Summary of the Stakeholders Workshop to Develop a National Volcano Early Warning System (NVEWS)

By Marianne Guffanti, William E. Scott, Carolyn L. Driedger, and John W. Ewert

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Contents

Figures

Tables

SUMMARY OF THE STAKEHOLDERS WORKSHOP TO DEVELOP A NATIONAL VOLCANO EARLY WARNING SYSTEM (NVEWS)

Portland, Oregon, 22-23 February 2006

Convened by the U.S. Geological Survey and Consortium of U.S. Volcano Observatories

INTRODUCTION

The importance of investing in monitoring, mitigation, and preparedness before natural hazards occur has been amply demonstrated by recent disasters such as the Indian Ocean Tsunami in December 2004 and Hurricane Katrina in August 2005. Playing catch-up with hazardous natural phenomena such as these limits our ability to work with public officials and the public to lessen adverse impacts. With respect to volcanic activity, the starting point of effective pre-event mitigation is monitoring capability sufficient to detect and diagnose precursory unrest so that communities at risk have reliable information and enough time to respond to hazards with which they may be confronted.

Recognizing that many potentially dangerous U.S. volcanoes have inadequate or no ground-based monitoring, the U.S Geological Survey (USGS) Volcano Hazards Program (VHP) and partners recently evaluated U.S. volcano-monitoring capabilities and published **"An Assessment of Volcanic Threat and Monitoring Capabilities in the United States: Framework for a National Volcano Early Warning System (NVEWS)"** (online at http://pubs.usgs.gov/of/2005/1164/). Results of the NVEWS volcanic threat and monitoring assessment are being used to guide long-term improvements to the national volcano-monitoring infrastructure operated by the USGS and affiliated groups.

The NVEWS report identified the need to convene a workshop of a broad group of stakeholders – such as representatives of emergency- and land-management agencies at the Federal, State, and local levels and the aviation sector – to solicit input about implementation of NVEWS and their specific information requirements. Accordingly, an NVEWS Stakeholders Workshop was held in Portland, Oregon, on 22-23 February 2006. A summary of the workshop is presented in this document.

Development of the NVEWS assessment and implementation framework was guided by CUSVO, the Consortium of U.S. Volcano Observatories. The principal CUSVO members are the Federal, academic, and State agencies directly and formally involved in observatory operations – *viz.*, the USGS, University of Washington, University of Alaska, University of Utah, University of Hawaii, Advanced National Seismic System, Earthscope Program of the National Science Foundation (NSF), Alaska Division of Geological and Geophysical Surveys, and Yellowstone National Park.

The NVEWS evaluation of monitoring capabilities is based on a systematic assessment of threats posed by all of the 169 geologically active U.S. volcanic centers. The methodology involves scoring volcanic threat for each volcano as the combination of various hazards factors (destructive natural phenomena produced by a volcano) and exposure factors (people and property exposed to the hazards). Based on the distribution of scores, five threat groups are identified ranging from Very High to Very Low. For each threat group, the commensurate level of monitoring that should be in place before the onset of an unrest crisis or eruptive activity is defined. The most threatening volcanoes, those near communities and transportation infrastructure (ground and air) and with a history of frequent and violent eruptions, need to be well monitored in real time with an extensive suite of instrument types to detect the earliest symptoms of unrest and to reliably forecast behavior

of the volcano. Waiting until unrest escalates to augment monitoring capabilities at these high-threat volcanoes puts people (including scientists in the field) and property at undue risk. Remote, isolated, or less frequently erupting volcanoes that nevertheless can pose hazards to air-traffic corridors require sufficient monitoring capability with ground-based instruments to detect and track unrest in real-time so that other agencies responsible for enroute flight safety can be kept apprised of the potential for explosive, ash-cloud-forming eruptions. Volcanoes that erupt infrequently and that pose little threat on the ground or in the air can be monitored by sparser networks and surveillance with meteorological satellites.

In the NVEWS monitoring assessment, the current monitoring level at each volcano is compared to the level indicated by its threat score to identify those volcanoes with significant monitoring gaps that require improvements (e.g., much of the Cascade Range) and highlights those that have no ground-based monitoring whatsoever (for example, parts of Alaska and the Northern Mariana Islands). Priority targets for monitoring improvements are dispersed throughout the United States, including in the Commonwealth of the Northern Mariana Islands (Figure 1).

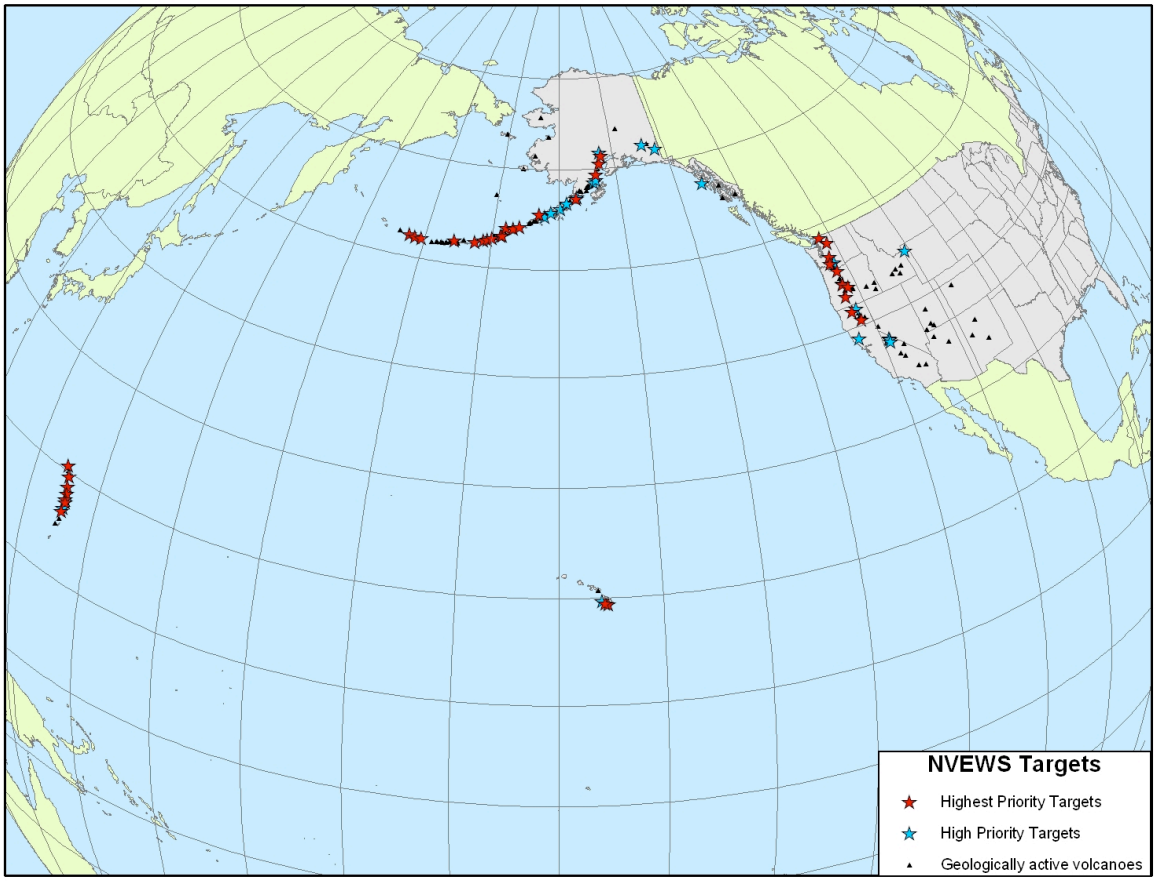
At the time of the report's publication in April 2005, **PRIORITY NVEWS TARGETS** were:

- 5 volcanoes currently or recently in eruption (Mount St. Helens in Washington, Kilauea in Hawaii, Anatahan in the Commonwealth of the Northern Mariana Islands, CNMI) or exhibiting heightened unrest (Mauna Loa in Hawaii, Mount Spurr in Alaska). After publication of the NVEWS report, Augustine Volcano in Alaska erupted from January to April 2006, and Anatahan stopped erupting in September 2005; both remain in states of heightened unrest as of July 2006;
- 13 very-high-threat volcanoes with insufficient monitoring (Rainier, Hood, Shasta, South Sister, Lassen, Crater Lake, Baker, Glacier Peak, and Newberry in the Cascade Range and Redoubt, Makushin, Akutan, and Augustine in Alaska);
- 19 high- and moderate-threat volcanoes that have high aviation-threat scores and **no** real-time ground-based monitoring (Semisopochnoi, Seguam, Kiska, Vsevidof, Yantarni, Little Sitkin, Recheschnoi, Cleveland, Amukta, Bogoslof, Amak, Kasatochi, and Yunaska in Alaska, and Pagan, Agrigan, Alamagan, Guguan, Farallon de Pajaros, and Asuncion in the CNMI); and
- An additional 21 under-monitored volcanoes in Washington, Oregon, California, Hawaii, Alaska, the CNMI, and Wyoming.

The NVEWS report identifies five main elements for effective implementation:

- Ensure that the most threatening volcanoes are properly instrumented before the onset of unrest;
- Evaluate monitoring data and provide volcanological expertise and rapid event notification during periods of escalating unrest and eruption at well-monitored volcanoes on a 24/7 basis;
- Improve both content of and access to hazard information products; create an NVEWS website that will post daily status reports covering all monitored volcanoes, including graphics and plots of monitoring data and links to related sites and official warning products;
- Create a National Volcano Data Center to archive diverse kinds of monitoring and related data in support of research to better forecast the onset, style, and duration of eruptive activity; and
- Efficiently utilize monitoring resources across agencies and institutions.

Figure 1. Map of priority volcano targets for NVEWS monitoring improvements.



WORKSHOP OBJECTIVES

No effort to provide reliable forecasting of volcanic hazardscan succeed without cooperation of land managers where networks are sited and hazards originate. Furthermore, earlier warnings of volcanic unrest will have little benefit to agencies charged with mounting a response or undertaking mitigation actions unless the information is conveyed in a manner they expect and understand. Broad participation in NVEWS planning is crucial to its success.

The main objectives of the workshop were to:

- *Improve risk awareness* – explain the results of the NVEWS analysis and implications for mitigation of volcanic threat.
- *Assess user needs* – solicit input about information products that NVEWS should and can provide.
- *Foster interagency coordination and collaboration* with partners at the Federal, State, & local level.

WORKSHOP ATTENDEES

Seventy-five people attended the workshop representing a cross-section of agencies, communities, and businesses (Table 1) that need and use volcanic-hazard information. People with diverse backgrounds and professions were brought together – scientists from the five U.S. volcano observatories and partnering institutions, airline dispatchers, air-traffic controllers of the Federal Aviation Administration, land managers from National Forests, Wildlife Refuges, and Parks, emergency management professionals from the Federal Emergency Management Agency (FEMA) and several states and counties, and representatives from the National Weather Service, U.S. Air Force, Yakama Nation, and Commonwealth of the Northern Mariana Islands. The workshop was structured with panels and breakout sessions to facilitate open discussion among attendees.

MAJOR FINDINGS AND RECOMMENDATIONS OF THE WORKSHOP

The two-day workshop highlighted the need to make the connection between improved volcano monitoring and the use of volcanic-hazard information in education, mitigation, and response activities at local, state, and national levels. Many lessons were shared from direct experience during volcanic crises and disasters in the past quarter century and from other recent natural disasters.

Major findings and recommendations from the panel and breakout sessions are highlighted below, organized by topics of crisis response, hazard messages and information exchange, permitting, regional issues, and community involvement.

Crisis Response

The Incident Command System imparts common communication and terminology and clear authority and structure during public crises. A commander oversees four major branches – Planning, Logistics, Finance/Administration, and Operations – as well as other units such as Information, Safety, and Liaison. Needed positions and qualifications for those positions are pre-determined. The system is meant to be flexible and enlarges and shrinks as needs dictate.

> ***In accordance with the National Response Plan and the National Incident Management System, as well as with coordination plans being written for several U.S. volcanoes, future volcanic crises involving ground-based hazards will be managed using the principles of the Incident Command System.***

Communication during a response should be as seamless as possible among agencies. The message to the public must be consistent, even if there is not complete agreement among scientists. Close working relationships among scientists and public officials are crucial throughout a volcanic response.

> ***Linking USGS to the command structure of civil authorities and availability of scientists to participate is an absolute necessity.***

When Mount St. Helens reawakened in 2004, the ability of the USGS Cascades Volcano Observatory to respond to media interest was overwhelmed, and setting up a Joint Information Center with the U.S. Forest Service and other partners proved to be a great help.

> ***The concept of a Joint Information Center (JIC) composed of representatives from key agencies to get a consistent ("seamless") and accurate message to the public was strongly endorsed at the workshop.***

Detecting unrest does not mean that scientists can always interpret what will happen (forecast) accurately. The best forecasts of volcanic activity have come from those volcanoes where we

have multiple historic events to study and data from multiple types of instrumentation such as at Mount St. Helens and Augustine.

Developing better monitoring capabilities as part of NVEWS will enable scientists to make the best forecasts possible and thus aid in supporting the JIC and Incident Command organizations.

According to one experienced emergency responder, "Five minutes before a party is not the time to learn to dance." Each relevant agency should have critical information compiled – on the shelf, in plans, on web sites, etc. – clearly specifying "what to do" and "with whom to do it" during a volcanic crisis.

As part of NVEWS, interagency response plans should be formulated for all very high and high threat volcanoes. Yearly reviews and practice of plans should be conducted to keep plans current.

An example of a response plan is the Mt. Rainier Volcanic Hazards Response Plan at http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/EMDiv/Mt%20Rainier%20VHRP.htm

The media time frame is 24/7. The advice of a land manager (USFS) is not to let a media vacuum develop, particularly when volcanoes are accessible to the public such as in the Cascades; in a vacuum, misinformation too easily can fill the void. Good communicators can make up for incomplete information.

Scientists must talk directly to the press frequently and with a coherent message.

Hazard Messages and Information Exchange

An important point was made in various contexts throughout the workshop: Trust in the messenger [of hazards information] is crucial to effectively convey the content of the message.

Building and keeping that trust must be held as an explicit value by all the agencies and institutions involved with helping people live safely and conduct their lives and businesses appropriately when faced with volcanic hazards.

The Internet age has changed the process of information dissemination, making it less top-down from the hazard agency to the users. People want ready access to information, with a substantial segment wanting to be able to specify what they will receive and filter out what they don't want. Information dissemination must allow for both pushing information out by the hazard agency (such as alert-level changes) and pulling it in when needed by the users (such as status reports of volcanic activity).

Accordingly, it is necessary to target subsets of users of hazard information by creating a variety of information products and by offering filters that are customized by users. For example, an NVEWS web space should consider offering an online "menu" of information products and delivery mechanisms from which people could customize a "subscription" (much as the USGS Earthquake Hazards Program website now does at http://earthquake.usgs.gov/eqcenter/ens/).

The information dissemination mechanism must be flexible enough to provide the type and frequency of online information required by individual users. Furthermore, warning messages should be carefully constructed to minimize unfamiliar jargon and employ the most appropriate format and units for various users.

Some information products are event driven (for example, a warning that a major eruption has occurred or is forecast) while others are time driven (a regular weekly or daily update).

Once volcanic activity starts, regular status reports are needed even when conditions at the volcano have not changed much; the most recent update must be prominently identified as such on websites. To reach citizens without access to the

Internet, agencies should use alternate methods such as television and newspaper outlets and phone lines with recorded updates.

Emergency managers from Pierce County, Washington, which encompasses Mount Rainier, presented an instructive example of linking USGS monitoring information to the mitigation actions of local users. A system for automatic detection of lahars (mudflows) has been installed along rivers on the western flank of Mount Rainier. When a lahar is detected, the system generates an automatic alarm that goes to local agencies responsible for notifying people of what action to take if lahars move toward populated areas (e.g., immediate evacuation from vulnerable areas). From the beginning of the project, USGS has worked closely with Pierce County on the development of the detection system, and both sides have clearly defined roles. The county uses a variety of methods to notify the public and builds redundancy into the warning system. The county is well aware that calling for an evacuation carries its own risk of panic, injury, and even death, so the stakes are very high that the detection and warning system be as reliable and accurate as possible.

Ashfall is the volcanic phenomenon/hazard that can affect the greatest number of people during an eruption. The National Weather Service and USGS have overlapping mandates to issue ashfall warnings to the public.

The workshop participants recommended that the USGS and NWS work together to improve ash fall forecasts, including better graphical depictions of where ash deposition is forecasted to occur.

Both the aviation sector and ground-hazards sector need reliable hazard information but have some significant differences in their perspectives. The aviation sector very quickly must ascertain and track the status of a changing set of volcanoes on a short-term basis during daily to weekly flight planning and dispatching, whereas responses to ground hazards often focus on the behavior of one volcano over the course of several months to years. A senior airline dispatcher at the meeting noted that airlines actively seek and use online information about volcanic activity and that it is best to have volcanic information early in the flight-planning process before flights take off.

Airlines have stated to the Federal Aviation Administration that information about ash-producing eruptions needs to get to regional air-traffic control centers very quickly, ideally within 5 minutes of the event, so that in-flight aircraft in the vicinity of an erupting volcano can be promptly notified and re-routed away from an ash cloud.

The USGS, National Oceanic and Atmospheric Administration, the Federal Aviation Administration, and Air Force Weather Agency (which provides ash-hazard notifications for U.S. Forces worldwide) actively collaborate to share data and continually refine communication protocols so that eruption and ash-hazard information quickly reaches commercial and military pilots, dispatchers, and air-traffic controllers.

Permitting for Instrument Installation on Federal Lands

Acquiring permits for installation of NVEWS monitoring equipment on sensitive federal lands such as Wilderness Areas can be a lengthy, difficult process.

NVEWS is envisioned to be a long-term project, and the USGS should consider assigning someone to become an expert in permitting for NVEWS.

Some land managers expressed confusion regarding how instrument sites and overall goals of the NSF's Earthscope Program relate to those of NVEWS. An expressed goal of NVEWS is to incorporate and use efficiently all appropriate monitoring resources, including those installed and operated by other institutions. The primary goal of deploying Earthscope instruments at volcanoes

is to provide data for deformation research. Such instruments are being deployed at a limited number of U.S. volcanoes in support of research, but they are being sited and deployed in cooperation with the USGS Volcano Hazards Program and, in addition to research data, will provide critical hazards information about the status of the volcanoes on which they are sited.

An effort will be made through NVEWS to coordinate the deployment of instruments by other groups such as those funded by the National Science Foundation to reduce confusion, avoid duplication of effort, and ensure that instruments can provide the hazards monitoring and research data sets.

The workshop also recommended that an interagency team be formed to recommend strategies for dealing with permitting issues. This team should consist of a representative from each relevant agency (U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, and USGS). The NPS representative should be a superintendent of a park with a hazardous volcano. The members of the team would not have power to issue permits, but would serve as facilitators and information sources for both land managers and permit requestors (usually the USGS).

Regional Considerations

NVEWS implementation must be tailored to account for regional differences – both in the nature of the hazards and in the societal setting – that occur across a country as large and diverse as the United States. In terms of the nature of the hazard, these differences include: potential for tsunami generation in Alaska, Hawaii, and the CNMI; lahar threats in the Cascades; rapid lava inundation in Hawaii; and vog effects on respiratory health in Hawaii and the CNMI. In terms of societal setting, differences include: temporary tourist concentrations at resort areas and National Parks, Monuments, and Forests in the conterminous U.S. and Hawaii; dominance of aviation risks over ground risks in Alaska and the CNMI; exposure to non-U.S. ash hazards in Alaska; desire by some people for pristine wilderness untouched by monitoring installations in Alaska, the Cascades, and Yellowstone; and people at risk that are off power/communication grids in Alaska, Hawaii, and the CNMI.

Given these differences, NVEWS implementation must build on the local and regional expertise of the observatory structure within the U.S.

Community Involvement -- Beyond Warning Messages

There was widespread consensus that the emergency-response community wants the USGS to provide interpretation of the significance of monitoring data; some groups also want the underlying data, but all emergency-response groups need scientific interpretation and situational awareness.

Scientists need to work closely with emergency managers, directly explaining uncertainty in forecasts of expected hazards and helping them to make the best decisions with the information at hand.

Communication is more than information dissemination. The great tragedy of Armero – a town in Colombia where nearly 23,000 people were buried alive by a mudflow generated by small eruption of the ice-clad volcano Nevado del Ruiz – was that communication of identified hazards failed. A Colombian geologist involved in responding to the eruption emphasized that the goal of communication is to form relationships among people involved in the issue.

The challenge for scientists is to participate over the long term in the transformative process by which knowledge is changed into specific actions taken by communities and officials.

The social sciences bring useful perspectives about how hazard warnings are perceived. Scientists and civil authorities should be aware of concepts that can color a person's thinking, such as normalization bias (little damage has occurred in recent events, so there is no problem with the current situation), optimization bias (some other person is at risk, not I), and transfer of responsibility (other people are responsible for preparedness).

Warnings and outreach should be preceded and followed by research in societal complexity, including case studies of hazard perception and preparedness to aid in gauging community readiness.

POST-WORKSHOP ACTIVITIES

CUSVO will continue to develop an NVEWS implementation plan by constituting small working groups to provide input on topics identified prior to the workshop: requirements and standards for monitoring instrumentation, online technical information products, data management and access, observatory interoperability, and an external grants program. These aspects of NVEWS are necessary for the CUSVO partners to provide the level of hazards information and analysis that land managers, emergency-management officials, and the aviation sector need and the public deserves.

A central theme raised often in the workshop is that expanded volcano-monitoring capability to detect and warn of escalating unrest and eruption must be accompanied by better community preparation, education, and action in areas that will be affected by volcanic activity. As one speaker said, "All emergencies are essentially local emergencies." Building stronger ties with people and organizations affected by the success or failure of hazard assessments and warnings is vital to reducing societal and economic disruptions and saving lives during future volcano activity.

Accordingly, a working group will be constituted to provide advice to CUSVO and the USGS Volcano Hazards Program on "Reducing Community Vulnerability to Volcanic Risk." The membership of the group will be mostly non-USGS people and will be charged with identifying strategies to help communities become more disaster resilient with respect to volcano hazards by improving use of early warnings and USGS/CUSVO information products.

The group will make recommendations about: the most effective methods for disseminating information to first responders before and during a crisis; how USGS/CUSVO, emergency managers and land-management agencies can work together during time between eruptions to better inform and educate the public; how an investment in NVEWS technology and science can be most effectively linked to risk-wise policy decisions; and which communities are high-priority targets for more intensive education, preparedness, and response planning.

STAKEHOLDERS WORKSHOP TO DEVELOP A NATIONAL VOLCANO EARLY WARNING SYSTEM: NVEWS

22-23 February 2006, Portland, Oregon

AGENDA

WEDNESDAY MORNING, 22 FEB. 2006

OPENING PLENARY SESSION, WILLAMETTE FALLS ROOM

8:30 **Welcome**
Session Chair: Linda Gundersen, USGS, Acting Associate Director for Geology

8:35-8:45 **Overview of Workshop Objectives**
James Quick, USGS, Volcano Hazards Program Coordinator

Keynote Addresses

8:45-9:00 **Readiness and Effective Mitigation**
John Pennington, FEMA Region 10, Regional Director

9:00-9:15 **Playing Catch Up with Volcano Hazards: Mount St. Helens Then and Now**
Stephen Malone, Univ. of Wash., Director, Pacific NW Seismograph Network

9:15-9:30 **Volcano Monitoring and Hazard Notification**
John Power, USGS, Alaska Volcano Observatory

9:30-9:45 **Applying Katrina Lessons to Volcanic Crises: A National Perspective**
William Lokey, Chief, Operations Branch of the Response Division of FEMA

9:45-10:00 **Volcanic Crises from the Perspective of County Emergency Management**
Steven Bailey, Pierce County WA, Director, Dept. of Emergency Mgt.

10:00-10:15 **Preserving Wilderness While Obtaining Volcano Data That Preserves Public Safety**
Kimberly Bown, Director of Lands, Rec., & Res., U.S. Forest Service, Region 6

10:15-10:45 Break

Framework for a National Volcano Early Warning System (NVEWS)

10:45-11:00 **Preparing for Eruptions: the Alaska Experience**
Thomas Murray, USGS, Scientist-in-Charge, Alaska Volcano Observatory

11:00-11:30 **Assessment of Volcanic Threat and Current Monitoring Capabilities in the U.S**.
Marianne Guffanti, USGS, Chair, Consortium of US Volcano Observatories

11:30-12:00 **Improved Volcano Monitoring: How Communities will Benefit from NVEWS**
John Ewert, USGS, NVEWS Project Chief

12:00-1:00 Lunch, Willamette Falls Room

WEDNESDAY AFTERNOON, 22 FEB. 2006

PLENARY PANEL 1, WILLAMETTE FALLS ROOM

1:00-2:30 **Lessons Learned That Will Help Design and Implement NVEWS**
Vicki McConnell, Oregon State Geologist (Chair)
John Ewert, USGS
Gail Ferguson, FAA
Bruce Houghton, University of Hawaii
Claire Lavendel, USFS

2:30-3:00 Break

BREAKOUT SESSIONS

3:00-4:30 **Monitoring Networks: Planning, Permitting and Installation, Willamette Falls Room**
Moderators: Lindsay McClelland, NPS, and John Power, USGS

3:00-4:30 **What Users Need from NVEWS Information Products, Wahkeena Falls Room**
Moderators: Gari Mayberry, USGS, and Peter Cervelli, USGS

THURSDAY MORNING, 23 FEB. 2006

PLENARY PANEL 2, WILLAMETTE FALLS ROOM

8:30-10:00 **Notifications of Volcanic Activity: Content, Structure, Dissemination**
Marianne Guffanti, USGS (Chair)
Leonard Salinas, United Airlines
Jeff Osiensky, NWS, Alaska
Michael Pierce, Dept. of Interior
Ken Parrish, Pierce County WA Dept. Emergency Mgt.
Fernando Muñoz, Community Communications Consultant

10:00-10:30 Break

BREAKOUT SESSIONS

10:30-12:00 **What Users Need on an NVEWS Website, Elowah Falls Room**
Moderators: Chris Nye, Alaska Div. Geol. & Geophys. Surveys,
and Dina Venezky, USGS

10:30-12:00 **Volcanic Monitoring Information for Effective Decision Making: What Works? Wahkeena Falls Room**
Moderators: Cynthia Gardner, USGS, and David Summer, USFS

10:30-12:00 **Mitigation Beyond Warning Messages: NVEWS as a Catalyst for Hazard Education, Preparedness, and Response Planning, Willamette Falls Room**
Moderators: Carolyn Driedger, USGS, and Chris Jonientz-Trisler, FEMA

12:00-1:30 Lunch, Willamette Falls Room

THURSDAY AFTERNOON, 23 FEB. 2006

BREAKOUT SESSIONS

1:30-2:30 **Volcano Monitoring and Mitigation: Topics Specific to Western Conterminous US, Elowah Falls Room**
Moderators: Bill Steele, UW, and Jake Lowenstern, USGS

1:30-2:30 **Volcano Monitoring and Mitigation: Topics Specific to Pacific Islands and Alaska, Wahkeena Falls Room**
Moderators: Jim Kauahikaua, USGS, and Tina Neal, USGS

2:30-3:00 ***Break***

CLOSING PLENARY SESSION, WILLAMETTE FALLS ROOM

3:00-4:00 **Major Findings of the Workshop**
Willie Scott, USGS and John Ewert, USGS

Adjournment

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Table 1. Workshop attendees

NAME	POSITION	AFFILIATION
David Applegate	Senior Advisor, Earthquake & Geologic Hazards	USGS Headquarters
David Ashe	Park Ranger	NPS, Mount Rainier National Park
Steven Bailey	Director	Pierce County (Washington), Department of Emergency Management
Teri Bequette	Workshop logistics	USGS, Cascades Volcano Observatory
Andy Bohlander	Emergency Management Coordinator	Washington Emergency Management Division
Betty Bollert	Dispatch Training Manager	Alaska Airlines
Kimberly Bown	Director of Recreation, Lands, and Mineral Resources	USDA, U.S. Forest Service, Region 6
Steve Brantley	Deputy Scientist in Charge	USGS, Hawaiian Volcano Observatory
Anthony Calvo	Planner, Federal Program Coordinator	Emergency Mgt. Office, Commonwealth of Northern Mariana Islands
Peter Cervelli	Research Geophysicist, Volcano geodesy	USGS, Alaska Volcano Observatory
Phil Cruz	District Ranger, Bend-Fort Rock	USDA, Deschutes National Forest
Claude Denver	Response Unit Leader	Alaska Division of Homeland Security and Emergency Management
James Devine	Senior Science Advisor	USGS Headquarters
Carolyn Driedger	Outreach Coordinator, Hydrologist	USGS, Cascades Volcano Observatory
John Ewert	Geologist and NVEWS Project Chief	USGS, Cascades Volcano Observatory, National Volcano Early Warning System
Gail Ferguson	Traffic Management Officer	Federal Aviation Administration, Anchorage Center
Steve Frye	Superintendent	NPS, Katmai National Park
Leon Fullner	Supervisory Traffic Management Coordinator	Federal Aviation Administration, Seattle Center
Cynthia Gardner	Observatory Scientist-in-Charge	USGS, Cascades Volcano Observatory
Chris Gregg	Assistant Professor of Geology	East Tennessee State University
Marianne Guffanti	Research Geologist and Chair of Consortium of US Volcano Observatories	USGS, Reston VA
Linda Gundersen	Acting Associate Director for Geology	USGS, Headquarters
Charles Holliday	Meteorologist, Branch Chief	U.S. Air Force Weather Agency, Satellite Applications Branch
Bruce Houghton	State Volcanologist	University of Hawaii
Chris Jonientz-Trisler	Natural Hazards Program Specialist	FEMA Region 10, Mitigation Division
James Kauahikaua	Observatory Scientist-in-Charge	USGS, Hawaiian Volcano Observatory
Paul Kennard	Region Geomorphologist	NPS, Mount Rainier National Park
Aleta Knight	Management Assistant	NPS, Hawaii Volcanoes National Park
Susan LaKomski	Division of Realty	US Fish and Wildlife Service, Alaska Region
Claire Lavendel	Forest Supervisor	USDA, Gifford Pinchot National Forest
Mike Lisowski	Research Geophysicist, Volcano geodesy	USGS, Cascades Volcano Observatory
Andy Lockhart	Geophysicist, Field instrumentation	USGS, Cascades Volcano Observatory
William Lokey	Chief, Operations Branch of the Response Division	FEMA, Headquarters
Jacob Lowenstern	Observatory Scientist-in-Charge	USGS, Yellowstone Volcano Observatory
Stephen Malone	Network Director	Pacific Northwest Seismograph Network, University of Washington
Margaret Mangan	Associate Scientist-in-Charge	USGS, Long Valley Observatory

NAME	POSITION	AFFILIATION
Gari Mayberry	Geoscience Advisor to Office of Foreign Disaster Assistance	USGS, Washington DC
Lindsay McClelland	Geologist, NPS-USGS liaison	National Park Service, Headquarters
Vicki McConnell	State Geologist	Oregon Department of Geology and Mineral Industries
Ken McGee	Research Geologist, Volcanic emissions	USGS, Cascades Volcano Observatory
Ed Miller	Project Manager, Volcanic Ash & Aviation Safety	Air Line Pilots Association
Seth Moran	Research Geophysicist, Volcano seismology	USGS, Cascades Volcano Observatory
Fernado Muñoz	Volcanologist and Community Communications Consultant	Chandler, Arizona
Thomas Murray	Observatory Scientist-in-Charge	USGS, Alaska Volcano Observatory
Manny Nathenson	Associate Team Chief Scientist	USGS, Volcano Hazards Team
Tina Neal	Research Geologist, Volcano hazards	USGS, Alaska Volcano Observatory
Christopher Nye	Volcanic Geologist, State of Alaska lead for Alaska Volcano Observatory	Alaska Division of Geological and Geophysical Surveys
David O'Hara	Emergency Services Coordinator	Mono County (California), Sheriff's Department
Jeff Osiensky	Volcanic Ash Program Coordinator	National Weather Service, Anchorage
Ken Parrish	Emergency Operations	Pierce County (Washington), Department of Emergency Management
John Pennington	Regional Director	FEMA Region 10
Mike Pierce	Emergency Manager	U.S. Department of Interior, Washington DC
John Power	Research Geophysicist, Volcano Seismology	USGS, Alaska Volcano Observatory
Will Prescott	President and Geophysicist	UNAVCO
James Quick	Program Coordinator	USGS, Volcano Hazards Program
Tom Ring	Hydrogeologist, Water Resources Program	Yakama Nation
Leonard Salinas	Dispatcher & Representative of American Dispatchers Federation	United Airlines
Dave Schneider	Research Geophysicist, Satellite remote sensing	USGS, Alaska Volcano Observatory
Willie Scott	Research geologist, Volcano hazards	USGS, Cascades Volcano Observatory
Bill Steele	Director of Information Services	University of Washington, Pacific Northwest Seismograph Network
George Stephens	Remote Sensing Scientist	NOAA, National Environmental Satellite, Data, and Information Services
Barbara Stunder	Meteorologist	NOAA, Air Resources Laboratory
David Summer	Fire Operations Specialist	USDA, U.S., Forest Service, Region 6
Steve Targosz	Pilot, Volcanic Ash and Aviation Safety Program	Air Line Pilots Association
Donald Thomas	Center Director	Center for Study of Active Volcanoes, University of Hawaii
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