into how volcanoes work in order to understand physical processes and monitoring signals; and, provides information to communities to be used in land use planning and emergency response.

### **Background**

Mount Hood is an active volcano of the Cascade Range. It is located about 50 miles east of the Portland metropolitan area. Mount Hood is a long-lived volcanic center that has erupted recurrently during the past 500,000 years. In the recent past, the volcano has produced two significant eruptive periods, one about 1,500 years ago and the other during the 1780s to 1790s. Today, Mount Hood continues to show signs that it is a functioning active volcano. While not erupting, Mount Hood produces frequent earthquakes and earthquake swarms, and steam and volcanic gases are emitted in the area around Crater Rock near the summit.

Mount Hood’s primary eruptive style has alternated between lava flows that have traveled as far as seven miles and lava dome building. On the steep upper slopes of Mount Hood, growing lava domes have repeatedly collapsed to form hot, fast-moving pyroclastic flows and volcanic ash clouds. The extreme heat and scouring effect from such flows can swiftly melt significant quantities of snow and ice to produce lahars that surge down river valleys, typically far beyond the flanks of the volcano. In the past, large lahars have reached the Columbia River via the Sandy and Hood Rivers.

Given the well-documented hazards posed by volcanoes to both ground-based populations and aviation, continuous robust monitoring is critical for public safety and hazard mitigation. Volcanoes in the Cascades are monitored using a network of scientific instrumentation distributed throughout the area. These instruments include seismometers, tiltmeters, cameras, gas sensors, and Global Positioning System (GPS) devices. The monitoring instruments are capable of detecting small movements of rising magma as it breaks rocks, which causes detectable earthquakes, deforms the land surface, and releases gases. The data from these instruments are transmitted back to USGS–CVO for review and analysis.

Effective monitoring requires a geographically distributed network of instruments that are located on the upper flanks, and around the volcano, and for these stations to be in place before significant unrest occurs to catch the earliest subtle signals of rising magma. Once heightened volcanic unrest has been detected, it is often too late for scientists to install the instruments required for adequate monitoring without considerable compromise to the safety of workers.

With adequate monitoring systems in place, volcano observatories can provide accurate and timely forecasts and early alerts of possible eruptive activity.

### **Purpose and Need for Action**

The primary purpose of the project is to fill gaps in the monitoring network at Mount Hood, particularly on the upper flanks and near the summit area. These stations enhance the ability to detect subtle signals beneath the volcano that indicate unrest, earlier and with greater confidence than current capabilities allow. Another purpose is to gather the data needed to help ensure the safety of both the adjacent communities as well as recreationists using the wilderness and the Forest.

As such, there is an underlying need to:

- Establish new volcanic monitoring sites on Mount Hood volcano; and,
- Build resiliency into the existing monitoring network to maintain continuous, real-time monitoring.

### **Proposed Action**

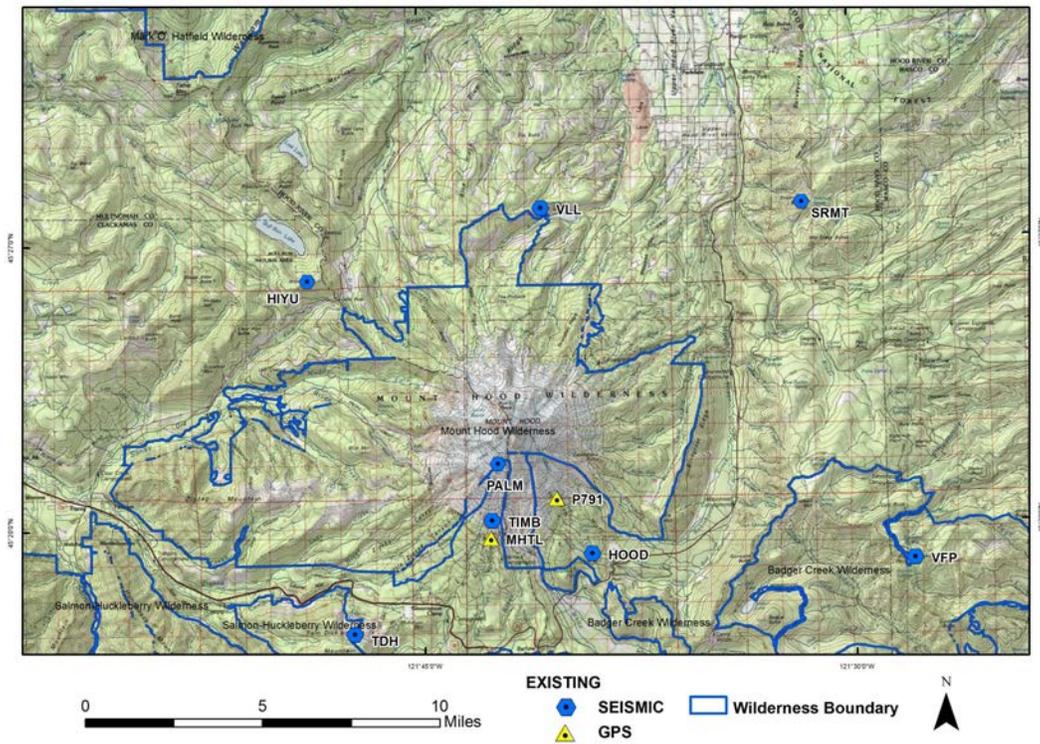
USGS–CVO and its partners currently operate ten monitoring stations near Mount Hood volcano in the Forest (Figure 1). The USGS–CVO proposes to install a total of four new volcano monitoring stations in areas of minimal human use on the flanks of Mount Hood volcano in the Mt. Hood Wilderness on the Zigzag and Hood River Ranger Districts (Figure 2). A minimum tools analysis following the Minimum Requirements Decision Guide (MRDG) has been completed for this project. The following sections provide more information.

#### Overview

The new instruments would consist of three co-located seismic and GPS stations, and one ground based continuous volcanic gas monitoring station. The legal descriptions for each station are listed in Table 1. The seismometers detect background and elevated seismic activity on the volcano. Having sufficient seismometers strategically located on and around the volcano allows for the detection and accurate location of small magnitude earthquakes and other seismic signals; analysis of which is used to determine if a volcano is reawakening while magma is still several miles below the summit. Additionally, seismic data aid in forecasting the likely onset time and style of eruptive activity.

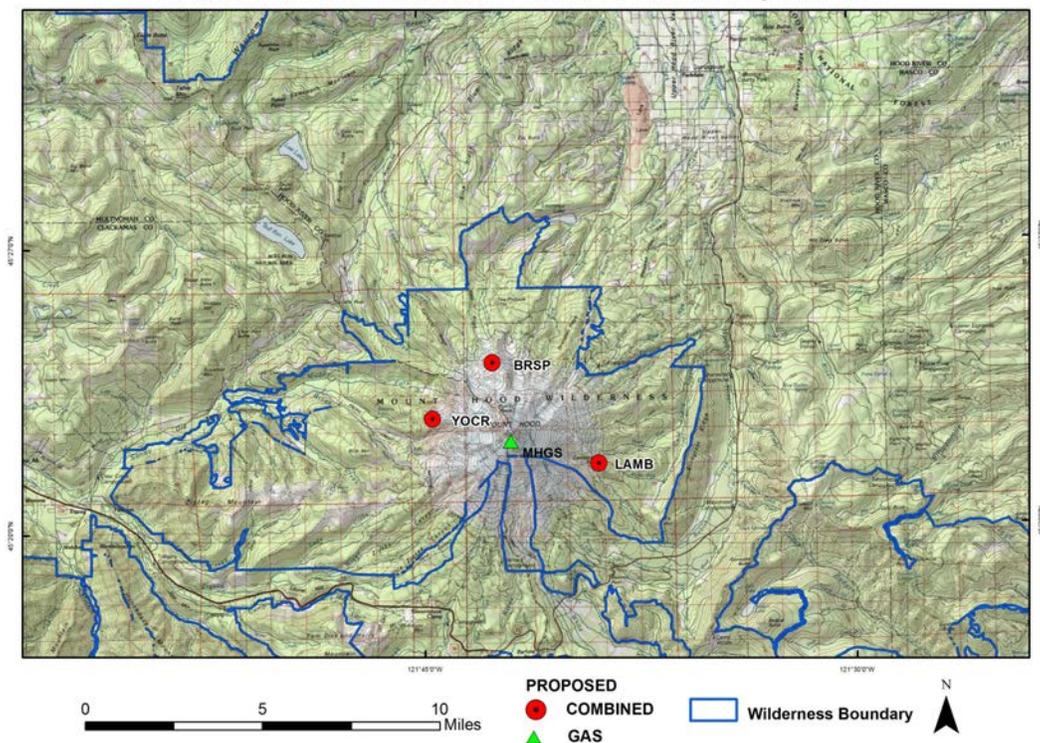
The GPS equipment measures subtle ground deformation of the volcano in response to magma entering or leaving the magma reservoir. Having multiple high precision receivers in place on the volcano flanks allows the distance between receivers to be determined to within less than a centimeter prior to, during, and after an eruption. Additionally, GPS data can help determine whether local earthquakes are caused by intrusion of magma or are of tectonic origin thus limiting false alarms of volcanic activity.

**Existing Mt. Hood Volcanic Monitoring Stations**



**Figure 1:** Map of existing USGS, PNSN and Plate Boundary Observatory volcanic monitoring stations on and around Mount Hood.

**Proposed USGS Wilderness Volcanic Monitoring Stations**



**Figure 2:** Map of proposed locations for the combined seismic/GPS and volcanic gas monitoring equipment to be installed on Mount Hood within the Mt. Hood Wilderness.

**Table 1:** Proposed USGS-CVO Volcanic Monitoring and Communication Stations

Site	Name	Type	Township	District
BRSP	Barrett Spur	Combined Seismic/GPS	2S, 9E, Section 18	Hood River
LAMB	Lamberson Butte	Combined Seismic/GPS	2S, 9E, Section 27	Hood River
MHGS	Mount Hood Gas	Gas	2S, 9E, Section 29	Hood River
YOOCR	Yocum Ridge	Combined Seismic/GPS	2S, 8.5E, Section 20	Zigzag

The main purpose of the gas monitoring station would be to measure the ratios of volcanic gases at Mount Hood and the temperature of the active fumaroles. This type of station would not measure emission rates of gases. Currently, Mount Hood emits a gas mixture composed of water vapor (~95.4%), carbon dioxide (CO<sub>2</sub>; ~3.3%), and hydrogen sulfide (H<sub>2</sub>S; ~0.3%) from boiling-point fumaroles (~195 degrees F). If the relative proportion of CO<sub>2</sub> were to change, or if sulfur dioxide (SO<sub>2</sub>) were to appear, the station would provide some of the first above-ground signals of changes in the hydrothermal system and the presence of new magma.

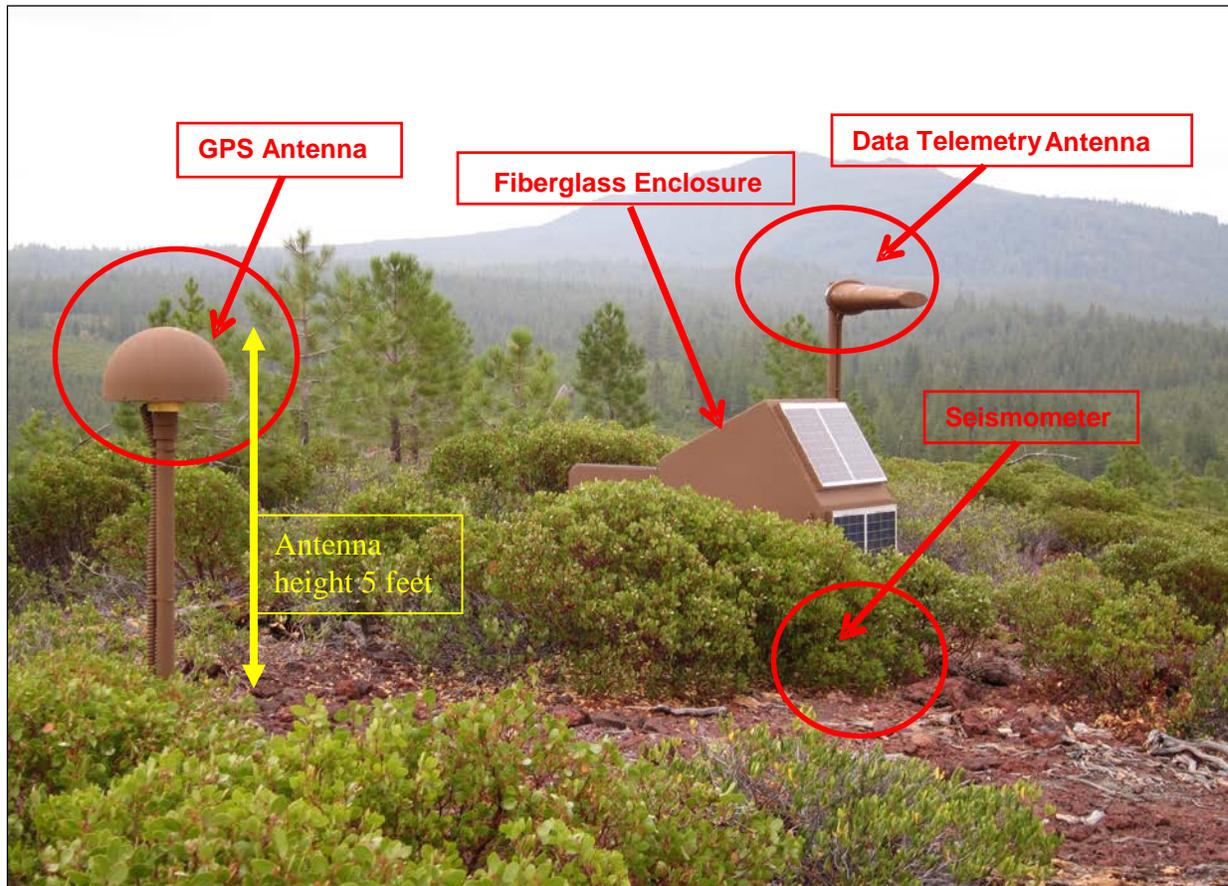
#### *Proposed Equipment Design*

The combined seismic and GPS stations enclosure type is fiberglass (Figure 3). All electronics and batteries would be located inside the water tight enclosure. Solar panels are mounted to an angled side of the enclosure and the stand-alone GPS antenna mast is located a few feet away from the enclosure. The GPS mast typically extends five to six feet above the ground surface. A small amount of cement is used to anchor the GPS mast and the corners of the enclosure to the ground. Any excavated dirt and sand would be placed over the top of the cement and graded by hand to match the preconstruction ground surface. The radio antenna is mounted outside on the side of the enclosure. Power to all the equipment inside the enclosure is provided by ten sealed lead-acid batteries inside the enclosure and solar panels mounted on the south facing side of the enclosure. The batteries, solar panels and the proposed enclosure and associated components serve as the minimum tools needed to accomplish the monitoring goals at Mount Hood.

The continuous volcanic gas monitoring station (Figure 4) would consist of a rectangular aluminum box placed directly on-the-ground that would not exceed 3x5x3 feet. The aluminum box would enclose ten air cell batteries and two to three waterproof plastic boxes that would house the volcanic gas measuring systems and satellite communications devices. The aluminum enclosure would be painted a flat brown or gray to minimize visibility.

Figures 5a and 5b show the approximate location of the proposed volcanic gas monitoring station in the Mount Hood Crater. Two locations are shown in Figure 5b, but only one monitoring device would be installed. The gas monitoring station would record and transmit gas concentration and composition data to USGS–CVO on a weekly basis via a satellite short burst data communication system.

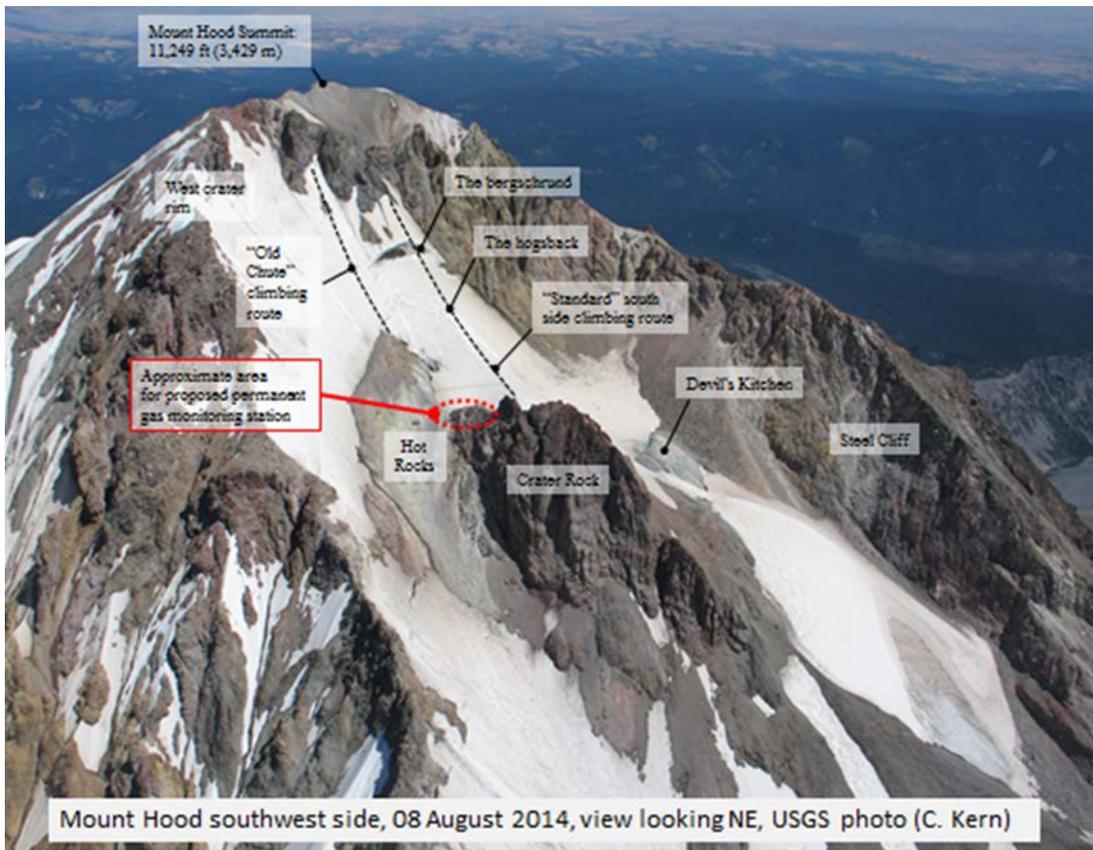
For additional information about the U.S. Geological Survey’s Cascade Volcano Observatory and to view the documents referenced in this letter please visit [http://volcanoes.usgs.gov/volcanoes/mount\\_hood/](http://volcanoes.usgs.gov/volcanoes/mount_hood/).



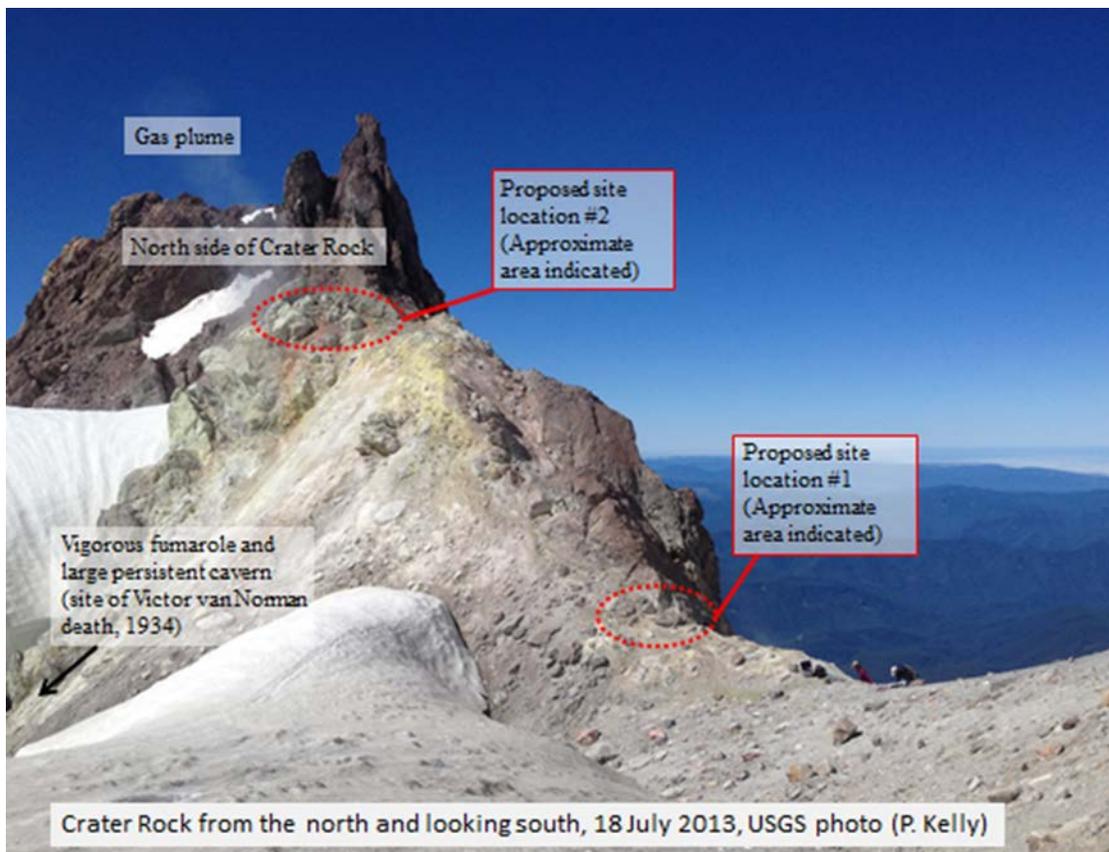
**Figure 3:** Photo showing an example of fiberglass enclosure style station with external GPS antenna mounted in bedrock. The digital seismometer is buried in the ground near the enclosure and not visible on site. This photo is of a USGS-CVO station installed on Newberry Volcano in the Deschutes National Forest in 2011. See Proposed Action for dimensions of equipment.



**Figure 4:** Photo showing approximate size and shape of continuous volcanic gas monitoring station to be installed on Mount Hood. Yard stick shown for scale.



**Figure 5a:** Photograph showing proposed location of the volcanic gas monitoring station (red dotted ellipse) in relation to Mount Hood summit, climbing routes and other landforms.



**Figure 5b:** Photograph showing proposed locations for gas monitoring enclosure. Only one station would be installed at either of the locations. USGS workers are shown in lower right for scale.

### *Installation Logistics*

All proposed sites are located on National Forest System (NFS) lands and accessible by existing roads and trails. After driving to the nearest trailhead, the sites will be reached by foot travel. During installation and battery replacement, helicopter use is needed given the unit size and weight. The volcanic monitoring state sites would be camouflaged, and would be visible only at close range.

Where and when necessary, a helicopter would deliver external sling loads of equipment, tools and materials to and from each site during construction and occasional maintenance operations when transport of bulky gear over varied and difficult terrain by foot is impractical. A minimum requirement analysis has been drafted for this project including analysis of transportation using the MRDG.

### **Designated Wilderness Area**

This project falls within the Mt. Hood Wilderness (A2 lands) within the Mt. Hood National Forest. The goal of these lands is to “promote, perpetuate and preserve the wilderness character of the land; protect watersheds and wildlife habitat; preserve scenic and historic resources; and promote scientific research, primitive recreation, solitude, physical and mental challenge, and inspiration” (Forest Plan, page 4-136). Similarly, Section(4)(3)(b) of the Wilderness Act (1964) states that “wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use”. This project is consistent with the goals of both the Wilderness Act and Forest Plan as a scientific research project.

The installation of the monitoring stations is a prohibited use identified in the Wilderness Act. Section 4(c) of the Act states: “there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.” Section 4(d)(1) of the Act, however, does include special provision where “such measures may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.” While these special provisions are not specific to volcanic eruptions, the Act contemplated natural events occurring within the area that could have detrimental effects on life or property outside the wilderness boundary and authorized the necessary measures for their control.

This monitoring data cannot be collected from non-wilderness sites; owing to the small magnitude of volcanic earthquakes and the localized nature of pre-eruptive deformation and gas emissions, the data must be collected from the flanks of the Mount Hood volcano, which is located entirely within designated wilderness. Mount Hood has had “frequent earthquake swarms” and is considered an active volcano. These monitoring stations are part of the NVEWS designed to move beyond a reactive mode of mitigating volcanic risk and toward a proactive, fully integrated approach. The seismic data collected from Mount Hood as part of this system is needed to ensure the safety of both the adjacent communities as well as recreationists using the wilderness and Forest.

The overall disturbance associated with these sites is summarized in Table 2. This project would impact approximately 105 square feet (<0.01 acre) at four separate sites, which represents a very small fraction of the designated Mt. Hood Wilderness (65,610 acres).

**Table 2:** Long Term Impact area for two USGS–CVO Station Designs

Type of Enclosure	Structure Dimensions (Ft) (LxWxH)	Long Term Impact Area (Square Ft)
Fiberglass Enclosure	5x5x5	30 (Includes GPS mast and seismometer buried in the ground.)
Gas Enclosure	3x5x3	15 (No external GPS mast or seismometer to be installed at site.)

The Department of the Interior, USGS has the delegated federal responsibility to provide notifications and warnings for earthquake, volcanoes and landslides to the affected populace and civil authorities. A MRDG for the installation and maintenance of these stations has been completed. This project would be implemented and maintained by the USGS–CVO using a special use permit.

### Opportunity to Comment

As directed by the National Environmental Policy Act (1969), the Forest Service and USGS–CVO are now seeking comments from individuals, organizations, local and state governments, and other federal agencies that may be interested in or affected by the proposed action. Comments may pertain to the nature and scope of the environmental, social, and economic issues, and possible alternatives to the proposed action. Comments will help the Forest Service and USGS–CVO determine the level of analysis required, refine the proposed action and develop mitigation measures. Comments will also determine the federal nexus and lead agency for completing the environmental analysis and documentation for this project.

Comments received in response to this solicitation, including names and addresses of those who comment, will be considered part of the public record for this project, available for public inspection, and released if requested under the Freedom of Information Act.

The Forest Service and USGS–CVO would like your scoping comments by **April 27, 2015**. Electronic comments may be submitted to [comments-pacificnorthwest-mthood@fs.fed.us](mailto:comments-pacificnorthwest-mthood@fs.fed.us) in a format such as an e-mail message, plain text (.txt), rich text format (.rtf), or Word (.doc). Please send your written comments to:

MaryEllen Fitzgerald  
Mt. Hood National Forest  
16400 Champion Way  
Sandy, Oregon 97055  
FAX: (503) 668-1423

You may also hand-deliver your comments to the above address during normal business hours which are 8:00 a.m. to 4:30 p.m. Monday through Friday, excluding federal holidays. All those who comment will remain on our mailing list and receive future updates on this proposal.

Additional information on this project is available at:

<http://www.fs.usda.gov/projects/mthood/landmanagement/projects>. If you have any questions concerning this proposal, please contact MaryEllen Fitzgerald with Mt. Hood National Forest at (503) 668-1429 or [mfitzgerald@fs.fed.us](mailto:mfitzgerald@fs.fed.us); or Benjamin Pauk at USGS-CVO at (360) 993-8992 or [bpauk@usgs.gov](mailto:bpauk@usgs.gov).

Sincerely,

  
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