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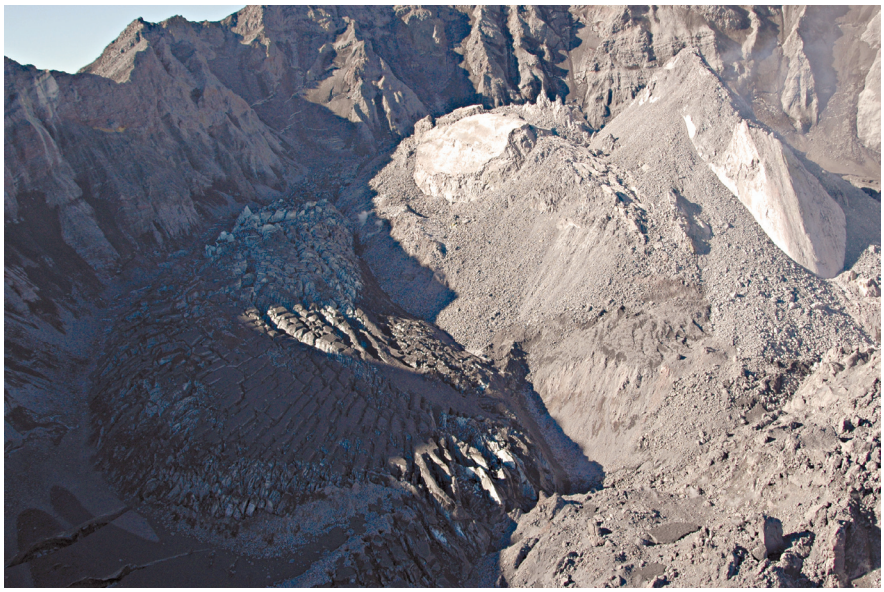
Crisis Management

Mount St. Helens reawakened during the age of electronic media and an unprecedented public appetite for real-time information. The volcano's legacy of a large explosive eruption in the 1980s—still within the memory of many—added an element of interest and drama to the volcanic unrest of 2004. The effort to satisfy that interest and meet the information needs of both media and the public, while simultaneously providing prompt hazard information to Federal, State, and local government officials, forms a story of its own, told here in two chapters on crisis management.

The emergency-response discipline has, over the years, recognized the value of Joint Operations and Information Centers as useful management tools. These centers are implemented on a temporary basis in response to crisis situations—be it wildfire, severe weather, or volcano related—and are purposely terminated as a crisis winds down. Such centers operated for about two weeks early in the 2004 eruption to help coordinate interagency operations and maintain a consistent, centralized source of current information about volcanic activity, hazards, and area closures.

The case is made herein for the value of advance planning and teamwork during the actual crisis. Successes during the eruption that began in 2004 stem from the depth to which partner agencies with responsibilities for Mount St. Helens have built their collaborative networks during the past quarter century. State and county emergency response agencies, the Gifford Pinchot National Forest, and the U.S. Geological Survey have been working together in the business of volcano-hazard awareness and risk mitigation since the 1980s. The framework of cooperation and understanding among these groups has been longstanding, originated through rank-and-file employees and passed unbroken to successive managers.



View southwest on July 26, 2005, with spine 5 on the right and a partially distintegrated spine 4 in center. USGS photo by S.P. Schilling.

A Volcano Rekindled: The Renewed Eruption of Mount St. Helens, 2004–2006
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Chapter 23

Managing Public and Media Response to a Reawakening Volcano: Lessons from the 2004 Eruptive Activity of Mount St. Helens

By Peter M. Frenzen[1] and Michael T. Matarrese[2]

Abstract

Volcanic eruptions and other infrequent, large-scale natural disturbances pose challenges and opportunities for public-land managers. In the days and weeks preceding an eruption, there can be considerable uncertainty surrounding the magnitude and areal extent of eruptive effects. At the same time, public and media interest in viewing developing events is high and concern for public safety on the part of local land managers and public safety officials is elevated. Land managers and collaborating Federal, State, and local officials must decide whether evacuations or restrictions to public access are necessary, the appropriate level of advance preparation, and how best to coordinate between overlapping jurisdictions. In the absence of a formal Federal or State emergency declaration, there is generally no identified source of supplemental funding for emergency-response preparation or managing extraordinary public and media response to developing events. In this chapter, we examine responses to escalating events that preceded the 2004 Mount St. Helens eruption and changes in public perception during the extended period of the largely nonexplosive, dome-building eruption that followed. Lessons learned include the importance of maintaining up-to-date emergency-response plans, cultivating close working relationships with collaborating agencies, and utilizing an organized response framework that incorporates clearly defined roles and responsibilities and effective communication strategies.

Introduction

Mount St. Helens has undergone major changes in volcanic activity and land-management direction since 1979. Public perception has run the gamut from "tranquil, snow-covered mountain" to "notorious killer volcano" and, most recently, to "celebrated volcanic attraction and research laboratory." These transformations, together with the recent return to eruptive activity in 2004, provide useful insight into how infrequent events such as eruptions can influence people's perception of natural hazards. A person's perception of "normal volcanic behavior" changes as a function of degree of personal experience with a volcano and time since the last eruption. Managers need to be prepared to address a wide array of public perceptions and responses as they seek to provide for public access, education, and visitor safety in these dynamic landscapes. Our experience at Mount St. Helens suggests that, in the days and weeks leading up to a potentially explosive eruption, it is the management of people and their responses to perceived events that poses the greatest challenge.

Events Shape Human Responses

Since the 1980 eruption, management and education programs at Mount St. Helens have been developed largely in response to catastrophic eruptive events and the prevailing lens of public perception. Between 1980 and 1986, memory of the catastrophic eruption was intense, and agency efforts were largely centered on emergency response, restoration of damaged resources, and creation of the congressionally designated Mount St. Helens National Volcanic Monument (U.S. Department of Agriculture Forest Service, 1984). Response to volcanic activity was managed by an Emergency Coordination Center (ECC) at the Gifford Pinchot National Forest headquarters in Vancouver, Washington. After explosive eruptions ended in 1980, geologists

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focused their efforts on monitoring an intermittently growing lava dome and developing increasingly sophisticated methods of eruption forecasting. In the early 1990s, several years after the dome-building eruption ended, the general consensus among geologists and emergency managers was that eruptive activity that began in 1980 had run its course. The ECC was discontinued, and an emergency response plan was developed that formalized calldown procedures and the role of collaborating State and local authorities in the event of renewed activity (U.S. Department of Agriculture Forest Service, 1992). During the next decade, in the absence of volcanic activity, emphasis on volcano emergency planning was reduced and efforts focused on restoration of damaged roads and construction of visitor facilities in and around the Monument (U.S. Department of Agriculture Forest Service, 1984).

Following an 18-year period of quiet, the rapid acceleration of events leading up to the 2004 eruption surprised many geologists and emergency managers. Agency managers quickly shifted their focus from visitor education and protected-area stewardship to management of a fast-paced media event and renewal of multiagency working relationships and contingency closure zones around the volcano. Public reaction to renewed volcanic activity varied with people's memory of the catastrophic 1980 eruption and familiarity with volcanic processes. The level of concern of some residents and emergency responders was heightened by their memory of the largely unpredicted, devastating lateral blast and geologists' uncertainty expressed prior to the 1980 eruption about the expected degree of explosiveness and areal extent of the eruption.

Planning is Key to an Effective Response

Following the 1980 eruption, land managers implemented revised land-use allocations in the Monument, on the basis of existing hazards assessments and recent experience. Federal acquisition of private and leased lands effectively created an uninhabited 8-km (5-mi) buffer around the volcano. Facilities and roads were placed on ridges above the level of valleys draining the volcano outside of immediate hazard zones. Visitor Center roofs were designed to support the combined weight of projected ash fall and precipitation. This groundwork greatly reduced the potential hazard to life and property and simplified the situation faced by emergency managers in 2004. Federal ownership of adjacent lands also greatly facilitated the October 2, 2004, evacuation and identification of 5-, 8-, and 11-km radius (3, 5, and 7 mi) contingency closure zones around the volcano. Mount St. Helens offers a compelling example of the importance of incorporating volcanic-hazards mapping in land-use planning, road location, and facility design.

The rapid pace of public and media response to events leading up to the 2004 eruption provided a vivid reminder of the importance of an up-to-date emergency-response plan and clearly defined roles for collaborating local, State, and Federal responders (table 1). Within hours of the release of the initial U.S. Geological Survey (USGS) Information Statement on September 24, 2004, media flocked to the USGS Cascades Volcano Observatory (CVO). The Monument's visitor-center staff received hundreds of media phone calls, conducted numerous drop-in interviews, and saw increased visitation. Live media coverage of the eruption greatly accelerated the pace of events both for scientists monitoring the eruption and monument employees. Two days after the initial Information Statement, the USGS issued an Alert Level 1: Notice of Volcanic Unrest, the lowest of their three alert levels, triggering emergency calldown procedures and initiating a series of coordination meetings and consultations between Federal, State, and local officials. Prompt notification and consultation proved to be important, because in only nine days the volcano progressed from no activity (background levels of seismicity) to rapid deformation of the crater floor and steam and ash eruptions. The pace and intensity of media and public response and need for thoughtful coordination among Federal, State, and local partners proved to be a challenge for participating agencies. A key lesson learned during the 2004 eruption has been the importance of developing a shared understanding of interagency roles and responsibilities and of ensuring a timely flow of information at both the field and leadership levels.

Emergency Preparedness Requires a Long-Term Commitment

Before the onset of renewed volcanic activity in 2004, it was difficult for the Gifford Pinchot National Forest staff and multiagency partners engaged in the press of daily business to find time to update the emergency-response plan and calldown list. Fortunately, status of the emergency-response plan was monitored as one of the National Forest's internal performance measures, and an updated response plan was completed in 2003. Planning efforts were largely a paper exercise, however, and many years had passed since the participating agencies last engaged in a table-top response exercise or a field-implementation drill—the need for which has been an important lesson learned during the 2004 eruption. Since that time, participating local, State, and Federal agencies have engaged in a table-top exercise, and Monument employees have conducted periodic readiness reviews and field-implementation drills. The future challenge will be maintaining awareness of volcanic hazards and a long-term commitment to effective interagency response as memory of the 2004 eruption fades.

Use of the Incident Command System

Volcanic eruptions and other large-scale disturbances can potentially impact large areas, triggering emergency responses by numerous agencies from multiple, often overlapping jurisdictions. Coordination of the response to the 2004 eruption was greatly facilitated by activation of the Incident Command System (ICS; Federal Emergency Management Agency, 2004). ICS provided the framework

for bringing together a regional, type-2 Incident Management Team (IMT–2) composed of Federal, State, and local emergency responders (fig. 1).

In 2004, following a USGS issuance of their highest alert level (Alert Level 3: Volcanic Alert), operations were directed through a Unified Command composed of a lead Incident Commander (IC) who shared command responsibility with a co-incident commander (Co-IC) from the Washington State Emergency Management Division (EMD) and a rotating Co-IC representing sheriffs from the four counties surrounding the volcano. Both the pace and efficiency of the response effort benefited from the resulting interagency coordination and unified voice.

The ICS is a highly organized, flexible structure that was developed for responding to fire and other emergency and nonemergency incidents on Federal lands. A major strength of ICS is the clear delegation of authority from the land-managing agency to the Incident Commander. The local Agency Administrator sets broad incident objectives and delegates management authority and responsibility for all aspects of the incident to the IC. This allows the IC to focus on a safe and effective response to the incident while the Agency Administrator focuses on day-to-day operations of the surrounding area. In cases where multiple jurisdictions are involved in response to a single incident, a Unified Command is established with command responsibility shared between two or more ICs, each representing his or her respective agency and Agency Administrator.

ICS offers the advantage of a uniform organizational structure composed of working groups that are universally recognized throughout the emergency-response community. This enables personnel trained in ICS functions to come together on a case-by-case basis and operate as an effective team. The size of an IMT is based on the size, complexity, or duration of the incident. On small (type 3) incidents, the IMT generally is staffed by personnel drawn from the local managing agency. As the incident grows in complexity—or if its duration exceeds local staffing capability—a larger, regional (type 2) IMT takes command. When size or complexity exceeds the capacity of a type-2 team, a national (type 1) IMT is brought in to manage the incident.

ICS is organized around five principal components or groups: Command, Planning, Operations, Logistics, and Finance (fig. 1). The Command component has primary authority and is responsible for setting overall objectives and priorities. Information and Safety are included in the Com-

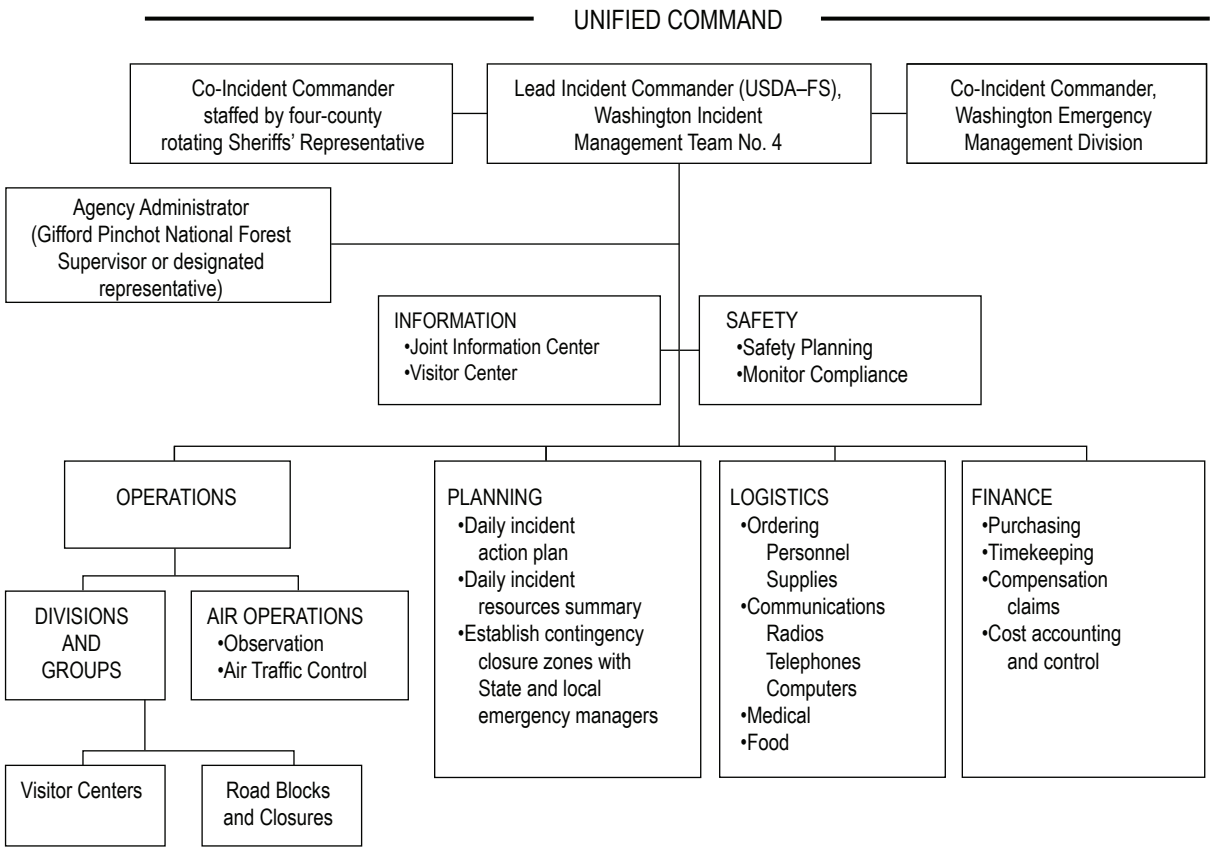

Figure 1. Organization chart for the short type-2 Incident Management Team that responded to the 2004 eruption of Mount St. Helens, Washington. USDA–FS, U.S. Department of Agriculture, Forest Service.

mand component because of their overall importance to ICS and the management of an incident. The Planning group develops action plans and collects and evaluates information about the status of the incident and available resources. The Operations group develops and conducts tactical operations to implement the plan; the Logistics group provides needed resources and support; and the Finance group provides cost accounting and procurement.

On October 3, 2004 (day 11 of the volcanic crisis), the Gifford Pinchot National Forest staff ordered a type-2 Incident Management Team known as a "short team" (fig. 1). Short teams are abbreviated versions of an IMT that provide an abbreviated command team and utilize local resources to fill in needed ICS functions. The National Forest staff utilized a Washington IMT that already included Gifford Pinchot employees and local collaborating agencies who were familiar with the volcano. The short team carried a full Command Staff composed of an Incident Commander, Deputy IC, Safety Officer, and Information Officer. Command was supported by a General Staff composed of Section Chiefs for Planning (responsible for contingency planning with collaborating agencies and preparation of daily action plans); Operations (responsible for managing area closures, patrols, and traffic management); Logistics (responsible for supporting field operations and the Joint Operations Center); Finance (responsible for managing business operations and cost containment); and Air Operations (responsible for a fixed-wing observation aircraft and managing air space around the volcano).

Factors Affecting Initial Response

The early phases of the 2004 eruption of Mount St. Helens did not fit any of the normal agency criteria for an incident response, which posed some interesting challenges for agency managers and field employees. Public interest was intense, but the eruption did not trigger resources for the logistical support and staffing normally associated with response to a forest fire or other large-scale event. At its public-interest peak, there were 24 satellite trucks at the volcano, media calls were arriving from around the world at

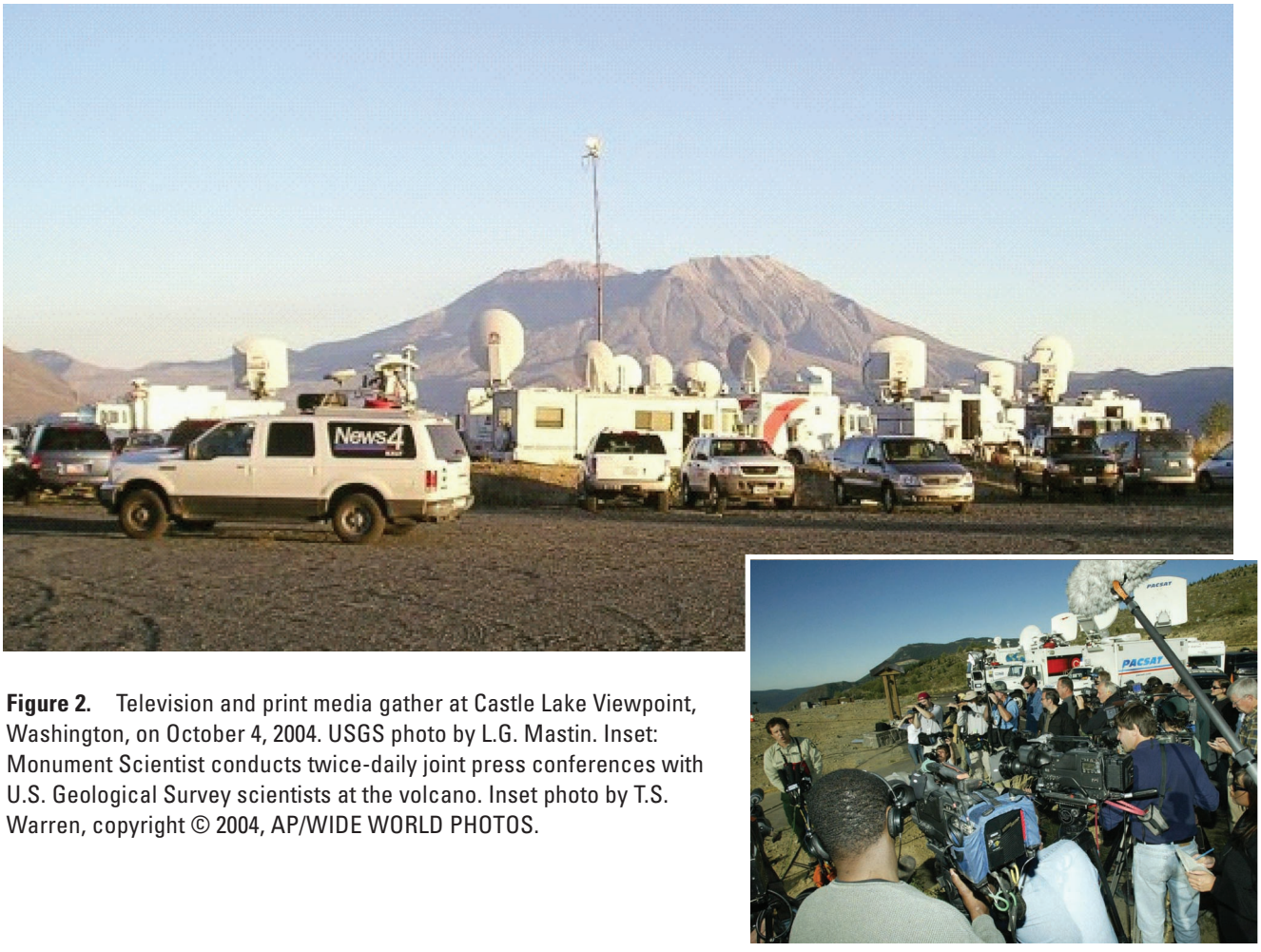

Figure 2. Television and print media gather at Castle Lake Viewpoint, Washington, on October 4, 2004. USGS photo by L.G. Mastin. Inset: Monument Scientist conducts twice-daily joint press conferences with U.S. Geological Survey scientists at the volcano. Inset photo by T.S. Warren, copyright © 2004, AP/WIDE WORLD PHOTOS.

Table 1. Initial management actions and lessons learned by local Ranger District personnel during days 1 through 5 of the 2004 eruption of Mount St. Helens, Washington.

[Volcanic events from this volume, Scott and others, chap. 1; Moran and others, chap. 2; Moran and others, chap.6. USGS, U.S. Geological Survey; CVO, Cascades Volcano Observatory; FS, U.S. Department of Agriculture Forest Service; M_d, earthquake coda magnitude.]

Day	Date	Volcanic events	Management challenges and responses	Lessons learned
1	Sept. 23	A swarm of small, shallow earthquakes begins at 0200 (depth less than 1 km, M_d less than 1) with 200 events recorded by 1700 PDT. The previous notable earthquake swarm occurred at 9 km depth in spring/summer, 1998.	Monument Scientist is notified by USGS–CVO, briefs other FS officials. CVO suggests earthquake swarm may be rock-fracturing from elevated ground water due to heavy rainfall.	On-staff science expertise helps transfer information from CVO to FS officials. Close working relationship with CVO staff proves invaluable for interpreting uncertain and rapidly changing events.
2	Sept. 24	CVO issues **Information Statement** describing earthquake swarm beneath 1980–86 lava dome and increased probability of small steam explosions in the crater. Number of seismic events peaks at midday and then starts to decline.	Monument posts information on Web site and at trailheads to notify climbers and hikers. Media flock to CVO, and visitor center (VC) staff responds to calls from media across the country. Staff familiarity with Mount St. Helens geology was an important ingredient in information transfer and effective response.	Monument response to fast-paced events was assisted by availability of employees well-trained in volcanic processes through past interpretive training by CVO staff. Managers of newly active volcanoes may need to bring in additional outside expertise for the short-term and (or) provide for needed employee training.
3	Sept. 25	Seismicity continues to decline through the afternoon and then begins to increase.	County sheriffs, emergency responders, and adjacent land managers all want to receive the latest information. FS and CVO initiate regular conference calls to brief collaborating State and local agencies.	The timely flow of information is a key element of an effective response. Since 2004, lead agencies have developed streamlined calldown procedures to facilitate the distribution of information and reduce duplication of effort.
4	Sept. 26	Shallow seismicity increases with 10 larger events (magnitude 2.0 to 2.8). **Alert Level 1: Notice of Volcano Unrest** is issued, the first such alert since October 1986. Character of some earthquakes suggests involvement of pressurized fluids (gas or steam) or perhaps magma. Increased possibility of small explosions, ashfalls above the crater rim, or small landslides and lahars.	Volcano is closed to climbing, and trails immediately north of the crater are closed. Satellite trucks, reporters, and volcano visitors continue to arrive, and a media center is established on a ridge west of VC. As number of media and visitors grows, logistics becomes increasingly challenging. By design, the FS Emergency Coordination Center (ECC) and Forest-Level Incident Management Team (IMT-3) are not activated until Alert Level 2.	Since 2004, the monument has developed local emergency-response procedures to support field operations during the early phases of a volcano-driven or public-interest-driven event. The plan recognizes the importance of maintaining strong working relationships between FS personnel and their local, State, and Federal counterparts. History of past collaboration with CVO and availability of CVO scientists for twice-daily briefings aids media response.
5	Sept. 27	Seismicity continues to increase slowly, although no events greater than magnitude 1.5 in last 24 hours. CVO crews report new crevasses in crater glacier south of 1980–86 lava dome. Gas flight does not detect magmatic gas.	FS officials review response plan and meet with collaborators to discuss interagency roles and responsibilities. The number of agencies and jurisdictions involved poses a challenge in the establishment of a Unified Command. Maintaining coordination and information flow is increasingly difficult as key personnel engage in interagency coordination and are assigned to VCs and other remote field sites.	2004 eruption demonstrated the need for maintaining up-to-date emergency-response plans that include clearly defined roles and lines of supervision for participating agencies. It is essential that co-incident commanders have a clear delegation of authority from the agencies that they represent. Periodic table-top exercises and response drills can help develop a shared vision of an effective multiagency response.

a rate of two per minute, and daily visits to the Monument's Web site exceeded 15 million (fig. 2).

By design, the Volcano Emergency Response Plan and Emergency Coordination Center (ECC) were not activated until CVO issued a Notice of Volcanic Unrest, three days after the earthquake swarm began. Activation of a local Incident Management Team (IMT–3) and associated logistical support was triggered when the Alert Level 2 (Volcano Advisory) was issued three days later (day 7). A major lesson learned in 2004 was the speed with which public and media response can outpace the actual progression of eruptive events. The task of responding to continuous, live media coverage and the many thousands of visitors who flocked to the volcano greatly exceeded the actual response needs generated by geologic events in what proved to be a remarkably quiet dome-building eruption (fig. 3). The Monument's response plan now includes provisions for augmented staffing and logistical support triggered by media and public response events irrespective of predetermined volcanic alert levels.

The use of predefined trigger points in emergency-response planning is useful because it focuses resources where and when they are most needed. In the case of the 2004 eruption, activation of ICS by the volcano alert system (Alert Level 1 on day 4 and Alert Level 2 on day 7; table 1) effectively compressed many critical response tasks into perhaps the busiest and most uncertain three-day period of the entire eruptive period. During

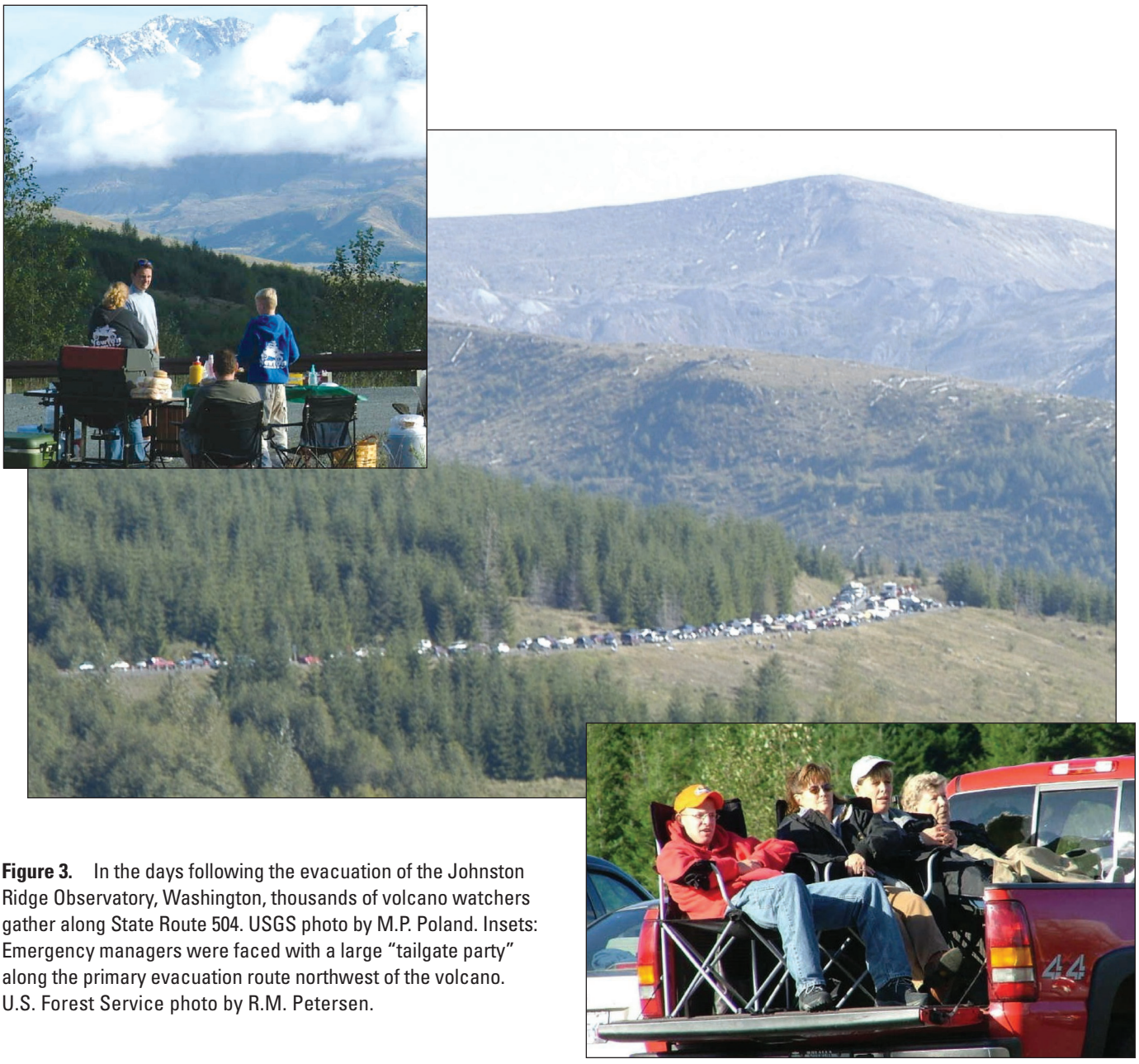

Figure 3. In the days following the evacuation of the Johnston Ridge Observatory, Washington, thousands of volcano watchers gather along State Route 504. USGS photo by M.P. Poland. Insets: Emergency managers were faced with a large "tailgate party" along the primary evacuation route northwest of the volcano. U.S. Forest Service photo by R.M. Petersen.

this three-day period, senior managers from the Gifford Pinchot National Forest and the Mount St. Helens National Volcanic Monument were engaged in coordination efforts involving multiple levels of the U.S. Department of Agriculture's Forest Service organization and those of collaborating local, State, and Federal agencies. Preparations were simultaneously underway to (1) establish a Joint Operations Center (JOC) managed under a multiagency Unified Command to respond to a potential large-scale eruption; (2) establish a Joint Information Center (JIC; Drieger and others, this volume, chap. 24) to handle steadily increasing national and international media coverage; and (3) activate a local Incident Management Team (IMT–3) to provide much-needed logistical support to field employees at the volcano. Local, State, and Federal managers were faced with considerable uncertainty as to the size of the potential eruption, the degree of hazard in adjacent areas, and the extent of a closure zone to implement around the volcano (fig. 4). In the absence of a State or Federal declared emergency, funding for associated personnel and response activities was also uncertain. To complicate matters further, these activities occurred at the end of the Federal fiscal year during a period of restricted purchasing and fiscal authority.

The combination of escalating earthquake activity and uncertainty about the anticipated eruption produced a heightened level of concern among emergency responders. Geologists at CVO did an excellent job of describing the most probable eruptive scenarios but were also careful to point out a broad range of less likely but potentially more destructive outcomes. Given the recent history and memory of the catastrophic eruption of May 18, 1980, geologists were careful to

Figure 4. Local, State, and Federal officials meet with Gifford Pinchot National Forest and U.S. Geological Survey officials on October 11, 2004, to discuss potential volcanic hazards and to define contingency closure zones. Photo courtesy of Pat Pringle.

frame potential eruptive scenarios within the context of how they differed from 1980. Geologists described the comparatively lower hazards associated with an open volcanic crater versus the magma-induced "bulge" that formed during the months preceding the 1980 eruption and failed so catastrophically. In the days preceding the Volcanic Alert and resulting October 2, 2004, evacuation of Johnston Ridge, there was considerable discussion about the presence or absence of gas-rich magma beneath the volcano. Geologists constructed probability trees in an effort to connect monitoring data with potential scenarios and to quantify the probability and magnitude of an explosive eruption.

The range of potential eruptive outcomes and potential for explosive activity formed the context within which local, State, and Federal agencies organized the emergency-response system. As live media coverage (fig. 2) fed a growing public interest and thousands of visitors gathered on Johnston Ridge, agency managers and geologists were actively discussing a potential pullback and the closure of an area 8 km (5 mi) radially around the volcano. Officials were concerned about potential human responses to a significant explosion or ashfall and the challenges posed by the evacuation of a large numbers of visitors on a single highway in steep, mountainous terrain. State and local officials who remembered the 1980 eruption were concerned about maintaining viable evacuation routes and providing an appropriate level of response in adjacent communities.

The steadily escalating tempo of earthquakes and rapid progression from Volcanic Advisory to Volcanic Alert (days 7 through 9; table 2) tested the emergency-response system. Implementation of the JOC and multiagency Unified Command was complicated by the fact that participating local, State, and Federal agencies each brought their own understanding of ICS, Unified Command, and its application to the process (table 2). Considerable effort was expended to work out the delegation of authority and lines of supervision associated with having a Unified Command composed of local, State, and Federal Co-Incident Commanders (lead IC from the IMT–2 for Federal; a representative of the Washington Emergency Management Division for State; and a rotating representative of the four county sheriffs for local jurisdictions). Communications and coordination were further challenged by the number of agencies, jurisdictions, and geographic locations involved in the response (CVO, JOC, GP National Forest headquarters, Monument visitor centers, and other remote sites).

The importance of instituting a Unified Command structure early in the process was a key lesson learned during the renewed eruptive activity of autumn 2004. Early activation allows collaborators time to familiarize their agencies with emerging issues, to make needed adjustments, and to implement needed agreements and delegations of authority. Early collaboration is important given the number of State and local agencies and jurisdictions involved in emergency response on National Forest and adjacent lands. Interagency response planning and periodic implementation drills can contribute to a shared understanding of roles, responsibilities, and supervisory structures and result in a more effective response.

Extended Eruptions Pose Challenges

During the fall of 2004, high levels of public and media interest were driven largely by the novelty of renewed eruptive activity and the opportunity to witness small steam and ash explosions. As the frequency of explosions diminished and winter weather increasingly obscured crater views, public interest evolved into fascination with the steaming volcano and amazement at the pace and longevity of the continuing eruption. Agency managers established closure boundaries and gate systems that restricted access to within 8 km (5 mi) of the volcano while providing access to adjacent areas for traditional forest activities (table 3). Since September 2004, the Monument has engaged in a sustained effort to manage evolving area closures, ensure adequate staffing during periods of increased visitation, and maintain a level of emergency preparedness among Monument employees. As geologists' confidence that any large-scale change in behavior will be detected by the monitoring network has increased, National Forest managers have reopened facilities and trails, restoring public access to most of the area surrounding the volcano.

The quiet, nonexplosive nature of the 2004 eruption provided a relatively safe opportunity for the public to watch volcanic processes firsthand and to increase their awareness of volcanic hazards in the Pacific Northwest. Since the fall of 2004, millions of people have learned about the ongoing eruption and monitoring through media coverage, Web sites, and personal experiences at the volcano. The continuing challenge for agency managers is to reaffirm the lessons learned during the 2004 eruption response and to periodically review and update interagency response plans and procedures. Given the intermittent nature of eruptive activity, we must adopt a long-term view and be prepared to act appropriately as volcanic events and associated public and media responses occur in the future.

Acknowledgments

The response to the 2004 eruption was truly a group effort. Our sincere thanks go to staff of the Gifford Pinchot National Forest; Mount St. Helens National Volcanic Monument; USGS Cascades Volcano Observatory; Washington Incident Management Team No. 4; Washington Emergency Management Division; Sheriff's Departments and supporting emergency responders from Clark, Cowlitz, Lewis, and Skamania Counties; Washington State Patrol; Washington Department of Transportation; Washington Department of Natural Resources; and the Federal Emergency Management Agency. Our response to worldwide media interest was greatly assisted by the availability of information officers from local, State, and Federal agencies whose voluntary assistance made the Joint Information Center possible. The manuscript benefited greatly from early reviews by Lynn Burditt and Tom Knappenberger and formal reviews by Drs. Shigeo Aramaki and Chris Newhall.

Table 2. Management actions and lessons learned following activation of the Emergency Coordination Center and type-3 Incident Management Team at the Gifford Pinchot National Forest Headquarters during days 7 through 11 of the 2004 eruption of Mount St. Helens, Washington.

[USGS, U.S. Geological Survey; CVO, Cascades Volcano Observatory; FS, U.S. Department of Agriculture Forest Service; M_d, earthquake coda magnitude. See table 1 for sources of volcanic events.]

Day	Date	Volcanic events	Management challenges and responses	Lessons learned
7	Sept. 29	Shallow seismicity accelerates overnight with four events per minute and increasing number of M_d 2–3 events. CVO issues **Alert Level 2: Volcano Advisory,** cautions that explosions, crater ballistics and ash clouds could occur at any time. GPS equipment detects northward movement of 1980–86 lava dome. No magmatic gas detected.	Emergency Coordination Center (ECC) and forest-level incident-management team (type 3) is activated, not all positions are filled. After 7 days, media-response capability at CVO and Visitor Centers begins to be strained. Federal and State officials discuss establishing a Joint Information Center to handle increasing demand for information and to allow CVO staff to focus on monitoring and eruption forecasting. Additional information officers arrive to help with media at Visitor Centers.	In 2004, public and media response to volcanic events was rapid and posed the biggest challenge to land managers. Current National Volcanic Monument response plans recognize the need for logistical support to field operations independent of volcano alert level. Plans include a trained cadre of local volcano-information officers to assist with phone calls and media inquiries at the Visitor Centers during the critical early phases of a volcanic or media-response event.
9	Oct. 1	CVO issues **Information Statement.** Seismicity continues at 1–2 events per minute, with largest up to M_d 3. Observations reveal uplift of Crater Glacier by several meters. At noon a small, 20-minute steam and ash explosion opens a vent in uplifted glacier. Elevated CO_2 detected on 1980–86 dome, and weak sulfurous odor but no SO_2 or H_2S.	Local, State, and Federal officials meet to discuss implementation of Unified Command and establishment of a Joint Operations Center. CVO and FS officials discuss potential hazards and trigger points for closure of the Johnston Ridge Observatory and viewpoints closest to the volcano. Visitor Center staff request additional help to handle expected crowds of volcano watchers for the coming weekend.	Maintaining timely flow of information to FS managers and field sites is the key to maintaining situational awareness and preparedness. Since 2004, CVO and FS have developed streamlined calldown procedures. As the eruption has continued, daily contacts have been replaced by weekly conference calls to keep Monument staff up-to-date on the latest monitoring information.
10	Oct. 2	Vigorous ~1-hour-long, low-frequency tremor occurs at 1215 PDT. Given that such tremors may indicate magma movement or pressurization, CVO issues **Alert Level 3: Volcano Alert**. Following the tremor, shallow seismicity continues at 1–2 per minute, with largest event M_d 3.	Visitor Center staff and State and local counterparts evacuate Johnston Ridge Observatory (JRO) and State Route 504. In less than an hour, 2,500 visitors and 14 satellite trucks are safely relocated. State highway, lands, and airspace within 8 km of volcano are closed. Some State and Federal officials express concern that evacuation of JRO exceeded the pace of official calldown procedures, but others view the 2004 evacuation of JRO as an example of front-line employees acting decisively to provide for public and employee safety.	The Monument emergency plan recognizes that field employees may need to act decisively in the interests of employee and visitor safety. Empowering field employees to implement clearly defined procedures can also be useful in the event that lines of communication fail. While empowerment of front-line employees is important, it is also critical to ensure that actions are well coordinated and communications are maintained across collaborating agencies and up and down the chain of command.
11	Oct. 3	25-minute low-frequency tremor occurs at 0250 PDT. Magnitude 3 earthquakes occur at a rate of one every 5 minutes. Large-scale uplift and fracturing of Crater Glacier continues.	Joint Information Center (JIC) is established at Gifford Pinchot National Forest Headquarters, providing relief for CVO staff and reducing media-call volume at Visitor Centers. CVO has difficulty reaching ECC afterhours contacts and finally reaches Visitor Center housing.	Afterhours calldown procedures have been amended to ensure that Visitor Centers are contacted directly by CVO. Maintaining vigilance in response to numerous seismic events and steam emissions over the long term is challenging.

Table 3. Management actions and lessons learned following activation of a short type-2 Incident Management Team from day 12 and onward in the 2004 eruption of Mount St. Helens, Washington.

[USGS, U.S. Geological Survey; CVO, Cascades Volcano Observatory; FS, U.S. Department of Agriculture Forest Service; M_d, earthquake coda magnitude. See table 1 for sources of volcanic events.]

Day	Date	Volcanic events	Management challenges and responses	Lessons learned
12	Oct. 4	22-minute-long steam and ash emission (3,700 m). Vent area is a bubbling lake. Visual observations assess tens of meters of uplift of Crater Glacier. Magma is at shallow level and could soon reach surface. Increased likelihood of larger steam and ash emissions. Gas flight detects CO_2 and low levels of H_2S.	FS brings in a regional Incident Management Team (IMT type 2) because Monument and Forest resources are becoming overextended. Unified Command coordinates the multiagency response effort. Providing resources to support IMT and field operations is challenging because a potential future eruption does not fit within the normal criteria for emergency-response funding or trigger an emergency declaration.	IMT-2 provides needed logistical support, organization, and supervision for increasingly complex multiagency effort. A key lesson learned is the importance of defining when Monument, National Forest, or regional-response officials are in charge. Since 2004, the Monument response plan clearly states that the Monument Manager is Incident Commander until the Forest Supervisor activates a Forest-level IMT.
13	Oct. 5	At 0905 PDT, a 70-minute-long steam and ash emission (4,500 m) deposits dusting of ash 60 miles to northeast. The ash plume is visible on Doppler weather radar. Seismicity drops and remains at low levels. Status remains at **Alert Level 3: Volcano Alert**.	Emergency response is directed by Incident Commander (IC) and two other co-ICs representing Washington State Emergency Management Division and four county sheriffs. Joint Operations Center is established. Resources include gate guards, traffic-control personnel at Visitor Centers, and fixed-wing observation aircraft.	IMT-2 provides welcome relief for Monument employees, many of whom have been on duty for more than 12 days. Current response plans recognize that Monument staff may need to be assisted by other Forest employees and resources during fast paced media events and prior to activation of a Forest or Regional IMT.
14	Oct. 6	Seismicity remains at reduced level. Probability of eruption that threatens life and property is decreased, so CVO steps back to **Alert Level 2: Volcano Advisory**. Rainfall overnight generates small debris flows in the crater. Low clouds and rain limit visibility and air operations.	IMT-2 and Forest representatives meet with local and State law enforcement and emergency managers to define closure zones; considerable discussion about the value of linking closure zones to specific alert levels. CVO and FS stress the importance of maintaining flexibility so closures can be adjusted according to current eruptive behavior and potential threats.	The Incident Command System (ICS) and Unified Command provide a useful structure for organizing a complex, multiagency response. However, in the absence of an emergency declaration or specific response funding, cost containment is a real concern. Response plans must ensure that key ICS functions are accounted for in a local response organization.
15 to 25	Oct. 7 to Oct.17	Shallow seismicity continues. After magma surfaces (day 19), seismicity gradually decreases. Small crater debris flows occur with rainfall. Status remains at **Alert Level 2: Volcano Advisory**.	Public and media interest declines as explosive activity subsides and weather obscures volcano. IMT-2 departs and operations are transitioned back to local IMT-3. As hazards diminish, closures are lifted and staffed temporary gates are replaced with unstaffed, permanent gates.	In absence of explosions, media and public interest in ongoing eruptive activity decreases. Outreach and information efforts are key to maintaining awareness of ongoing events and potential future hazards. Periodic press conferences and field visits aid outreach effort.
26 to 575	Oct.18, 2004 to June 2006	Continuous eruption and formation of spines. Extrusion rate and seismicity gradually decline. Periodic small steam and ash emissions with dome rockfall. Status remains at **Alert Level 2**.	Maintaining calldown procedures and response capability over months and years of continuous eruptive activity is a challenge. As comfort level with continuing nonexplosive eruption grows, additional areas around the volcano are reopened.	Confusion can occur when staff unfamiliar with volcanic processes and terminology relay technical information during calldowns. Need to ensure that contacts are knowledgeable about monitoring terminology and volcanic hazards.

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Chapter 24

Hazard Information Management During the Autumn 2004 Reawakening of Mount St. Helens Volcano, Washington

By Carolyn L. Driedger[1], Christina A. Neal[2], Tom H. Knappenberger[3], Deborah H. Needham[4], Robert B. Harper[5], and William P. Steele[6]

Abstract

The 2004 reawakening of Mount St. Helens quickly caught the attention of government agencies as well as the international news media and the public. Immediate concerns focused on a repeat of the catastrophic landslide and blast event of May 18, 1980, which remains a vivid memory for many individuals. Within several days of the onset of accelerating seismicity, media inquiries increased exponentially. Personnel at the U.S. Geological Survey, the Pacific Northwest Seismic Network, and the Gifford Pinchot National Forest soon handled hundreds of press inquiries and held several press briefings per day. About one week into the event, a Joint Information Center was established to help maintain a consistent hazard message and to provide a centralized information source about volcanic activity, hazards, area closures, and media briefings. Scientists, public-affairs specialists, and personnel from emergency-management, health, public-safety, and land-management agencies answered phones, helped in press briefings and interviews, and managed media access to colleagues working on science and safety issues. For scientists, in addition to managing the cycle of daily fieldwork, challenges included (1) balancing accurate interpretations of data under crisis conditions with the need to share information quickly, (2) articulating uncertainties for a variety of volcanic scenarios, (3) minimizing scientific jargon, and (4) frequently updating and effectively distributing talking points. Success of hazard information management during a volcanic crisis depends largely on scientists' clarity of communication and thorough preplanning among interagency partners. All parties must commit to after-action evaluation and improvement of communication plans, incorporating lessons learned during each event.

Introduction

In late September 2004, a sudden and rapidly accelerating increase in seismicity beneath Mount St. Helens heralded the onset of the first volcanic event of consequence in the contiguous 48 states since 1986 (Dzurisin and others, 2005). In addition to its volcanologic significance, the 2004 eruption captured the attention of the public worldwide, who, even after 24 years, vividly recalled the images and impacts of Mount St. Helens' catastrophic eruption on May 18, 1980. The 2004–2006 eruption was also the first in the contiguous 48 states since the establishment of widespread Internet use and development of the 24-hour international news cycle and its attendant around-the-clock demands. An Internet Web camera (VolcanoCam) installed and maintained by staff at the Gifford Pinchot National Forest (GPNF) gave unprecedented access to visual images of a Cascade Range eruption in near-real time. Real-time seismic information in the form of Internet-available seismograms maintained by the Pacific Northwest Seismic Network (PNSN) enabled the general public to monitor the volcano from home computers. At Mount St. Helens National Volcanic Monument (MSHNVM), scenic overlooks, such as the Johnston Ridge Observatory (JRO), provided an unprecedented view for thousands of visitors (fig. 1). All of these factors combined to create an enormous and urgent demand

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for information and commentary regarding the volcano and its activity, hazards, likely outcomes, the daily activities of scientists, and any other available information about Mount St. Helens, one of the world's most famous volcanoes. This chapter describes some of the pre-event planning, the real-time development of strategies to respond to this demand, significant challenges, and lessons learned. Additional details regarding the first few weeks of unrest and eruption can be found in other contributions in this volume (Scott and others, chap. 1; Moran and others, chap. 2; Qamar and others, chap. 3; Moran and others, chap. 6).

Pre-Event Coordination and Planning

Since the mid-1990s, the U.S. Geological Survey (USGS) has produced a series of modern volcano-hazard assessments for each potentially active volcano in Washington and Oregon, including Mount St. Helens (Wolfe and Pierson, 1995). Each assessment was written in a format accessible to both technical and lay audiences and was distributed to public officials, educators, and public libraries in areas at risk.

Soon after this series of publications was completed, USGS staff began working with partner agencies in Washington and Oregon to develop hazard-response plans based on the assessments. These response plans define the roles of individual agencies and protocols for cooperation during volcanic unrest, such as the plan for Mount St. Helens (Gifford Pinchot National Forest, 2003). As of spring 2006, volcano-response plans now exist for Mounts Baker, Rainier, St. Helens, and Hood, and for Glacier Peak. Similar plans are in progress for Mount Adams and for the volcanoes of central Oregon.

Figure 1. Visitors at Mount St. Helens National Volcanic Monument's Johnston Ridge Observatory, Wash., view the October 1, 2004, explosion of steam and ash from vent approximately 9 km south, in crater. USGS photo by E.Y. Iwatsubo.

Ironically, the USGS was working with the GPNF and other agencies to update the Mount St. Helens plan when the 2004 volcanic unrest began.

In addition to collaborating on volcano response protocols, the USGS maintains active cooperation with its partners in hazard communication on the Federal, State, and local levels. This includes planning and practicing rapid initiation of a Joint Information Center (JIC), sharing expertise at news briefings, and assembling interagency-communication call-down lists. Since the 1980s unrest at Mount St. Helens, staff at the University of Washington's (UW) PNSN in Seattle have coordinated with the USGS in the development and release of Volcano Information Statements and Volcanic Alert Level changes. This close collaboration, refined over the years, enabled separate but well-synchronized media responses to the rapidly evolving unrest at Mount St. Helens that began on September 23, 2004.

Chronology of Events

The initial earthquake swarm on the morning of September 23, 2004, now commonly viewed as the onset of volcanic unrest, was noted in a Cascade Range update posted on the USGS-Cascades Volcano Observatory (CVO) Web site at 1800 PDT, but it brought little immediate inquiry from the media. The following morning CVO and PNSN released an Information Statement regarding the earthquake swarm, and veteran public viewers of seismograms on the PNSN Web site began to recognize the potential significance of the seismicity. This recognition culminated in approximately one dozen media inquires per day during the next few days at CVO. The PNSN, which provided information to Seattle television and radio stations and newspapers, was inundated by requests regarding the earthquakes. The growing public interest in the unrest resulted in a deluge of requests for information from members of the local press and other media providers. The PNSN published a press release on its Web site that described the onset of the earthquake swarm and provided links to seismicity pages on its own Web site and to Web sites of CVO, GPNF, and other sources. The PNSN Seismology Lab staff extended their operation to seven days per week, often working late into the night. As seismicity increased, the PNSN placed a disclaimer on its Web site, noting that postings for recent earthquakes were incomplete because staff could not keep up with processing these seismic events during regular working hours.

On September 26, the USGS issued an official Alert Level 1: Notice of Volcanic Unrest (unusual activity detected; Dzurisin and others, 2005), prompting inquiries to increase at both CVO and UW from about one dozen to more than 40 per day. Scientists at the USGS and PNSN consulted one another early each day about the increasing seismicity. After these conversations, USGS staff wrote formal talking points for use by information scientists, who were scientists recruited to speak

to the media. On September 29, the USGS issued an Alert Level 2: Volcano Advisory (eruption likely but not imminent) and began to offer formal media briefings.

Staff at CVO and the USGS Office of Communications worked hard to address all inquiries in the face of increasing interest. Scientists identified the range of eruption potential. The ability to compile, synthesize, and understand the significance of the events was strained by mounting demands for information. The U.S. East Coast news cycle resulted in interviews at 0400 PDT, challenging USGS personnel as they struggled to maintain adequate 24-hour staffing. Only a few individuals rotating through the informal position of information scientist had the breadth of knowledge about all aspects of the volcanic unrest to answer all questions. Scientists found it challenging to interpret and distill the continuous stream of field data into timely public statements.

At the PNSN, television satellite trucks filled the parking lot, and staff and student volunteers struggled to keep up with phones and interview requests. In an attempt to make the monitoring and media response more sustainable, staff were ordered home after a 12-hour shift, and a number of key staff alternated on 12-hour shifts. By Monday, September 27, the PNSN Web site became completely congested, and system administrators were forced to configure high-capacity servers on the UW network backbone to serve the PNSN site.

During this time, USGS staff supplied information to the news media (many of whom kept satellite trucks present all day and night), critical operational partners, and other scientists, primarily by telephone and by the release of once- or twice-daily text updates by e-mail, faxes, and postings on the CVO Web site. Independently, colleagues at other USGS offices, the PNSN, the GPNF, and the Washington State Emergency Management Division (EMD) handled other inquiries. The communications landscape faced by USGS scientists is shown schematically in figure 2.

By September 28, five days into the event, USGS communications and technical staff were fielding 60 or more inquiries per day. It became apparent that media and public demands for information would soon exceed the capacity that could be managed effectively by any single agency. That notion, and the concern for the consistency and centralization of hazard messages, prompted the USGS to work with agency partners from the GPNF and the Washington EMD to plan and establish a JIC, described more completely later in this chapter. On September 29, GPNF officials and local emergency managers arriving at CVO to discuss the JIC encountered numerous media trucks in the parking lot and had to step over media cables that snaked through the CVO lobby, preventing the doors from closing at this normally secure government facility. It was clear that, in order for CVO staff to function, a JIC facility would need to be located away from CVO. The GPNF headquarters in Vancouver, only six miles distant, was chosen as a logical site.

During this time at the PNSN, UW Computing and Communications staff installed fiber-optic television circuits in the Seismology Lab to help meet the continually increasing demand for staff interviews, which now included national and international media providers. To help manage the more than 100 daily phone calls, a six-line phone bank was installed in the conference room adjacent to the lab. This facility was staffed by students and also was used for interviews with national and international media members.

As the rate and magnitude of earthquakes under Mount St. Helens continued to build, speculation about the nature of the coming eruption became the focus of many press reports. Daily teleconferences between PNSN and USGS–CVO scientists were crucial in formulating and sharing assessments of the volcano. Frequent consultation helped keep the public message from CVO and PNSN reasonably consistent.

On October 1, with JIC provisioning still in progress, a 20-minute-long steam and ash emission sent ash more than 3 km above the crater (Dzurisin and others, 2005; Moran and others, this volume, chap. 6). News of this event escalated inquiries to more than 80 per day at CVO. At PNSN, requests for information lessened slightly as attention shifted to CVO and the MSHNVM Castle Lake Viewpoint.

On October 2, intensified seismicity, including an hour-long period of energetic seismic tremor, prompted USGS–CVO to issue its highest warning level for the Cascade Range, an Alert Level 3: Volcano Alert, which means that a volcanic event threatening to life and property appears imminent or is underway. That afternoon millions of viewers worldwide watched a media briefing at CVO presented to U.S. Department of the Interior Secretary Gale Norton and a host of congressional dignitaries. Its political significance and public interest confirmed, Mount St. Helens unrest had become an incident of national and international prominence.

Late on the afternoon of October 2, the JIC opened its doors at GPNF headquarters. The media, at first reluctant to move from CVO, were eventually persuaded to relocate owing to the disciplined refusal of CVO staff to answer their inquiries onsite and by the ready availability of expertise at the new JIC. All information sources, including public-information officers (PIOs; a term that we use in a general sense to include a variety of professionals, other than volcanologists, who communicated with the media and public), scientists, staff at the USGS Office of Communications, and agency phone recordings, referred media to the JIC as the principal source of volcano information.

The JIC was fully activated from October 3 to October 13, spanning the buildup to and start of lava extrusion (Dzurisin and others, 2005). After October 13, media attention diminished sufficiently to allow JIC staff to return to normal agency facilities. Remaining calls were addressed at CVO by the outreach staff, information scientists, and USGS Office of Communications staff. The latest information, usually from the daily update, was made available on a 24-hour media line maintained and updated by the GPNF. Importantly, according to Incident Command principles for an evolving, ongoing situation, former JIC employees maintained contact so that in the event of later heightened activity, the information systems could be reestablished quickly. As of this writing in October

2006, no escalation of activity requiring JIC reactivation has occurred at Mount St. Helens.

Media interest in Mount St. Helens decreased owing to cessation of dramatic steam and ash explosions and the onset of cloudy weather, which blocked views of the volcano. Media managers were unwilling to pay for satellite trucks sitting idle and were less willing to report daily about lava dome-building events when interesting visual images were unavailable.

Development of Joint Operations Center and Joint Information Center

During the onset of volcanic unrest at Mount St. Helens, USGS and PNSN scientists and other public officials conducted their own hazard information dissemination according to each agency's protocols. As unrest escalated and the demand

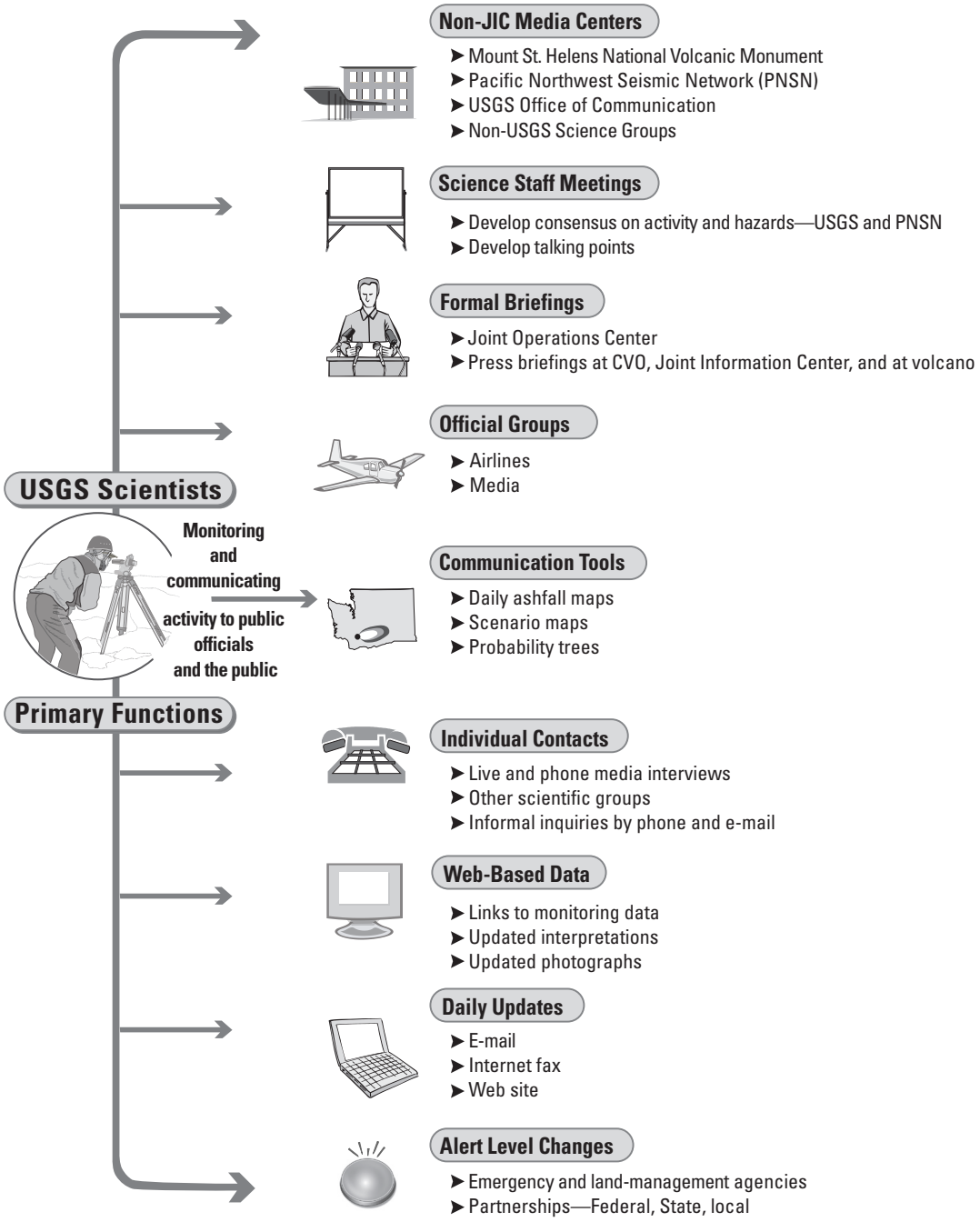


Figure 2. Graphic illustrating shared responsibilities of U.S. Geological Survey (USGS) scientists for communication with a broad range of individuals and agencies. CVO, Cascades Volcano Observatory.

for a more coordinated message grew, the agencies formally pooled their resources in a unified response that employed the precepts of the Incident Command System (ICS), a standard, on-scene, all-hazards incident management system already in use by emergency responders and codified nationally in 2004 as the National Incident Management System (NIMS; Federal Emergency Management Agency, 2004; Frenzen and Matarresse, this volume, chap. 23). Under this arrangement, agencies work together through designated members of a unified command (often the senior person from each agency) to establish a common strategy and a single Incident Action Plan (Federal Emergency Management Agency, 2004). In the case of the 2004 Mount St. Helens event, those stakeholder agencies created a Joint Operations Center (JOC; the term coined in present-day terms by NIMS is an "Incident Command Post"; Christine Jonientz-Trisler, oral commun., 2006). The JOC focused on operational aspects of the response (not scientific or research aspects) and took responsibility for the creation of the JIC.

This system of JOC and JIC (under NIMS terminology the JIC is called a "Joint Information System") is a well-known tool used in the ICS today. The JOC-JIC system enables interagency coordination, support for decision makers, flexibility based on changing circumstances, and, through the JIC, development and delivery of consistent messages. The system includes plans and protocols to provide information during incidents. A JIC (there can be several, although one is preferable) generally exists in a location where PIOs from involved organizations colocate to provide critical emergency information, crisis communications, and public-affairs functions. Although the public can receive information from many sources, a JIC allows the various organizations with responsibility during an incident to come together to ensure clear, timely, and consistent hazard messages.

The JIC can be viewed as a central hub for communication, a "one-stop shopping" facility where representatives from cooperating agencies can address inquiries with a single voice. A JIC can be assembled when communications needs exceed the capacity of individual agencies. The JIC provides interagency coordination and integration, development and delivery of coordinated messages, support for decision makers, and flexibility to meet demands based on changing circumstances. The use of a JIC reduces confusion, inaccuracies, and duplication of efforts and can help address rumor control. Each organization maintains its own authority and policies but still contributes to an overall unified message to the public (Federal Emergency Management Agency, 2004). A general call center and other office resources are shared, and technical representatives from specific agencies address inquiries germane to their agency's interest. The JIC is dynamic and can be resized to meet incident needs. To the detriment of the host agency, the JIC can displace normal agency operations for extended periods, such as the two weeks during 2004 that the headquarters conference room was unavailable to GPNF staff.

Physical Description, Responsibilities, and Operation of Joint Information Center

The Mount St. Helens JIC leadership (fig. 3) included the JIC Manager who reported to the Incident Commander at the JOC. The JIC Manager was responsible for functioning of the JIC and for maintaining records. Liaisons from Washington EMD, GPNF, and USGS were in constant contact with the JIC Manager or served in that role at some point during JIC operation. The Media Briefings Facilitator, Products Coordinator (news releases, for example), Call Center Supervisor, and PIOs at MSHNVM all reported to the JIC Manager, as did information scientists and other technical specialists. As needed, each agency in the command structure provided PIOs to coordinate their home agency's information (both internally and externally), act as spokespeople, and provide appropriate technical expertise. The PIOs also sent talking points to other information outlets, such as the PNSN, USGS staff in other cities, and to MSHNVM visitor facilities.

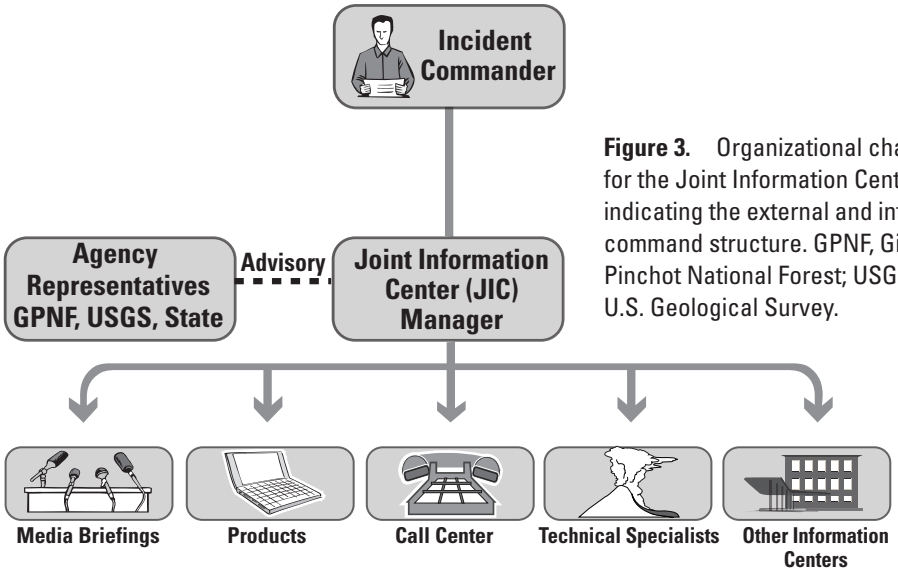


Figure 3. Organizational chart for the Joint Information Center indicating the external and internal command structure. GPNF, Gifford Pinchot National Forest; USGS, U.S. Geological Survey.

The JIC staff used a conference room at the GPNF headquarters (fig. 4). The room was dividable by heavy, soundproof curtains. During operation of the JIC, one-half of the room served as the Media Briefing Room, with areas reserved for television cameras, seating, and a podium. The other half of the conference room was arranged by function; one side housed the Call Center, and the other side housed the JIC Manager, technical experts, the news release production team, and the media briefings team.

The JIC Call Center consisted of a temporary six-line switchboard system that allowed call takers to simultaneously answer multiple incoming lines and to transfer media and public-affairs calls to the technical experts as needed. Call Center staff included employees of the GPNF and other national forests, USGS, Washington EMD, Oregon's Department of Geology and Mineral Industries, Washington's Department of Geology and Earth Resources, and many emergency-management and nontechnical public-affairs professionals from across the greater Portland-Vancouver metropolitan area. The Federal Emergency Management Agency (FEMA) also assisted with staffing and could have provided more formal assistance and resources had the incident escalated to an emergency or had an official Federal disaster declaration been issued. FEMA also pre-positioned management staff at the JOC and provided liaisons to the States of Washington and Oregon Emergency Operations Centers and a liaison to the USGS at CVO.

Call Center staff conveyed basic information about the current incident to media representatives, reading from daily talking points, updates compiled on a dry-erase whiteboard, and fact sheets compiled by the technical experts (fig. 5). This information satisfied many of the media callers. When an interview was requested and a technical expert was unavailable, the request was given to the Media Interview Coordinator. Detailed information (reporter name, media organization, publication or broadcast schedule or deadline, and nature of the questions) allowed the Media Interview Coordinator to prioritize pending requests and to assign USGS or other staff to the appropriate interview. This system was highly effective in meeting the vast majority of live interview requests. Technical experts, along with the JIC management from Washington

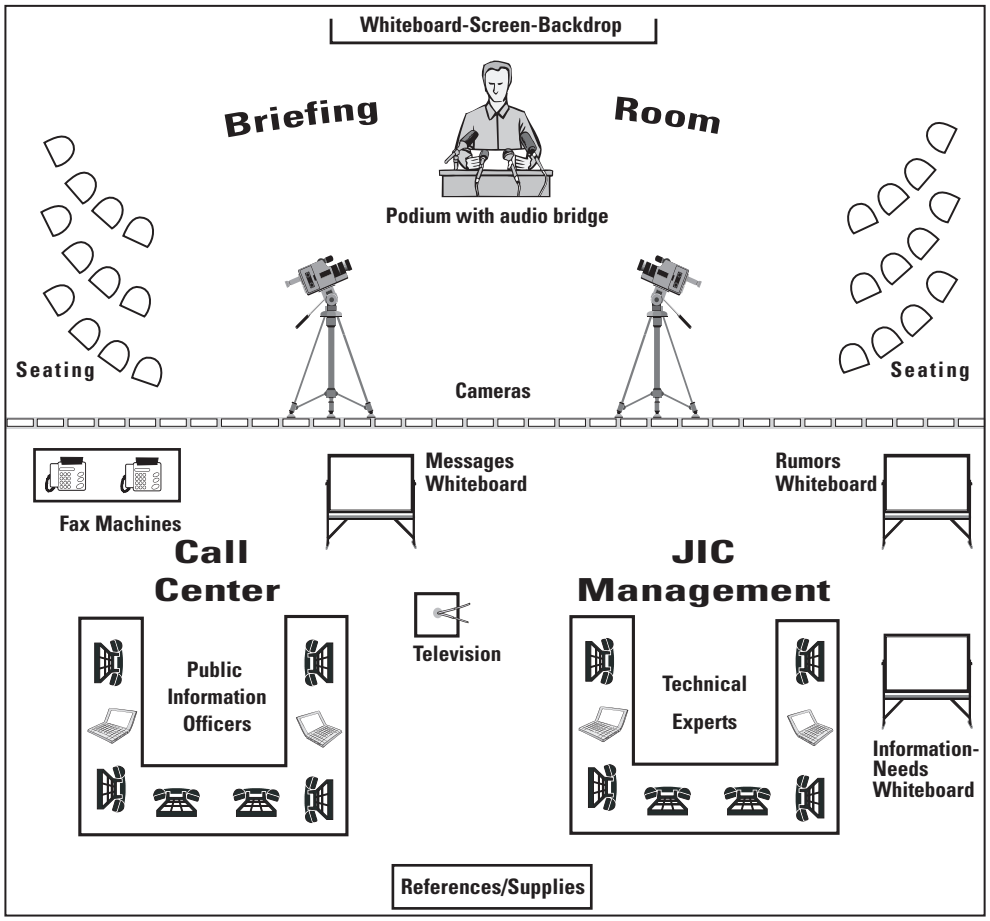
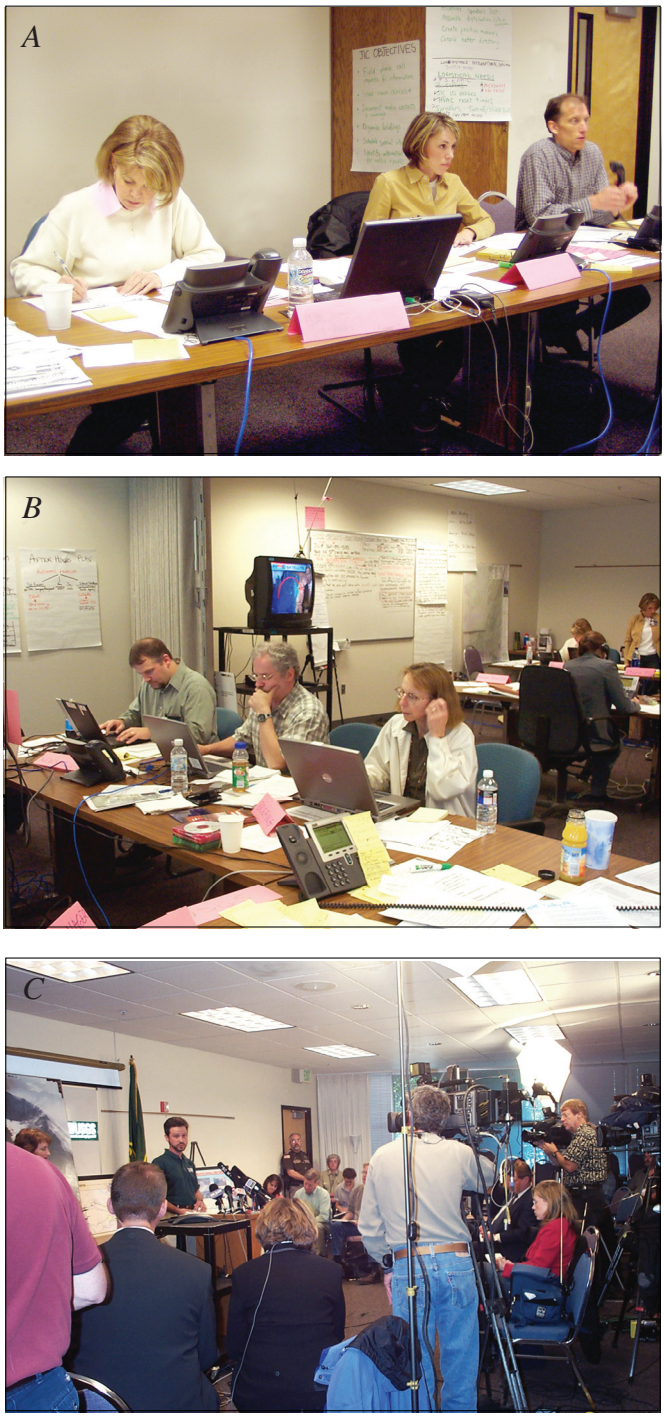


Figure 4. Layout of Joint Information Center (JIC), housed in conference room of Gifford Pinchot National Forest headquarters in Vancouver, Wash. The conference room was divided into three parts: a Media Briefing Room, a Call Center, and a section for JIC management and technical specialists.

EMD, the U.S. Department of the Interior Bureau of Land Management, and the GPNF and other national forests, posted new information prominently on the whiteboard so that it could be provided to media callers almost instantaneously. The Call Center's close proximity to scientists ensured that the nontechnical PIOs used the appropriate scientific descriptions.

Whereas CVO provided daily updates on volcanic activity and alert levels on its Web site, the JIC distributed news releases by e-mail or fax from information derived largely from CVO. Staffers combined rosters of media contacts from several agencies and amended them continuously in an effort to maximize distribution of information and to assure media that they would be informed of changes of volcano status. The JIC also established a recorded phone message line that summarized the current volcano conditions. This telephone number was widely advertised to the media, and the message was updated daily and provided in English and Spanish. The JIC also provided general volcano-hazards information that previously had been translated into eight languages.

News briefings at the JIC became an important regular source of authoritative information. The JIC initiated a rigorous, controlled protocol for briefing time, participation, and followup interviews with scientists or other officials. Briefings were conducted live on camera by designated scientists from USGS, often with equipment and graphics to illustrate content. Out-of-area media and radio station representatives called in during live briefings by way of a telephone audio link. The audio link enabled remote listeners to ask questions of presenters after the briefing. USGS Office of Communications staff often managed the media briefings. The JIC conducted two briefings on most days and a single briefing as demand decreased. During a period of several weeks, approximately 38 formal briefings were given at the JIC and at MSHNVM (see below).



Information Centers at Mount St. Helens

In addition to the JIC in Vancouver and the PNSN in Seattle, several other information centers provided updates in close coordination with the JIC. These included the interpretive facilities of MSHNVM, especially the Coldwater Ridge Visitor Center and nearby Castle Lake Viewpoint (fig. 6). At its peak, the Castle Lake Viewpoint hosted 24 television satellite trucks and accompanying media. Six GPNF PIOs and USGS information scientists staffed the viewpoint and held twice-daily news briefings. The multitude of media and public visitors at this remote viewpoint was substantial, and MSHNVM staff were soon overtaxed with the strain of conducting media interviews and providing crowd control for thousands of tourists who flocked to the monument. Media preferred to operate from Castle Lake Viewpoint because of its proximity to Mount St. Helens; however, scientists and the JOC preferred indoor briefings at the JIC in Vancouver, in close proximity to CVO.

Figure 5. Mount St. Helens Joint Information Center (JIC) housed at Gifford Pinchot National Forest headquarters, Vancouver, Wash. (USGS photos by C.L. Driedger, October 2004). *A*, Call Center, staffed by public-information officers from local agencies. *B*, JIC management and technical specialist center. *C*, Media Briefing Room.

Help in providing information also came from several colleges and universities with knowledgeable Earth science faculty, from State geological surveys in Washington and Oregon, and from other USGS offices throughout the nation. We have no satisfactory method to quantify the load of inquiries on these outlets.

Joint Information Center and Web Site Statistics

To document and evaluate the work of the JIC, staff tracked the number and type of inquiries (table 1) and maintained a master list of participants. During its 11-day operation, the JIC was staffed by 70 people from 30 different emergency-management, health, safety, and land-management agencies and the USGS, most of whom came from the Portland-Vancouver area. These individuals responded to more than 750 e-mail inquiries and more than 800 telephone inquiries from media staff in 12 countries.

Not surprisingly, the number of inquiries increased with a rise in real-time seismic amplitude measurements (RSAM) that reflected increased seismicity at the volcano (fig. 7). Inquiry frequency spiked when the alert level was raised, when volcanic tremor occurred, and when there were visible events, such as steam and ash explosions. USGS–CVO Web site statistics illustrate the same intense and event-driven demand for online information.

Table 1. Sources and numbers of inquiries to the Joint Information Center, Gifford Pinchot National Forest headquarters, Vancouver, Wash., from October 3 to October 13, 2004.

Sources of inquiries to the Joint Information Center	Number of inquiries
Television (local and affiliate)	278
Print (specific news publications)	228
Other (Associated Press wire service, public, and others)	163
Radio (local and affiliate stations)	137
Web-based news services	6

The PNSN Web site, where information about seismic activity related to volcanic unrest was available, received 31 million hits on the Web servers (equaling approximately 10 million pages viewed) between September 28 and October 5. Early during the event, in anticipation of this intense interest, UW staff separated the public Web site servers from computer servers that process scientific information, potentially saving both systems from failure.

As at PNSN, the record high number of hits on the CVO Web site prompted USGS system administrators to add servers and then to contract with temporary commercial service providers to accommodate the demand for online information. In September 2004, before onset of the erup-

Figure 6. Castle Lake Viewpoint, Mount St. Helens National Volcanic Monument, Wash., located approximately 15 km from Mount St. Helens, served as a nexus for media representatives during October 2004. Monument staff directed all media representatives to this viewpoint, dubbed "Satellite City," where media queries could be addressed efficiently by local staff and U.S. Geological Survey scientists. As many as 24 media trucks were on site at the height of media interest. USGS photo by L.G. Mastin, October 5, 2004.

tion, there were approximately 34,000 Web pages requested per day. During the steam and ash explosion on October 4, 2004, 1.43 million Web pages were requested—a 42-fold increase in daily CVO Web page requests. In the 2-week time period between September 24 and October 7, Web users requested 8.4 million pages, and 11.2 million pages were requested during October 2004. As of this writing in October 2006, the number of Web pages requested remains high. The volume of Web page requests has, on occasion, inexplicably risen tenfold, far exceeding October 2004 levels. CVO Web site access has yet to return to pre-October 2004 levels (Lyn Topinka, oral commun., 2006).

The majority of GPNF Web site hits were to the Mount St. Helens VolcanoCam Web page, which received an estimated 131 million hits (equaling approximately 18 million Web pages requested) between September 23 and October 31, 2004. The VolcanoCam's popularity resulted in a manyfold increase in Web page requests to the GPNF Web site.

Update Protocols at Cascades Volcano Observatory

USGS scientific and communications staff generated text updates on the status of the volcano each morning on the basis of consensus at daily scientific meetings. Although the JIC staff relied upon these daily updates, volcanic events sometimes rendered them obsolete. For example, during a scheduled news briefing at the JIC, scientist Willie Scott was inter-

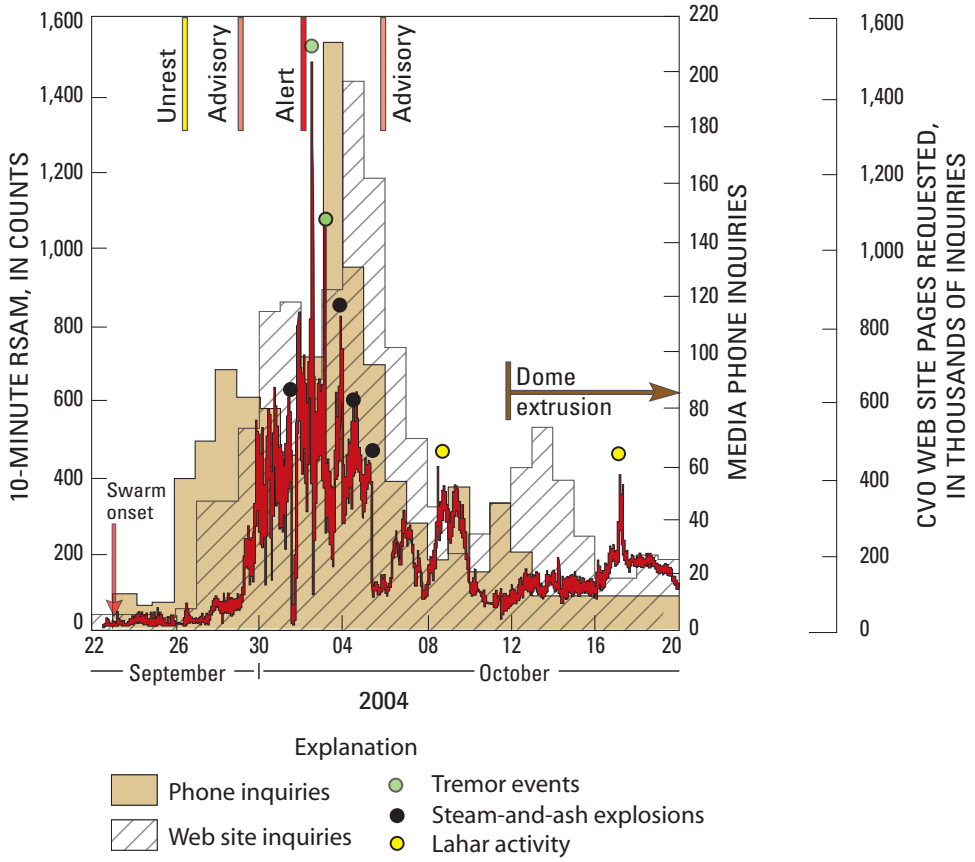


Figure 7. Relation between volcanic activity, alert levels, volume of media inquiries to the Cascades Volcano Observatory, and number of Web pages requested from the CVO Web site (Lyn Topinka, oral commun., 2005) during the first weeks of unrest at Mount St. Helens. Real-time seismic amplitude measurement (RSAM), in red, is a proxy for the level of seismicity at volcano. Media phone inquiries (daily counts, in tan) and public Web activity (hachured) generally increased with the rise in RSAM and spiked following changes of alert level and prominent volcanic events, such as steam and ash explosions.

rupted by a news reporter who announced that a steam and ash explosion was in progress. Scott was forced to abandon his prepared text and interpret the eruption as seen on a small monitor provided by one of the television stations.

Before the onset of the 2004 volcanic unrest at Mount St. Helens, CVO issued occasional written statements concerning volcanic activity and posted these to its Web site. Such statements were posted daily in the fall of 2004 and were supplemented by media advisories, information about news briefings, and notification of events released by fax and e-mail. In October 2004, CVO broadened daily update dissemination by e-mail to include media and aviation contacts; previously, e-mailed updates were sent primarily to government agencies. Broad update distribution has continued throughout 2006.

Hazard Information Management Through October 2006

Since cessation of the JIC on October 13, 2004, staff at CVO has replied to about 800 phone inquiries from the media, principally about the status of Mount St. Helens. As of October 2006, the combined number of media phone inquiries received by CVO and by the JIC during its 11 days of operation in 2004 exceeded 2,000. In addition to these general media inquiries, representatives of 41 documentary film projects contacted USGS–CVO for interviews, information, and graphics, mostly about the ongoing and 1980 eruptions at Mount St. Helens. Each year, the CVO staff has provided additional media briefings on the anniversary of the 2004 eruption and after significant explosive events. USGS staff assembled 10 rolls of video for use by media (b-rolls) between November 2004 and October 2006. As of this writing, the level of media interest is variable. The number of media inquiries rises with sightings of rockfall, with its subsequent suspension of dust and ash particles in the air, and with the onset of cold and clear weather, which initiates visible condensation plumes above the crater rim. CVO staff has taken the time to educate local media about these two phenomena. It is commonly accepted that this education has reduced the number of media inquiries considerably.

Challenges and Lessons Learned

The USGS and its partner agencies in emergency management faced a number of challenges in this episode of unrest at Mount St. Helens. Here, we present the most important challenges and lessons into four groupings: media and message management, JIC management, special needs of university cooperators, and organizational constraints. Many of these observations were compiled at an interagency after-action review of the eruption response, an important step in identifying lessons learned following any eruption crisis.

Media and Message Management

Pre-Event Planning for Communications with Media

A pre-event hazard communication and media management plan reduces the inevitable scramble to establish an effective information pipeline to the public and other constituencies (Peterson and Tilling, 1993; Newhall and Punongbayan, 1996). The plan should be written by agency representatives most likely to be in the "hot seat" during an event. Volcano observatories and cooperating scientific agencies need full-time scientists whose major roles are to manage media relations, community outreach, and education. These scientists should achieve a working understanding of emergency roles codified in NIMS, including their role in a JIC. The roles should address the following responsibilities:

1. Engage the media and educate them about hazards and agency roles in hazard response.
2. Prepare background information about a volcano and its hazards before a crisis begins and arrange for rapid development and dissemination of updated information, graphics, and maps required for briefings.
3. Maintain relations with media representatives so that they are prepared to reach broad audiences with agency messages. Media representatives should feel comfortable asking questions so that they can "get the story right."
4. Establish, exercise, and review phone, e-mail, fax, and other crisis-communication protocols.
5. Identify scientists who can dedicate their time to communication needs and offer media training for key staff.
6. Establish a system for obtaining photography and video footage for inclusion in media b-rolls.
7. Acquire official agency logos and apparel.
8. Consider a system for tracking media inquiries and workload.
9. Isolate public Web sites, by serving them from computer systems independent of the computers used for processing scientific data, to reduce the potential that increasing demand will crash either system.

Tools for First Moments Following an Event

After months or years of volcanic quiet, an eruption or onset of dramatic unrest can be a chaotic time with respect

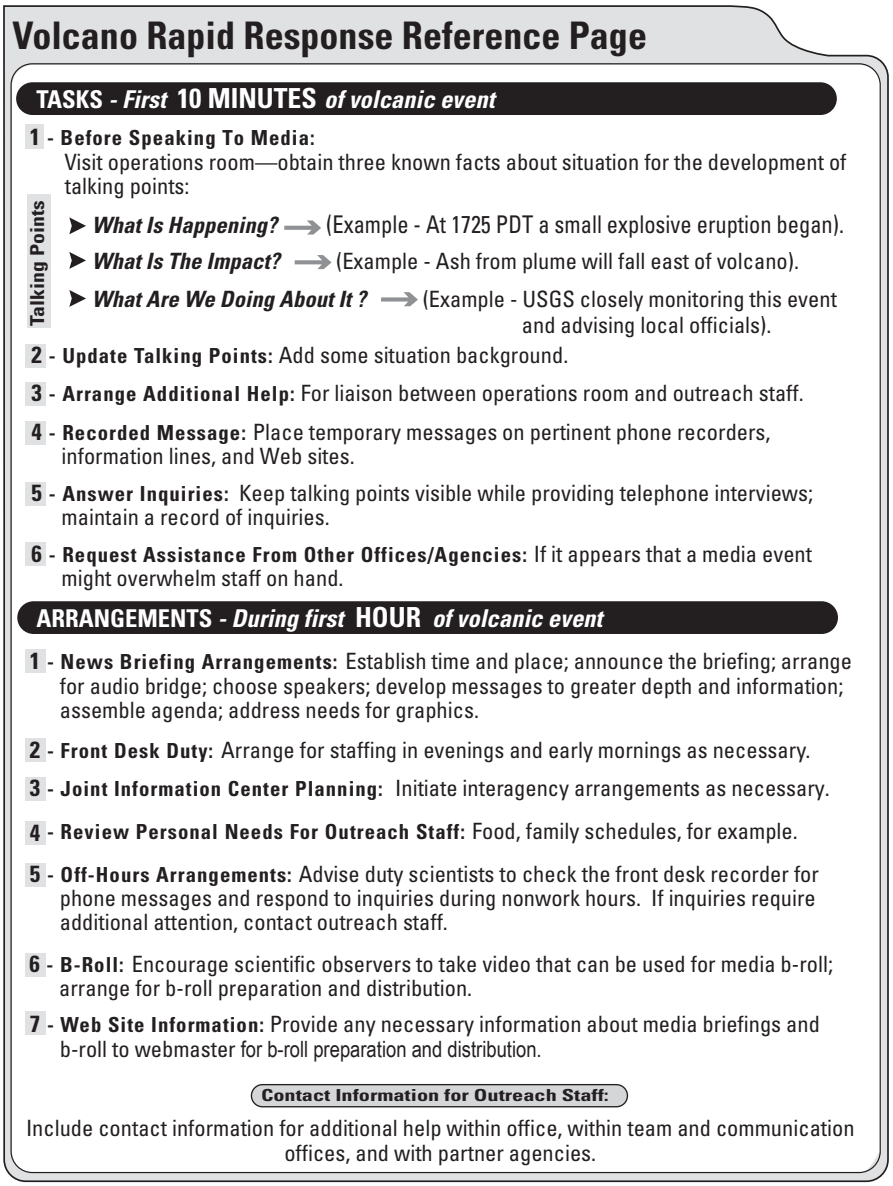
to media-communication protocols. Background fact sheets, FAQs, and other pre-event resources can help fill the immediate need for information. CVO developed a "Volcano Rapid Response Reference Page" that lists steps to be taken within the first few minutes of a visible volcanic event (fig. 8). The Reference Page can be customized for eruptions at any volcano.

Fighting Imaginations and Misperceptions

Agencies must devise a system to prepare, review, and update talking points that reinforce appropriate messages and terminology. A recurring challenge during the 2004 volcanic unrest concerned the widespread perception that any activity at Mount St. Helens was a prelude to another cataclysmic eruption resembling the event on May 18, 1980. Dispelling this image was a challenging exercise in wording and repetition. Once lodged in the public's mind, such misperceptions are hard to remove.

Disseminating Updates to Remote Information Centers

Maintaining contact, continuity, consistency, and completeness of message with remote information centers is both a technical and a human challenge. Communication and sharing



Volcano Rapid Response Reference Page

TASKS - *First* 10 MINUTES *of volcanic event*

1 - Before Speaking To Media:
Visit operations room—obtain three known facts about situation for the development of talking points:

Talking Points

- ***What Is Happening?*** → (Example - At 1725 PDT a small explosive eruption began).
- ***What Is The Impact?*** → (Example - Ash from plume will fall east of volcano).
- ***What Are We Doing About It ?*** → (Example - USGS closely monitoring this event and advising local officials).

2 - Update Talking Points: Add some situation background.

3 - Arrange Additional Help: For liaison between operations room and outreach staff.

4 - Recorded Message: Place temporary messages on pertinent phone recorders, information lines, and Web sites.

5 - Answer Inquiries: Keep talking points visible while providing telephone interviews; maintain a record of inquiries.

6 - Request Assistance From Other Offices/Agencies: If it appears that a media event might overwhelm staff on hand.

ARRANGEMENTS - *During first* HOUR *of volcanic event*

1 - News Briefing Arrangements: Establish time and place; announce the briefing; arrange for audio bridge; choose speakers; develop messages to greater depth and information; assemble agenda; address needs for graphics.

2 - Front Desk Duty: Arrange for staffing in evenings and early mornings as necessary.

3 - Joint Information Center Planning: Initiate interagency arrangements as necessary.

4 - Review Personal Needs For Outreach Staff: Food, family schedules, for example.

5 - Off-Hours Arrangements: Advise duty scientists to check the front desk recorder for phone messages and respond to inquiries during nonwork hours. If inquiries require additional attention, contact outreach staff.

6 - B-Roll: Encourage scientific observers to take video that can be used for media b-roll; arrange for b-roll preparation and distribution.

7 - Web Site Information: Provide any necessary information about media briefings and b-roll to webmaster for b-roll preparation and distribution.

Contact Information for Outreach Staff:

Include contact information for additional help within office, within team and communication offices, and with partner agencies.

Figure 8. Volcano Rapid Response Reference Page illustrating how the Cascades Volcano Observatory addresses media inquiries during sudden volcanic events, such as steam-and-ash explosions and resultant plumes.

of talking points with PIOs and information scientists at Castle Lake Viewpoint were hampered by technological difficulties (fax and phone line service between information centers was intermittent) and the Viewpoint's physical distance from the JIC.

The Media's Need for Information, Now!

Agency representatives must be prepared to address nearly continuous information demands from the media for the 24-hour international news cycle. Scientists must create a steady stream of updated information to satisfy the appetite of media outlets and their constituencies. During the Mount St. Helens unrest, media photographers found it difficult to get close-range photographs because of temporary flight restrictions. At the request of the media, the 10 b-rolls released by the USGS provided close-up video coverage of the eruption, volcanologists working in the crater, and time-lapse and thermal-image video. Photographs taken by USGS observers were posted on the CVO Web site within a day of their being taken. There was a constant need for charts and illustrations for news briefings, especially for diagrams of volcano cross sections and schematics showing the relative sizes of the lava dome through time. Any media management plan should cover how these graphical products will be distributed efficiently.

Near-Simultaneous Observations by USGS Staff and Media

Scientists must often react to near-simultaneous observations by scientific staff and media. Today's media outlets have access to and budgets for fly-bys of the volcano by helicopters, which often are outfitted with modern infrared sensors and cameras similar to those used by scientists. At Mount St. Helens, there was pressure to interpret observations made by media representatives before the extended group of monitoring scientists had seen or analyzed the information.

Maintaining Appropriate Distance Between Media and Operational Staff

Maintaining appropriate distance between media representatives and operational staff is a primary reason for positioning the JIC away from science facilities. Prior to the 2004 volcanic unrest, many media members had developed links with scientists and contacted them at will. The creation of the information-scientist role freed operational scientists who had responsibilities for monitoring and analysis. The founding of the JIC and its media briefings allowed controlled access to scientists.

Consistent and Careful Use of Nomenclature

Another important concern in sharing information with the media and public is consistent use of terminology and nomenclature. In one particular case, USGS scientists unwittingly fed public concern through their casual use of geographical terms. Constant repetition of the "bulging crater floor…on the south side…of the old lava dome" gave rise to a mistaken notion that the south flank of the entire volcano was bulging in a manner similar to the north flank prior to the catastrophic May 18, 1980, event. Another source of terminology confusion concerned use of the word "eruption." For example, there were references to the events of early October 2004 as explosions, emissions, and eruptions. Although such distinctions appear trivial, and in many senses are purely semantic, to the reporting media representatives, these are important facts to get right.

The word "eruption" has a fairly specific image to many, and that includes visible lava, ash, and activity that is full of motion and potential danger. At this writing in October 2006, many people are unaware that Mount St. Helens continues to erupt. The same phenomenon occurred in Alaska during the 2005–6 eruption of Augustine Volcano. Once the volcano ceased ash-cloud production and began quietly producing lava flows, many people assumed the eruption had stopped altogether, despite the local volcano observatory's constant repetition of messages that the eruption continued.

Joint Information Center Management

Development and Concept

Agencies must recognize the value of a JIC and then plan for it. At Mount St. Helens there was a hesitancy to form a JIC, caused in part by immediate needs but in greater part by not understanding a JIC's value to all involved agencies. Volcano-response plans for each Cascade Range volcano refer to the use of a JIC, but, at the time of the 2004 event, no detailed plan existed for rapid development and staffing. It is important to understand the basics of the NIMS, each agency's role during a crisis, and how a JIC may help.

Adequate Space for Necessities

A JIC requires large and small rooms with secure entry points. The Mount St. Helens JIC lacked distinct and secure entry points that were out-of-view of JIC operations. Access to the Media Briefing Room required passage of media representatives through the inner workings of the JIC, which exposed sensitive information not intended for public release, such as private phone numbers. This required JIC workers temporarily to "sanitize" whiteboards of sensitive information. Such security issues can be addressed with good JIC design. The Mount St. Helens JIC suffered from a lack of small rooms for individual media interviews.

Staffing and Logistics

Agencies must plan for the details of assembling people and technological facilities rapidly during establishment and maintenance of a JIC. At the Mount St. Helens JIC, staff from

the Clark Regional Emergency Services Agency took the initiative to locate call center personnel by announcing the need on an extensive PIO listserve in the Portland-Vancouver area. Many people responded to the call for help, but maintaining a refreshed staff of trained and knowledgeable call takers, technical specialists, and JIC managers was a constant challenge. Also of value was participation of volunteers from the City of Vancouver who could assist traveling media with requests for general local information. A JIC handbook of procedures and resources was extremely helpful for educating existing and newer personnel. Lines of authority were a subject of frequent discussion, with personnel adjusting to the roles placed upon them within the JIC. Security firewalls presented continuous technical roadblocks for communications, both within the JIC and to outside agencies. A general e-mail account could not be established, so staff had to use individual e-mail accounts for transmitting JIC business information.

Maintaining Consistent and Timely Messages

Agencies must consider that maintenance of a consistent, current message requires vigilance. At Mount St. Helens, volcanic events frequently eclipsed the Daily Update and necessitated hurried development of updated talking points, education of call takers and staff at other information outlets, and rumor control. An official JIC Daily Update required review by a representative of each agency. The duration of the production process often outlived the usefulness of the product. Early morning requests from East Coast media were most challenging because daily updates were not yet available. News briefings came too late for local morning news shows. There was demand for hourly updates, but no official process was available to provide this need. As a result of such media demands, the Alaska Volcano Observatory provided hourly status reports on its Web page during the height of the eruption of Augustine Volcano in early 2006. These were informal and nonreviewed snapshots of what was happening at the volcano, and they served to underscore that scientists were actively watching the volcano. Even remarking that nothing had changed in many hours apparently served to reassure Web users that the Observatory was aware of current conditions.

Special Needs of University Cooperators: Pacific Northwest Seismic Network

University cooperators must find the resources to protect monitoring capabilities while addressing media response. The greatest challenge faced by the PNSN was to find ways to satisfy the numerous requests for interviews while maintaining network operations and analyzing and interpreting data.

The PNSN PIO addressed media needs with support from student staff, who answered phones and organized requests for information and interviews. The PIO reviewed these requests and PNSN scientists monitoring the eruption were scheduled, when appropriate, to participate in interviews. The PNSN also received assistance from the UW Office of News and Information who assisted in scheduling interviews and disseminating press releases. At key moments, such as a change in alert level or following steam and ash explosions, reporters were pooled and the PNSN Director made a statement, answered questions for a few minutes, and then returned to work. National news outlets did not always get to talk to the scientist they requested, but all media requests were addressed. The PNSN concentrated their response onsite at the UW and turned down almost all requests for television-studio interviews. The PNSN also frequently referred many requests to the JIC, particularly those not directly related to seismicity.

Organizational Constraints

Staffing

The USGS volcano observatory system consists primarily of technical specialists with defined scientific roles and expertise to monitor volcanoes and assess hazards. For most staff, outreach and interaction with the media are ancillary duties; therefore, technical tasks may go unfinished when scientific staff are consumed by providing information. Even for observatories with professional communication and public-information specialists, a single eruption crisis can quickly overwhelm slim resources. To respond effectively and not diminish the technical efficacy of the observatory, it is key to call quickly for reinforcements from within and outside the USGS. It is helpful to have predetermined lists of staff available for temporary short-term duties to assist in this capacity. Crisis-related staffing should include information scientists, Web and illustration staff, and information technology support.

Cost

Establishing a JIC is not cost free. According to the GPNF, the total JIC operation costs for 11 days, including extra staffing by interpreters at MSHNVM, was approximately $88,400 in salaries and $7,500 in equipment and supplies. Most of the personnel who worked at the JIC either donated their time, or their agencies absorbed salary costs as a contribution to the regional response. For the Call Center, where 40 people rotated through various shifts to answer phones, the estimated cost of staff time alone totaled more than $17,000.

The State of Washington does not have a system to pay for JIC support without declarations of emergency or disaster, a situation common in other states. Once such a declaration exists, the State can request Federal resources from FEMA to support staff costs. Cultivating partnerships in advance, including the development of formal mutual-aid agreements, can help local offices deal with the staffing shortage during an information crisis. Although some agencies or jurisdictions were unable or unwilling to commit paid staff time to volunteer at the Mount St. Helens JIC, many others did donate personnel to the public-information effort. This volunteer

opportunity provided PIOs with skill-building advantages, because it is rare to get the chance to work within a JIC.

Another expense of JIC operation is technological outfitting of the facility. The Mount St. Helens JIC at the GPNF headquarters already had phone lines and extensions available, so the cost of installing a switchboard and other phone lines was minimal. However, it was necessary to install fiber-optic cable to serve the needs of the media satellite trucks, and this involved some major contract work. By pre-identifying a facility with critical infrastructure in place and securing an agreement in advance for free or low-cost emergency use of that facility, technical costs can be minimized.

Media Training Needs

Scientists rarely, if ever, are trained to work with the media. For those who are likely to be directly involved in providing information to the media, many resources are available to provide an appropriate level of training, including classes in basic crisis communication available through local emergency-management offices.

Conclusions

Preeruption planning contributed significantly to the readiness of the USGS, PNSN, GPNF, and other key agencies to deliver timely and effective hazard information about the evolving eruption at Mount St. Helens, one of the world's most famous volcanoes. The success of the response speaks well of decisions by the USGS, a largely scientific agency, to enable communication planning to proceed on par with scientific response planning. Training of media representatives over the long term; practicing response plans; and ongoing communication among scientists, emergency managers, and community leaders about volcano hazards in the Pacific Northwest brings a cushion of support that bolstered effectiveness of the response. Despite this preparation, considerable flexibility, creativity, and rapid development of strategies to deal with unanticipated issues were essential. In particular, today's widespread use of the Internet and the around-the-clock news cycle required a fast, sustained pace of information delivery that frequently pushed the limits of staffing and internal communications. Establishing a JIC within the ICS structure contributed substantially to managing these expectations. The JIC also insulated the JOC and CVO and PNSN scientists from media attention, freeing managers and scientists to deal with critical aspects of the crisis.

To our knowledge, this was the first time that a fully developed JIC was used to address volcanic unrest. Earlier volcanic responses have tended toward multiple agencies providing information independently by specialists, such as at Ruapehu volcano, New Zealand (David Johnston, oral commun., 2005) and Volcán Santa Ana, El Salvador (John Ewert, oral commun., 2005). An exception was a single source at Pinatubo volcano, Philippines (Chris Newhall, oral commun., 2005). Our 2004 experience at Mount St. Helens confirms that volcano and seismic observatories benefit from the availability of a full-time scientist focusing on the needs of media relations, community outreach, and education.

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