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

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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-

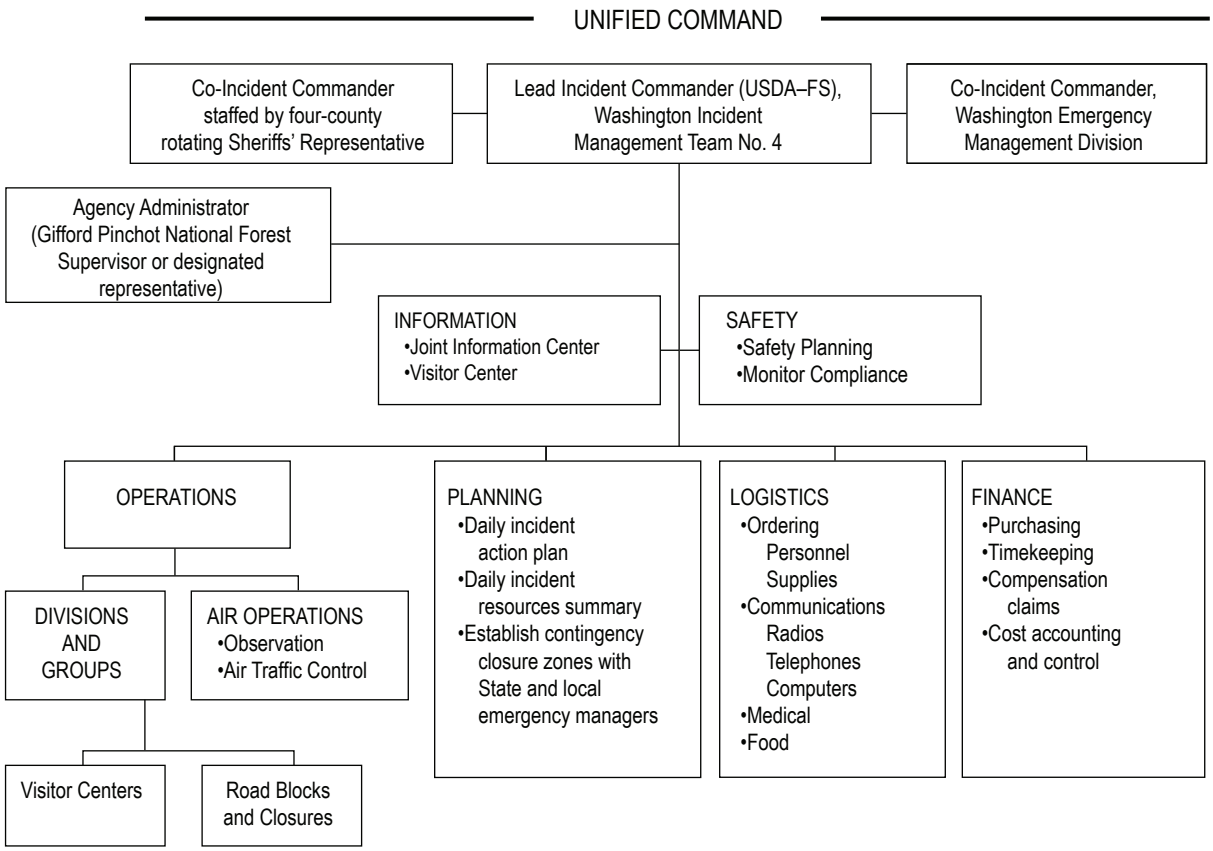

Figure 1. Organization chart for the short type-2 Incident Management Team that responded to the 2004 eruption of Mount St. Helens, Washington. USDA–FS, U.S. Department of Agriculture, Forest Service.

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

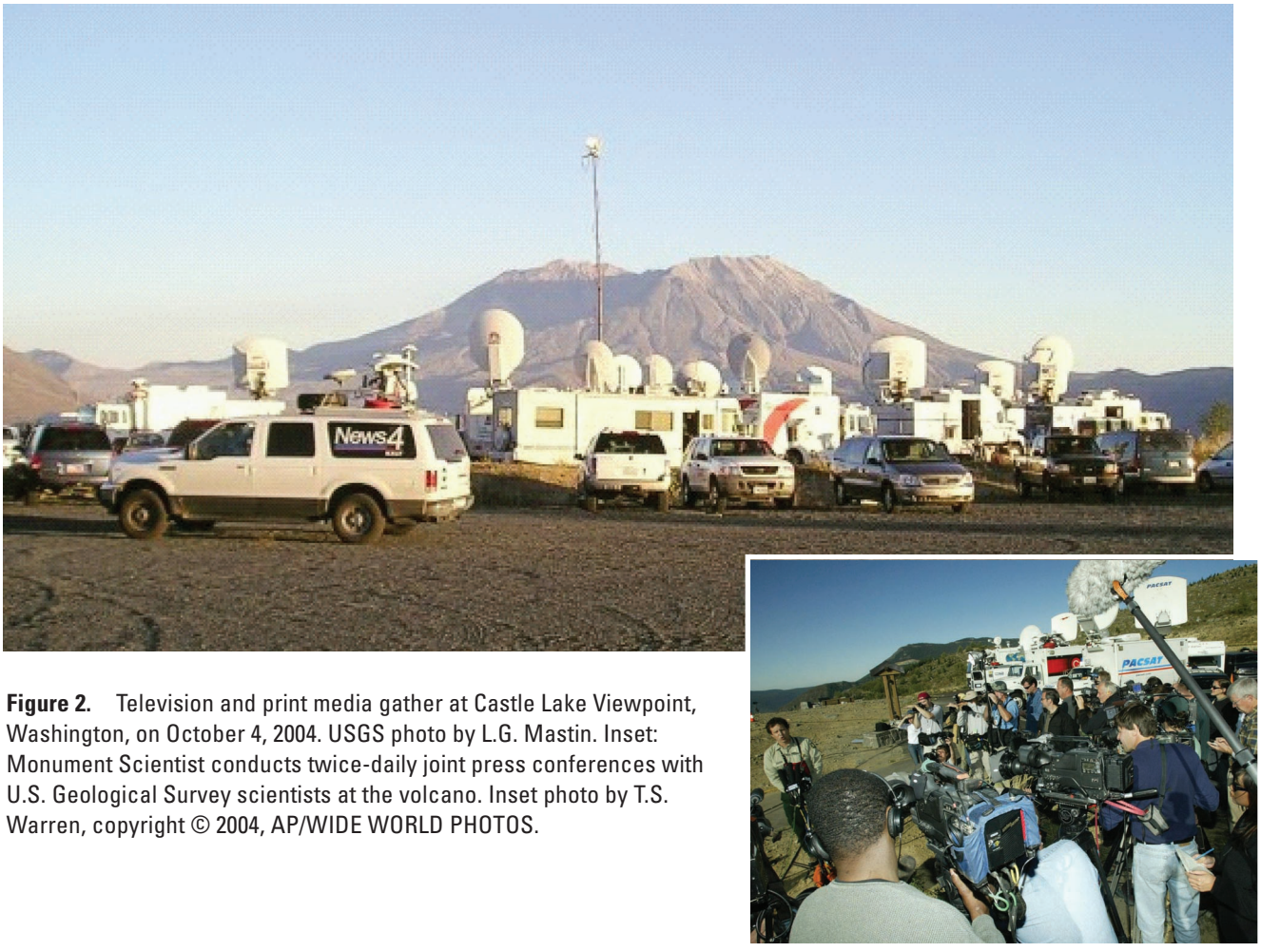

Figure 2. Television and print media gather at Castle Lake Viewpoint, Washington, on October 4, 2004. USGS photo by L.G. Mastin. Inset: Monument Scientist conducts twice-daily joint press conferences with U.S. Geological Survey scientists at the volcano. Inset photo by T.S. Warren, copyright © 2004,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

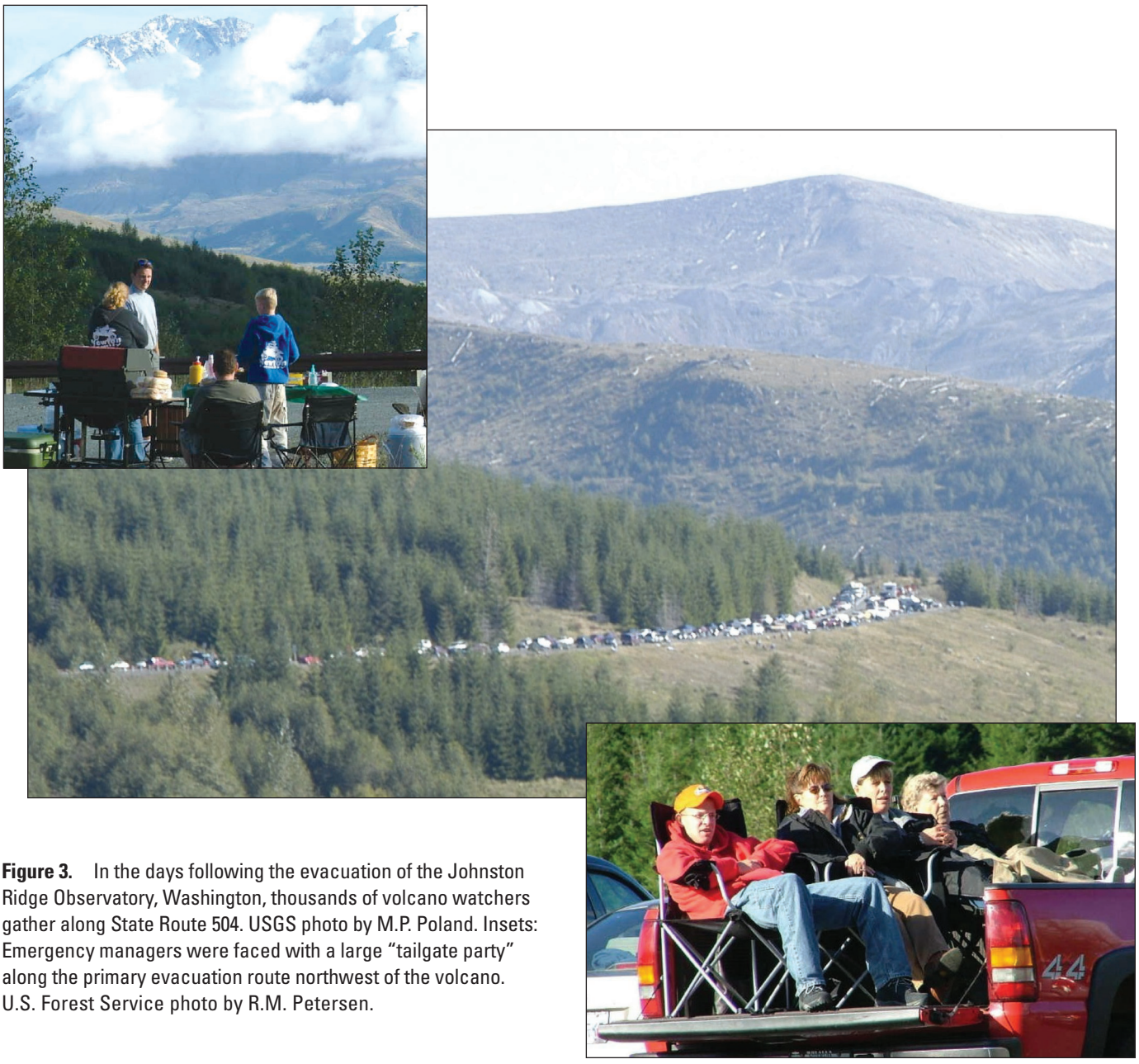

Figure 3. In the days following the evacuation of the Johnston Ridge Observatory, Washington, thousands of volcano watchers gather along State Route 504. USGS photo by M.P. Poland. Insets: Emergency managers were faced with a large "tailgate party" along the primary evacuation route northwest of the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