Alaska
Interagency Operating Plan
for
Volcanic Ash Episodes

April 1, 2004

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Cover Photo: An explosive eruption of Sheveluch Volcano in Kamchatka on May 19, 2001. The ash column rose more than 39,000 feet. Taken by Yury Demyanchus, Kamchatka Experimental and Methodical Seismological Department. Used with permission.

1.0 INTRODUCTION

Volcanic eruption plumes and subsequent drifting ash clouds from North Pacific volcanoes have caused delays in flight operations nationwide and substantial damage to aircraft and equipment. Volcanic ash also has caused difficulties in Alaskan communities, ranging from property damage to health hazards. This operating plan provides an overview of multiple agency integrated operations in response to the threat of volcanic ash affecting Alaska, and an agency-by-agency description of roles and responsibilities in such events. A cohesive, well coordinated response will result in the flow of timely and consistent information to those at risk.

The agencies involved in this operating plan are: The Federal Aviation Administration (FAA); the Alaska Volcano Observatory (AVO) operated jointly by the United States Geological Survey (USGS), Alaska Division of Geological and Geophysical Surveys (ADGGS) and the University of Alaska Fairbanks Geophysical Institute (UAFGI); the National Weather Service (NWS); the Department of Defense (DOD); the State of Division of Homeland Security and Emergency Management (DHS&EM); and the United States Coast Guard (USCG).

This operating plan is written to cover the State of Alaska and the adjacent United States airspace Flight Information Regions (FIR). This also includes responsibility for volcanic ash transported by upper winds from erupting volcanoes outside the United States FIRs into the Alaska airspace, such as those in Kamchatka and the Kurile Islands, Russia.

The Interagency Operating Plan for Volcanic Ash Episodes in Alaska is considered an integral part of the current National Oceanic and Atmospheric Administration (NOAA)/FAA Volcano Hazards Implementation Plan that supports the Agreement between NOAA and the FAA on volcanic hazards. A Letter of Agreement has added volcano hazards support from the USGS to the NOAA/FAA Agreement. As such, the interagency plan describes the communication links and the operational actions necessary for the Plan to support those NOAA, FAA and USGS components operating under the NOAA/FAA/USGS Volcano Hazards Implementation Plan.

1.1 INTEGRATED RESPONSE TO VOLCANIC ASH

The release of airborne volcanic ash should invoke quick, definitive, and systematic action among participants of this Plan. Each agency is responsible for some element of response to airborne volcanic ash, be it in the realms of public safety, flight safety, military integrity, continuity of government, commerce, transportation, or a combination of these. In response to individual agency mission, priorities may differ slightly, and call-down lists vary from agency to agency. However, the most important element of this Plan is ensuring those at risk receive timely, consistent information. Each agency, therefore, must respond in a coordinated and systematic manner. Participants of this Plan must ensure they are sending the same message. An integrated response to the occurrence of airborne volcanic ash is critical. That response involves: data collection and processing, information management and coordination, and distribution and dissemination.

1.2 DATA COLLECTION AND PROCESSING

Each of the participant agencies has potential to be the first to receive a report of a volcanic eruption or volcanic ash. How that information is treated, i.e., validation, processing, and relay, is crucial to a successful multi-agency response. DHS&EM, AVO, NWS, DOD, and the FAA may receive reports in very different manners; some from sophisticated remote and *in situ* instrumentation, others from trained observers and pilots, and still others from law enforcement, municipal workers, or the general public. Considering the comparative rarity of volcanic ash (at any given locale) but high potential for catastrophic loss, all such reports should be taken very seriously and validated as quickly as possible.

While each agency may tend to receive reports of volcanic ash in different manners, and from different sources, once they get the information and validate it (with corroborating evidence if possible), that report should be relayed to the warning agency (National Weather Service) and the FAA Air Route Traffic Control Center (ARTCC) within minutes. It is crucial to ensure this relay of information is done quickly since commercial aircraft travel 90 miles in 10 minutes, and ash can get to flight level in less than half that time. Furthermore, airborne ash can begin depositing on surfaces hundreds of miles from the source within a couple of hours. Both accuracy and timeliness are essential.

Validation of reports first should involve calling on the data gathering capabilities of other agencies participating in this Plan. For example, should DHS&EM receive a report from law enforcement in Homer that Iliamna is erupting and ejecting ash, they should call AVO since Iliamna is instrumented. If appropriate, they should remain on the line while AVO evaluates the potential ash eruption (which could be a steam emission, meteorological cloud formation, or wild fire). Once confirmation is made, AVO should proceed calling NWS and ARTCC, freeing DHS&EM to continue with their call-down to the State Emergency Coordination Center, affected political subdivisions, and so forth (see section 2.1). Alternatively, should AVO first receive an eruption report, they should validate its occurrence (by ground or satellite sensor, contact FAA ARTCC for any pilot reports in the vicinity), relay that information to NWS, and proceed with their call-down. So, the general rule is: the agency gathering the initial volcanic ash report validates it, ensures it gets to the warning agency, and proceeds with its own call-down.

1.3 INFORMATION MANAGEMENT AND COORDINATION

It is essential that agencies relaying information about the occurrence of volcanic ash, its trajectory, and potential effects, deliver a consistent message. However, to ensure rapid dissemination, the Alaska Aviation Weather Unit (AAWU) will take the lead role in determining the details of the initial eruption Significant Meteorological Advisory (SIGMET). As time allows, coordination (collaboration) should take place on all subsequent SIGMETs to ensure a consistent message. Coordination (collaboration) is necessary to better define the ash plume in both time and space, integrating all of the data collected by the partner agencies. At a minimum, at least one formal coordination (collaboration) should take place each day to share information and discuss issues pertaining to the event.

1.4 DISTRIBUTION AND DISSEMINATION

Each agency is obligated to redistribute critical information to its constituencies in a way that optimizes their ability to mitigate the loss of life and property, and those methodologies vary from agency to agency. National Weather Service uses NOAA Weather Wire, marine High Frequency (HF) and Very High Frequency (VHF) radio, NOAA Weather Radio (NWR), and the statewide Alaska television weathercast, in addition to distribution of text and graphics by its own telecommunications Gateway and through telephone facsimile. FAA distributes critical aviation weather forecasts, advisories and warnings from the NWS, as well as flight information, pilot reports, and terminal information via its Digital Aviation Weather Network (DAWN) and Aeronautical Fixed Telecommunications Network (AFTN) data links. The DHS&EM staff can redistribute critical information via the First Class e-mail system as well as call upon commercial radio, television, cable and Internet service in addition to the Emergency Alert System (EAS). Greater detail of each agency's means to pass along information is provided in section 2.5.4. By utilizing as many diverse methods to disseminate information as possible, chances of reaching as many people as possible are optimized.

The following sections provide an agency-by-agency breakdown about specific roles and responsibilities should volcanic ash threaten Alaska.

2.0 RESPONSIBILITIES OF THE PARTIES

The duties and responsibilities of each of the participating agencies in providing volcanic ash hazards information are outlined.

2.1 DIVISION OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT (DHS&EM)

DHS&EM will conduct the following actions upon notification from AVO that any volcano has been upgraded to Code ORANGE or Code RED. The purpose of these actions are to coordinate State and municipal actions for a single imminent volcanic event:

A. Determine the appropriate level of activation for the State Emergency Coordination Center (SECC).

B. Notify the potentially affected political subdivisions of the situation.

C. Determine if the potentially affected political subdivisions will begin operations of local emergency operations centers during the Code ORANGE or Code RED situation.

D. Determine if any of the above communities would want to participate in a conference call coordinated by DHS&EM pertaining to the Code ORANGE or Code RED situation. This conference call will initially include representation from the Alaska Volcano Observatory, the National Weather Service, the Alaska Department of Environmental Conservation (for air quality information), and DHS&EM. The purpose of this conference call is to:

(1) Allow the AVO and the NWS to provide any additional information on the situation.

(2) Provide the opportunity for the local communities to ask questions pertaining to the situation.

(3) Coordinate any local/state actions that may be needed in coping with the situation.

(4) Determine if an additional coordinating conference call will be needed, at what time, and what agencies or individuals should participate. This call will be scheduled approximately one hour after the initial notification of the Code ORANGE or Code RED situation.

DHS&EM will verify the name of the local person and the telephone number to be used for this conference call and provide it to the conference call operator.

E. Post situation information on First Class e-mail and other information systems as available.

2.2 ALASKA VOLCANO OBSERVATORY (AVO)

The AVO is responsible for the volcano monitoring program, volcanic hazards assessment, and eruption notification in Alaska. AVO is a joint program of the USGS, the UAFGI, and the ADGGS and is funded by the USGS Volcanic Hazards Program. In keeping with the statutory responsibilities of its component agencies, AVO has three primary objectives:

A. To provide timely and accurate information on volcanic hazards, warnings of impending dangerous activity, and eruption notifications to local, state, and federal officials and the public.

B. To conduct monitoring and other interpretive scientific investigations in order to assess the style, timing, and duration of future volcanic activity.

C. To assess volcanic hazards associated with anticipated or ongoing activity, including types of events, potential effects, and areas at risk.

2.2.1 ORGANIZATION

Both the USGS facility in Anchorage and the UAFGI in Fairbanks employ geologists, geophysicists, and remote sensing specialists. Much of the routine processing and analysis of seismic and remote sensing data is performed in Fairbanks, while the USGS facility in Anchorage serves as the crisis center during times of increased volcanic activity. However, both facilities can also serve as limited backups to the other if required. AVO also maintains close ties to ancillary laboratories and offices shared by UAFGI and ADGGS in Fairbanks and at USGS facilities in Menlo Park, California and Vancouver, Washington. Managerial responsibility for AVO rests with a USGS Chief Scientist for Volcano Hazards, a Scientist-in-Charge (SIC), and a Coordinating Scientist, as described below.

CHIEF SCIENTIST FOR VOLCANO HAZARDS, USGS - WESTERN REGION HEADQUARTERS, VANCOUVER, WASHINGTON

The USGS Chief Scientist for Volcano Hazards is based in the Western Region and has line authority for all USGS volcano observatories. In this role, the Chief Scientist enables mission support for the observatories during times of enhanced response and crisis.

SCIENTIST-IN-CHARGE (SIC), AVO/USGS - ANCHORAGE

The SIC is based at the office of the USGS in Anchorage, Alaska and is the official spokesperson for AVO. During periods of routine, non-crisis operation, the SIC coordinates all AVO monitoring, hazards assessment, and information dissemination. The SIC ensures that the monitoring and hazards data are adequately analyzed and periodically reviewed; that monitoring and hazards assessments are conducted efficiently, effectively, and thoroughly; and that accurate and timely hazards assessments and supporting scientific information are issued to all concerned parties, including local, state, and federal officials, and to the public.

COORDINATING SCIENTIST, AVO/UAFGI - FAIRBANKS

During routine monitoring operation, the Coordinating Scientist based at the UAFGI in Fairbanks, acts as principal liaison between the UAFGI and ADGGS in Fairbanks and the SIC in Anchorage. The Coordinating Scientist is responsible for ensuring the timely communication of monitoring and scientific information gathered at the UAFGI and/or ADGGS to the SIC. The SIC confers with the Coordinating Scientist prior to issuance of a volcanic hazard or eruption notification.

2.2.2 GENERAL OPERATIONAL PROCEDURES

During periods of routine, non-crisis activity, the role of AVO is to coordinate a volcano monitoring program including interpretation of monitoring data, gathering basic geologic data on Alaskan volcanoes to predict probable eruption scenarios based on prior behavior, and developing hazard assessments of Alaskan volcanoes. Under conditions of heightened volcanic activity, the crisis center at AVO-Anchorage becomes directly responsible for all AVO activities concerning the emergency and is the principal point of contact for government agencies, the media, and the public regarding information on volcanic activity and hazards assessment.

AVO coordinates eruption responses with other USGS Volcano Observatories in the Cascades (CVO), Hawaii (HVO), Long Valley California (LVO), and Yellowstone (YVO), as well as with international agencies involved in volcanic ash cloud warnings including the Japan Meteorological Agency (JMA), the Geological Survey of Canada (GSC) and the Canadian Meteorological Centre (CMC). AVO has a major role in responses to eruptions from Russian volcanoes and has a formal operational agreement in place with the Kamchatkan Volcanic Eruption Response Team (KVERT).

2.2.2.1 EARLY ERUPTION PREDICTION, WARNING & CALL-DOWN: SEISMICALLY INSTRUMENTED VOLCANOES

AVO has a program of real-time seismic monitoring at four Cook Inlet volcanoes: Mt. Spurr (Crater Peak), Redoubt, Iliamna and Augustine; and currently at an additional 21 potentially active volcanoes on the Alaska Peninsula and Aleutian Islands (Appendix A). In addition, AVO conducts routine satellite monitoring and may conduct periodic observational overflights and/or landings as weather and volcanic conditions permit, and may obtain intermittent airborne sulfur dioxide and carbon dioxide measurements. The continuous recording of seismic activity at volcanoes, in combination with satellite monitoring techniques, allows AVO to issue warning of the possibility of a volcanic eruption hours to weeks in advance. Normal business hours for AVO are 9:00 a.m. to 5:00 p.m. Monday through Friday. Additionally, seismic data is inspected once a day and satellite data twice a day on weekends. Once a volcano has been placed in color code YELLOW, AVO goes to a 7 day/week watch during which AVO staff check activity of the volcano at least three times a day. AVO goes to a 24-hour watch once a volcano has been placed in color code ORANGE or RED, or if an eruption notification has been received. Notification of an ash-producing eruption will be issued, usually within minutes of onset of eruption. Through the use of an answering service, pagers, and cell phones, AVO staff can be contacted quickly at any time in an emergency.

Once a monitored volcano has become restless (e.g., shows a rising level of seismic activity), the following procedures are implemented:

A. Upon notification of unusual volcanic activity based on any information, a duty person in Anchorage will call the SIC, who is responsible for the decision to activate the calldown procedure. AVO staff in Fairbanks will call either the SIC directly or the Coordinating Scientist who in turn will call the SIC.

B. Initial communication of any change that might indicate an increased level of volcanic hazard will be initiated by the SIC and will be by telephone calldown followed by fax and e-mail information releases as needed and as new information becomes available. AVO's calldown list is as follows:

CALLDOWN RESPONSIBILITY OF AVO ANCHORAGE FOR ALASKAN VOLCANOES

1. FAA	907-269-1103	Air Route Traffic Control Center
2. NWS	907-266-5110	Aviation Forecast
3. CWSU	907-338-1010	
4. ELMENDORF AFB	907-552-2719 . . .	11th Operational Weather Squadron
	907-552-3013	Wing Command Post
5. FORT RICHARDSON	907-384-6666 . .	U.S. Army Alaska Command Center
6. NOAA/SAB	301-763-8444	
7. CANADIAN MET. CENTRE	514-421-4635	
8. U.S. COAST GUARD	907-463-2001	Juneau

CALLDOWN RESPONSIBILITY OF AVO FAIRBANKS FOR ALASKAN VOLCANOES

1. DHS&EM	800-478-2337	
	907-428-7000	Duty Officer
2. GOVERNOR'S OFFICE	907-465-3500	
3. EIELSON AFB	907-377-1500	Command Post

For each call, AVO will state the following message:

"THIS IS AN ERUPTION NOTIFICATION FROM THE ALASKA VOLCANO OBSERVATORY. SEISMIC (or other) DATA INDICATE THAT A (SMALL, MODERATE, LARGE) ERUPTION OF _____ VOLCANO BEGAN AT ___AST (__Z) ON _____ (DATE). THE LEVEL OF CONCERN CODE IS ____ (ORANGE, RED)."

AVO may add additional recipients to the basic calldown list as appropriate (e.g. Drift River Oil Terminal in the case of Redoubt Volcano, Beluga Power Plant in the case of Spurr Volcano, etc.). Following the calldown, a written information release is then implemented by fax and electronic mail distribution to these parties as well as to other constituents.

CALLDOWN RESPONSIBILITY OF AVO ANCHORAGE FOR RUSSIAN VOLCANOES

1. FAA	907-269-1103 . . . . . Air Route Traffic Control Center
2. NWS	907-266-5110 . . . . . Aviation Forecast
3. CWSU	907-338-1010
4. ELMENDORF AFB	907-552-2719 . . . 11th Operational Weather Squadron 907-552-3013 . . . . . Wing Command Post
5. NOAA/SAB	301-763-8444
6. CANADIAN MET. CENTRE	514-421-4635
7. U.S. COAST GUARD	907-463-2001 . . . . . Juneau
8. EIELSON AFB	907-377-1500 . . . . . Command Post

C. Phone surveys of relevant citizen contacts, pilots, and other agency personnel at remote sites along the Alaska Peninsula and the Aleutian Chain are conducted for additional information.

D. If warranted, AVO personnel will attempt to overfly and/or land on the volcano to assess the situation. Airborne gas measurements, deployment of portable seismic and other recording instrumentation, and field observations are options available to AVO and can be used depending on the location of the eruption and severity of hazards.

E. A written information release is made available to constituents by fax and/or e-mail as soon as data are available. At any time, should an eruption be verified and pose a significant hazard to aircraft or a population center, the formal telephone calldown procedure will be done. Calldowns will also be initiated during each significant change in the status of an eruption.

2.2.2.1.1 KAMCHATKAN VOLCANIC ERUPTION RESPONSE TEAM (KVERT)

KVERT is composed of scientists from the Institute of Volcanic Geology and Geochemistry (IVGG), and the Kamchatkan Experimental Seismological and Methodical Department (KEMSD) located in Petropavlovsk-Kamchatsky. As of 2003, ten volcanoes of Kamchatka and Paramushir Island in the northern Kuriles are monitored by seismic instruments (see Appendices B and C). KVERT also receives visual and satellite data for Kamchatka and the northern Kuriles. AVO facilitates dissemination of eruption reports from KVERT, however, KVERT is the

authoritative source of information regarding volcanic activity in Kamchatka and on Paramushir Island.

As of 2003, no formal volcano monitoring and reporting organization exists for the Kurile Island chain south of Paramushir Island. However, discussions are underway to establish such a group in Yuzhno-Sakhalinsk.

KVERT prepares a weekly Information Release describing the status of Kamchatkan volcanoes that is sent by e-mail to AVO, with whom KVERT has a formal working relationship for distribution. In the event of a major eruption, KVERT immediately makes phone calls to the Hydrometeorological Survey at Elizovo Airport in Petropavlovsk, the Department of Civil Emergency, AVO, media, and local officials. A color code is assigned and a written Information Release is sent to AVO. This information is disseminated by AVO through phone, fax and e-mail to international air traffic groups, weather services, and airlines. KVERT releases additional updates and makes call downs as needed, depending on changes in volcanic activity or hazard.

2.2.2.2 SEISMICALLY UNMONITORED VOLCANOES

At this time, AVO has no seismic monitoring instruments on about 16 historically active volcanoes of the Alaska Peninsula, along the Aleutian Islands, and in the Wrangell Mountains (see Appendix A). For these volcanoes, prompt detection and notification of eruptive activity may be delayed, and future activity cannot be forecast. However, AVO routinely checks remote sensing data obtained by satellite for all volcanoes in Alaska and Kamchatka for signs of activity at least twice a day. In addition, AVO responds to and requests information from pilot reports (via FAA and NWS) and observations from the U.S. Coast Guard, U.S. Fish and Wildlife Service, local residents, the military, and fishing vessels to detect and monitor activity on all volcanoes, whether seismically monitored or not. If AVO receives a report of a possible eruption or detects one in satellite data, the following steps are taken:

A. Satellite data is analyzed (if the report comes from another source) to determine whether volcanic activity or an ash plume can be detected.

B. Based on information archives maintained at AVO, descriptions of past activity at a given volcano are reviewed as possible indicators of the type of activity to be expected.

C. Phone contact is made with the FAA and NWS, depending upon the source of the original information, to alert both agencies to the situation and to the possible need for additional pilot reports.

D. Procedures are followed as for seismically instrumented volcanoes.

2.2.2.3 UPDATES AND INFORMATION RELEASES

AVO's component agencies have a statutory obligation to disseminate to the public information that reports and interprets potentially hazardous volcanic activity in Alaska. A formal operational agreement with KVERT calls for AVO also to disseminate information of volcanic activity in

Kamchatka. AVO's responsibility overlaps and integrates with that of NWS once an ash cloud has been generated and is in the atmosphere. Upon verification of a major eruption and following the calldown procedure, a written statement (e.g., an AVO Update) that includes (as much as known) the location, time, type, size of the eruption, and a listing of possible hazard scenarios is distributed by AVO to federal, state, and local government agencies, directly affected private parties, the media, and commercial airlines by pre-programmed facsimile machines and electronic mail systems. Additional updates are released as needed, depending on changes in volcanic activity or hazards. All requests for inclusion on the distribution list must go through the SIC. This list is updated at least bimonthly or as needed during crises.

AVO maintains a recorded phone message line for general information use (907-786-7478) that is updated frequently with summations of the latest status of volcanic activity. A very short message for air carriers reporting the status of volcanoes in Color Code ORANGE and/or RED is at 907-786-7477. Information can be obtained at the AVO web site at http://www.avo.alaska.edu or the USGS Volcano Hazards site at http://volcanoes.usgs.gov which also links to all the USGS volcano observatory sites. Timely and accurate dissemination to appropriate agencies and the public of information regarding volcanic activity and associated hazards is the responsibility of the SIC.

2.2.2.4 COMMUNICATION WITH OTHER AGENCIES

Throughout a volcanic crisis, frequent telephone contact with NWS, FAA, DOD, DHS&EM, US Coast Guard, and other concerned agencies must be maintained to ensure effective communication of observational data and consistent interpretations of volcanic activity and potential hazards.

2.2.2.5 LEVEL OF CONCERN COLOR CODE SYSTEM

The SIC, in consultation with the Coordinating Scientist, may decide to implement a level of concern color code system that assigns a level of concern to one of four categories that are keyed to the current state of a specific seismically monitored volcano and the nature and impact of its expected activity. Updates and/or Information Releases that indicate a change in level of concern will include an explanation for the choice of color code, a description of the volcano's current activity, and a discussion of the identified hazards.

The SIC, in consultation with the Coordinating Scientist, may also assign a level of concern color code to a volcano that is not seismically monitored based on its past eruptive history, pilot or ground-based observations, and/or remote sensing data. However, non-seismically monitored volcanoes can never be in code Green because AVO can never know with any certainty that no activity is occurring and the volcano is quiet. Thus a volcano without a seismic network may have a color code assigned to it while active and no color code when not. Also AVO will not be able to track increases in seismic activity at volcanoes without a seismic network and in most cases, will not be able to issue warning or notification of an impending eruption.

NOTE: THE DEFINITION OF EACH COLOR-CODED CATEGORY, AS OUTLINED ON THE FOLLOWING PAGE, COULD VARY SLIGHTLY DEPENDING ON THE SPECIFIC VOLCANO.

Alaska Volcano Observatory

LEVEL OF CONCERN COLOR CODE: Generic

To more concisely describe our level of concern about possible or ongoing eruptive activity at an Alaskan volcano, the Alaska Volcano Observatory (AVO) uses the following color-coded classification system. Definitions of the colors reflect AVOs interpretations of the behavior of the volcano. Definitions are listed below followed by general descriptions of typical activity associated with each color.

GREEN: **No eruption anticipated.**

Volcano is in quiet, "dormant" state.

YELLOW: **An eruption is possible in the next few weeks and may occur with little or no additional warning.**

Small earthquakes detected locally and (or) increased levels of volcanic gas emissions.

ORANGE: **Explosive eruption is possible within a few days and may occur with little or no warning. Ash plume(s) not expected to reach 25,000 feet above sea level.**

Increased numbers of local earthquakes. Extrusion of a lava dome or lava flows (non-explosive eruption) may be occurring.

RED: **Major explosive eruption expected within 24 hours. Large ash plume(s) expected to reach at least 25,000 feet above sea level.**

Strong earthquake activity detected even at distant monitoring stations. Explosive eruption may be in progress.

2.2.2.6 DESIGNATION OF AUTHORITY

The Federal Government, through the Stafford Disaster Relief and Emergency Assistance Act of 1974 (Public Law 93-288), states that the U.S. Geological Survey has been delegated the responsibility to issue disaster warnings "... for an earthquake, volcanic eruption, landslide, or other geologic catastrophe."

The Alaska State Legislature has similarly directed that the Alaska Division of Geological and Geophysical Surveys conduct scientific investigations to assess geologic hazards to buildings and transportation facilities (AS 41.08.020). The Geophysical Institute of the University of Alaska Fairbanks is instructed to collect and archive seismic data on volcanic eruptions, to assess eruption hazards, and to inform the public, public officials, and industry of risks to lives and property (AS 14.40.075).

The MOU establishing the Alaska Volcano Observatory coordinates fulfillment of these state and federal obligations among the USGS, ADGGS, and UAFGI.

2.3 DEPARTMENT OF DEFENSE

The 11th Operational Weather Squadron (OWS) at Elmendorf Air Force Base (AFB) has the responsibility of informing key personnel at Alaskan Command (ALCOM) and the Alaska North American Aerospace Defense Command (ANR) of any volcano activity expected to affect flight or ground operations within the Alaskan Theater. In the event of a significant volcanic eruption, the 11 OWS will also ensure aircrews requesting remote weather briefings are made aware of the estimated horizontal and vertical extent of the ash cloud.

The 3rd Wing Command Center (3 WG/CP) has the responsibility of informing 3 WG key personnel of volcanic activities specifically affecting Elmendorf AFB and pilots flying the North Pacific (NOPAC) routes.

The 354th Fighter Wing Command Center (354 FW/CP) has the responsibility of informing 354 FW key personnel of volcanic activities specifically affecting Eielson AFB.

The United States Army Alaska (USARAK) Command Operations Center has the responsibility of informing USARAK key personnel of volcanic activities specifically affecting U.S. Army locations in Alaska.

2.3.1 PROCEDURES

The Theater Meteorological Satellite Coordinator at the 11 OWS has the responsibility to provide satellite imagery from the Defense Meteorological Satellite Program (DMSP) polar orbiting satellites. DMSP imagery will be made available through normal communication circuits, and will be provided as long as no scheduling conflicts occur with Air Force mission requirements. In case of a conflict, Air Force requirements will be met first, and any excess satellite time will be devoted to volcanic activity imaging.

The 11 OWS and Combat Weather Teams (CWT) from Elmendorf AFB, Eielson AFB, and Fort Wainwright will transmit, over normal communications channels, both civilian and military aviation weather circuits, any pilot weather reports (PIREPs) they receive containing volcanic activity information and will encode them as Urgent PIREPs (UUA) in accordance with Air Force Manual 15-124.

2.4 FEDERAL AVIATION ADMINISTRATION (FAA)

The FAA Anchorage ARTCC collects and disseminates volcanic information received from various sources, including AVO, pilot reports, other FAA facilities, and the Russian air traffic control facility in Petropavlovsk-Kamchatsky, Russia. The FAA does not generate information pertaining to volcanic ash episodes, nor track or predict volcanic ash cloud movement. The FAA relies on information provided by NWS, AVO, and pilot reports, for current and forecast conditions.

2.4.1 PROCEDURES

When volcanic information is received by an FAA facility, it is forwarded to the Anchorage ARTCC Supervisory Traffic Management Coordinator-in-Charge (STMCIC) who then notifies the ARTCC's Traffic Management Unit (TMU). If the initial notification is from other than AVO, the STMCIC attempts to obtain verification of the eruption from AVO.

The Alaskan Region FAA contact is the Anchorage ARTCC STMCIC. The Anchorage ARTCC STMCIC can be contacted at 907-269-1103; the TMU Manager at 907-269-1108.

The STMCIC will notify the Center Weather Service Unit (CWSU) meteorologist who will issue an UUA. If an eruption occurs when a CWSU meteorologist is not on duty, the STMCIC will issue the UUA, contact the AAWU, and, if required, contact a CWSU meteorologist to report immediately to the ARTCC.

The STMCIC will contact the FAA Regional Operations Center (ROC), Anchorage ARTCC Manager, the Flight Service Station (FSS) nearest to the volcanic activity, and Anchorage Air Traffic Control Tower to notify them of the volcanic eruption.

The STMCIC then issues a Flight Data Center (FDC) Temporary Flight Restriction (TFR) Notice to Airmen (NOTAM). When information is known about the extent and drift of the ash cloud, an FDC/International Volcano Advisory NOTAM is issued.

The STMCIC will coordinate with the CWSU meteorologist on duty to provide NOTAM and PIREP information. The STMCIC will ensure that the Volcano Meteorological Impact Statements (MIS) prepared by the CWSU are sent via the flexcache rapid fax computer to a designated listing of more than sixty-five aviation users to assist them in their operational planning.

The Operations Supervisor-in-Charge (OSIC) will disseminate the NOTAM, PIREP, current conditions, and any flight restriction information to the air traffic controllers on duty.

The air traffic controllers will disseminate this information to all aircraft in flight through air to ground radio frequencies. The most current information available concerning ash cloud position and altitude will be provided. The air traffic controllers will continue to solicit, relay, and record PIREP data. With pilot's concurrence they will suggest headings or reroutes around known ash or possible ash cloud areas.

Simultaneously, the TMU will coordinate with the Air Traffic Control System Command Center (ATCSCC) advising them of possible reroutes and traffic delays. The TMU will determine what, if any, reroutes or air traffic flow control measures to issue.

The TMU will coordinate these reroutes with the affected facilities and monitor the new routings and affected areas.

2.5 NATIONAL WEATHER SERVICE (NWS)

The NWS provides the Alaska aviation community, other government agencies, and the public with forecasts and warnings for volcanic ash in the atmosphere. The NWS also provides the AVO, FAA, DOD, and DHS&EM with meteorological details during eruptions containing volcanic ash: satellite imagery interpretations of ash plume boundaries, ash plume top measurements, ash plume movement from radar, forecasts and warnings for the location of volcanic ash in the atmosphere, and summaries of pilot reports containing volcanic ash information.

The AAWU is a Volcanic Ash Advisory Center (VAAC) for the Northern Pacific within the boundaries of the Alaska FIR and for northeast Russia, north of 60° North latitude and east of 150° East longitude. In Alaska the NWS-VAAC and AVO work as a team. The NWS provides the meteorological and communication pathways for the Volcanic Ash Advisories (VAA) prepared using International Civil Aeronautics Organization (ICAO) format. The AVO provides the volcanological input to the AAWU for use in the VAAs.

A total of nine VAACs are located around the globe and are a designation of the ICAO. VAACs issue VAAs which are informational messages about volcanic eruptions disseminated through the AFTN. The AAWU also is a Meteorological Watch Office (MWO), another designation of the ICAO. MWOs issue Volcanic Ash International SIGMETs to aviation customers and the FAA. Volcanic Ash International SIGMETs are disseminated worldwide through the FAA's DAWN and also through the NWS' Telecommunications Gateway.

The Anchorage CWSU provides UUAs to those already airborne. The CWSU issues graphical MISs that are disseminated globally via facsimile. The CWSU also disseminates an alphanumeric MIS as well as a Center Weather Advisory (CWA) as conditions warrant.

Weather Forecast Offices (WFO) and Weather Service Offices (WSO) in Alaska participate in the volcanic eruption response by issuing volcanic ash statements and warnings to the public. These offices also provide observations of eruptions and the resulting volcanic ash.

2.5.1 DEFINITION OF A REPORT OF VOLCANIC ERUPTION WITH ASH

The definition of a reliable report of an eruption accompanied by volcanic ash used by the NWS Alaska Region is any of the following conditions:

A. An eruption with ash is assumed to have occurred within the Alaska FIR when reported by at least one of the following, subject to confirmation:

   (1) Pilot report.

   (2) Ground observer.

   (3) Information from the AVO.

   (4) Satellite or weather radar imagery.

   (5) NWS operations staff.

   (6) National Centers (Washington VAAC or the National Centers for Environmental Prediction (NCEP) Aviation Weather Center (AWC)).

B. An eruption with ash is assumed to have occurred for volcanoes outside of the Alaska FIR when reported by at least one of the following:

   (1) JMA.

   (2) Environment Canada.

   (3) CMC.

   (4) KVERT.

   (5) VAACs.

   (6) MWOs.

Reliable reports of volcanic eruptions are extremely important for the timely notification and warning of any volcanic ash potentially affecting the Alaska FIR. Information from reliable sources outside of the Alaska FIR also is valuable for inclusion in the VAAs, the Volcanic Ash SIGMETs, Volcanic Ash UUAs, and graphical MISs.

2.5.2 NWS VOLCANO ERUPTION RESPONSE PROCEDURES, COORDINATION, PRODUCTS, AND SERVICES

2.5.2.1 ALASKA AVIATION WEATHER UNIT (AAWU)/ANCHORAGE VAAC

2.5.2.1.1 PRODUCTS

SIGMET: The AAWU, as an international MWO, issues volcanic eruption and volcanic ash SIGMETs. The SIGMET serves as the primary warning product to the aviation community of the hazard of volcanic ash. The initial eruption or ash SIGMET is issued as soon as possible within ten minutes from the time of notification of volcanic ash impacting the Anchorage FIR and may contain limited information. If it is determined volcanic ash is present, a follow-up SIGMET identifies the spatial and vertical extent of a volcanic ash hazard for a six-hour period and an outlook for the extent of the ash at 18 hours from the SIGMET issuance time. A SIGMET is canceled as soon as it is reliably confirmed an ash hazard no longer exists in an area.

Volcanic Ash Advisory - Alert: In an ash event the AAWU, as the Anchorage VAAC, issues an Alert VAA which serves as a guidance product to the aviation, meteorological, and volcanological community. An Alert VAA product contains information on the volcano, volcanic eruption, current areal and vertical extent of ash, a forecast of the ash hazard 18 hours from issuance time, and any other pertinent information. The VAA is issued every six hours with updates any time as necessary.

Volcanic Ash Advisory - Watch: A Watch VAA is issued when, as determined by the AVO, a monitored Alaska Volcano is in code level ORANGE or RED (or an unmonitored volcano has a high probability of an imminent eruption). The Watch VAA, which is only issued when there is no ash currently present, indicates the speed and direction ash would spread if there was an eruption. The Watch VAA is issued every six hours and would be replaced by an Alert VAA if an eruption was to occur. A one time Watch VAA is issued as a first notification of increased activity when AVO upgrades a monitored volcano from color code GREEN to YELLOW.

2.5.2.1.2 AAWU COORDINATION PROCEDURES

Information observations indicating a volcanic eruption or the presence of volcanic ash can be incomplete and/or highly uncertain. The exchange of information between the AVO, CWSU, ARTCC, DOD, the NWS AWC in Kansas City, and other VAACs is vital in determining the extent and severity of a volcanic ash hazard.

Upon notification of a potential volcanic ash hazard, the AAWU immediately coordinates this information with the CWSU (or the FAA supervisor during CWSU non-duty times) at the ARTCC so that an immediate alert can be given to aircraft in flight near the ash hazard. The AAWU then coordinates with the AVO on the geologic aspects of the eruption producing the ash.

Before the issuance of the VAA and/or the follow-up SIGMET, the AAWU will initiate a conference call to the CWSU and AVO to coordinate on the latest information on the event. Close coordination with the AVO and CWSU continues throughout the duration of the event.

Subsequent coordination is made with the Washington VAAC, the Tokyo VAAC (for Kamchatka eruptions), the Montreal VAAC (for potential hazards in Canadian air space), the AWC, and affected Alaska NWS offices.

Before an event is ended or handed off to another VAAC a conference call will be made to the CWSU, AVO, and any other principle units involved in the event to achieve a consensus on further actions.

2.5.2.1.3 COORDINATION PARTNERS

CWSU/ARTCC: AAWU coordinates with the Anchorage CWSU meteorologist (or ARTCC Supervisor) to solicit additional PIREPs and related information, and to consider issuing a CWA/MIS. If the event occurs during CWSU non-duty hours, coordination is made with the ARTCC STMCIC on the decision to recall the CWSU meteorologist to issue a CWA or MIS. *The CWSU/FAA ARTCC also should be contacted for possible contact with their counterparts in Petropavlovsk-Kamchatsky, Russia for verification and provision of any details regarding an ash plume in that region.*

AVO (KVERT): AAWU coordinates with AVO (or KVERT) for geologic information such as seismic data, ground-based observations, and background knowledge of eruptive history and type of eruption to be expected. Collaboration on satellite imagery interpretation also may occur. The AVO also can provide information on suspected volcanic eruptions occurring on the Kamchatka Peninsula/Kurile Islands of Russia.

NWS WFOs/WSOs: AAWU coordinates with Alaska Region WFOs and WSOs potentially affected by volcanic ash to gain information they may have on the volcano's activity and to collaborate on volcanic ash forecasts and warnings.

FAA Automated Flight Service Stations/Flight Service Stations, FAA Air Traffic Control Towers, and Air Force Alaska Regional Forecaster Center (11th OWS) - Elmendorf Air Force Base: AAWU contacts Automated Flight Service Stations, Flight Service Stations, FAA Air Traffic Control Towers, and the Elmendorf Air Force Base Alaska Regional Forecast Center to solicit additional PIREPs or other volcanic information.

Washington VAAC (composed of the NCEPs Senior Duty Meteorologist and the National Environmental Satellite, Data, and Information Service's Satellite Applications Branch): AAWU collaborates with the Washington VAAC on running the Volcanic Ash Forecast Transport and Dispersion (VAFTAD) model, satellite imagery interpretation, and the possible transfer of VAAC responsibility and/or the ending of an event.

AWC - Kansas City, Missouri: AAWU coordinates with AWC on Volcanic Ash SIGMETs near and over the Oakland FIR.

Tokyo VAAC: AAWU conducts a two-way collaboration with the JMA Tokyo VAAC through multi-lingual telephone fax forms and resulting text and graphics products. Using this method, AAWU and the Tokyo VAAC share information on possible eruptions on the Kamchatka Peninsula and Kurile Islands.

Montreal VAAC (Canadian Meteorological Centre, Meteorological Services of Canada (MSC)): AAWU coordinates with the Montreal VAAC to run the Canadian Emergency

Response Model (CANERM), collaborate on event details and products involving ash in the vicinity of Canadian airspace, and regarding the possible transfer of VAAC responsibility.

MSC Western Aviation Forecast Center, Edmonton, Alberta, Canada: AAWU coordinates with Edmonton regarding volcanic ash SIGMETs near Canadian airspace.

2.5.2.2 ANCHORAGE CENTER WEATHER SERVICE UNIT (CWSU)

The Anchorage CWSU, located at the FAA's Anchorage ARTCC, is staffed by NWS meteorologists and operates 15 hours a day (6:00 a.m. until 9:00 p.m. local time), 7 days a week. The Anchorage CWSU staff prepare and disseminate UUAs (as a quick response report of volcanic eruptions), volcanic ash CWAs, MISs, and graphical MISs.

An UUA for an eruption is issued by the CWSU immediately upon notification of volcanic eruption. The CWSU staff train FAA ARTCC staff to disseminate the volcanic ash UUA during those times when the CWSU staff are not on duty.

The CWA, similar to the SIGMET, contains information about eruptions and location of volcanic ash for a 0-6 hour period. The CWA is an in-flight aviation weather advisory to pilots, air traffic controllers, and ARTCC operational staff. The CWA should be issued for volcanic activity which is below SIGMET criteria but still merits attention by aviation operations.

Dissemination of the graphical volcanic ash trajectory MIS includes commercial aviation services, domestic and international (Korea, Japan, China, France, Canada); airport managers; U.S. Air Force; National Transportation Safety Board; Environment Canada; the Smithsonian Institute; and the NCEP Satellite Analysis Branch. The dissemination is by an automatic telephone facsimile system to more than 70 locations. The CWSU manages and maintains the list of facsimile locations, and may be contacted for changes or additions. The MIS covers a 2-12 hour period.

The CWSU meteorologist also prepares a graphic on the Weather and Radar Processor (WARP) depicting the volcanic ash plume, forecast plume movement, and any additional information pertaining to the volcano. The graphic is sent to seven briefing terminals which are located throughout the Anchorage ARTCC. These products are part of an automated aviation weather briefing sequence.

CWSU PROCEDURES

1. Once a report of a volcanic eruption or volcanic ash is forwarded to the CWSU, the CWSU meteorologist enters the report as an UUA.

2. The UUA is disseminated to the STMCIC, TMU, sector supervisors, and controllers.

3. A phone call is made to the AAWU.

4. A phone call is made to the AVO.

5. Any SIGMETs pertaining to the eruption are copied and disseminated to the STMCIC, TMU, sector supervisors, and the controllers.

6. A volcano MIS is prepared (if required) and faxed to the customers.

7. A graphic is prepared and transmitted to the five briefing terminals within the Anchorage ARTCC.

8. Follow-up briefings and coordination calls take place as needed.

2.5.2.3 ALASKA REGION WFOS AND WSOS

Public and Marine Volcanic Ash Warnings and Statements: The NWS responsibility for providing meteorological information to other government agencies and the general public about volcanic ash clouds includes:

A. WFOs coordination with the Anchorage VAAC (AAWU) on the location and forecast movement of volcanic ash clouds.

B. WFOs issue and WSOs may issue warnings and statements in public and marine products when volcanic ash is present or is expected to be present within the next **four** hours in their area of responsibility. Warnings and statements contain the spatial extent and progress of the ash. Warnings and statements should be consistent with the location of the ash as given in SIGMETs issued by AAWU and given in graphical MISs issued by the CWSU.

C. WFO volcanic eruption response and ash-tracking activities should be coordinated with DHS&EM and the AVO in Anchorage.

D. The public should be referred to DHS&EM for information on the effect of ash fallout relating to health and safety. The public should be referred to the AVO in Anchorage for information on the geological aspects of the eruption.

2.5.3 ASH TRAJECTORY FORECASTS FROM NUMERICAL MODELS

The AAWU should initiate the PUFF trajectory model available on the local area network at the VAAC when a volcanic eruption is suspected or has occurred. The PUFF is intended to provide guidance to forecasters for preparing the initial ash SIGMET and VAA. It is also useful for minor ash producing eruptions with the potential to affect airports within 40 nautical miles of the volcano. Output from PUFF is not disseminated.

The primary eruption response ash tracking model is the NWS VAFTAD model. The VAFTAD is initiated by a request from the Anchorage VAAC. The VAAC should initiate the VAFTAD for all significant or major eruptions affecting Alaska FIRs. Issuing the VAFTAD for minor eruptions will be at the discretion of the AAWU senior forecaster based on coordination with the AVO and the Washington VAAC Senior Duty Meteorologist (SDM). Definitions of minor, significant, and major are:

Minor Eruption = Estimated vertical extent ash is below 20,000 feet.

Significant Eruption = Estimated vertical extent ash extends to or above 20,000 feet up to 40,000 feet.

Major Eruption = Estimated vertical extent ash extends to or above 40,000 feet.

These definitions are for meteorological aspects of volcanic ash clouds.

The VAFTAD products from the request are automatically sent to the AAWU via File Transfer Protocol (FTP) and the AVO via telephone facsimile. The AAWU should initiate the VAFTAD as quickly as possible to support AVO eruption response operations. This is critical for support of the AVO volcano hazards warning system and safety of personnel and instruments during monitoring logistics once an eruption has begun.

A request from the AAWU forecaster to the SDM at NCEP is required for dissemination of the VAFTAD products to external customers. VAFTAD products should be disseminated for significant and major eruptions. The dissemination includes (1) the service to Alaskan airlines, DOD, U.S. Coast Guard, and the FAA Flight Service Stations, and (2) the World Area Forecast Service (WAFS) to government, national commercial, and international commercial customers. There are two modes of VAFTAD products – the **Alert** mode and the **Watch** mode:

A. **Alert** - all **Significant** and **Major** eruptions. The **Alert** status should remain in effect until advised by the AVO that the volcano in question is no longer erupting.

B. **Alert -** Seismically **unmonitored** volcanoes when any eruption occurs that contains **volcanic ash**. The continuation of an **Alert** will be based on coordination with volcanological authorities and the SDM at NCEP.

C. **Watch** - Seismically monitored volcanoes the volcanological authorities have listed as color code **RED** that are **not erupting** should be issued at least **twice daily**.

D. **Watch** - All **seismically monitored** volcanoes listed with color code **ORANGE** the local volcanological authorities indicate could produce a significant or major eruption in the next 24-48 hours.

In the event VAFTAD is not available, a request should be made by the AAWU lead forecaster for the CANERM through the Canadian Meteorological Centre. The request is made by calling CMC in Montreal, Canada. Output from the CANERM is available via telephone facsimile or the Internet.

2.5.4 DISSEMINATION OF PRODUCTS

Meteorological information from the NWS about volcanic ash is disseminated through operational communications systems, such as:

A. FAA's DAWN and the NWS' Telecommunications Gateway for Volcanic Ash International SIGMETs, public, and marine text products.

B. NOAA Weather Wire for public and marine text products.

C. NOAA Weather Radio, which is the link to the Emergency Alert System, for public and marine text products.

D. NWS marine HF and VHF radios for marine text products.

E. The WAFS for VAFTAD graphic products.

F. AFTN and Advanced Weather Information Processing System (AWIPS) (to NWS facilities) for the VAA.

G. Telephone facsimile machine for graphical MIS.

These operational dissemination systems are reliable and maintenance is on call 24 hours a day, seven days a week.

Volcanic ash advisories, public and marine text/graphic products, VAFTAD, CANERM, satellite and radar imagery applicable to the eruption and volcanic ash also are available through the Internet and CoastWatch. The Internet and CoastWatch are not as reliable as the preceding operational systems because posting of the products could be disrupted without repair service outside of the regular hours of business at night, on weekends, and on holidays. Information on the CoastWatch service can be provided by the CoastWatch Manager.

The warnings and statements for the public also are disseminated by DHS&EM through the DHS&EM First Class e-mail system, the DHS&EM Daily Situation Update and the DHS&EM Website (ak-prepared.com). This network reaches the majority of the emergency services organizations in the state.

2.6 UNITED STATES COAST GUARD

Coast Guard aviation assets fly missions on a routine basis throughout the State of Alaska. If during these missions, Coast Guard aircrews notice any suspected volcanic activity, they shall attempt to report that activity to the nearest FAA Flight Service Station.

3.0 PLAN MANAGEMENT

This Operating Plan should be reviewed and updated every two years by each participating agency by December 15th. The plan should be maintained by the National Weather Service Alaska Region (Environmental and Scientific Services Division).

4.0 LIST OF ACRONYMS

ACRONYM	DESCRIPTION
AAWU	Alaska Aviation Weather Unit
ADGGS	Alaska Division of Geological and Geophysical Surveys
AFB	Air Force Base
AFTN	Aeronautical Fixed Telecommunications Network
ALCOM	Alaskan Command
ANR	Alaska North American Aerospace Defense Command
ARTCC	Air Route Traffic Control Center
ATCSCC	Air Traffic Control System Command Center
AVO	Alaska Volcano Observatory
AWC	Aviation Weather Center
AWIPS	Advanced Weather Information Processing System
CANERM	Canadian Emergency Response Model
CMC	Canadian Meteorological Centre
CVO	Cascades Volcano Observatory
CWA	Center Weather Advisory
CWSU	Center Weather Service Unit
CWT	Combat Weather Team
DAWN	Digital Aviation Weather Network
DHS&EM	Division of Homeland Security and Emergency Management
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
EAS	Emergency Alert System
FAA	Federal Aviation Administration
FDC	Forecaster's Development Course
FIR	Flight Information Region
FSS	Flight Service Station
FTP	File Transfer Protocol
GSC	Geological Survey of Canada
HF	High Frequency
HVO	Hawaiian Volcano Observatory
ICAO	International Civil Aeronautics Organization
IVGG	Institute of Volcanic Geology and Geochemistry
JMA	Japan Meteorological Agency
KEMSD	Kamchatkan Experimental Seismological and Methodical Department
KVERT	Kamchatkan Volcanic Eruption Response Team
LVO	Long Valley California Volcano Observatory
MIS	Meteorological Impact Statement
MSC	Meteorological Services of Canada
MWO	Meteorological Watch Office
NCEP	National Centers for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NOPAC	NOrth PACific

NOTAM	NOTice to AirMen
NWR	NOAA Weather Radio
NWS	National Weather Service
OSIC	Operations Supervisor-in-Charge
OSS	Operational Support Squadron
OSW	Operational Support Weather
OWS	Operational Weather Squadron
PIREP	PIlot Weather REPORT
ROC	Regional Operations Center
SAB	Synoptic Analysis Branch
SDM	Senior Duty Meteorologist
SECC	State Emergency Coordination Center
SIC	Scientist-In-Charge
SIGMET	SIGnificant METeorological Advisory
STMCIC	Supervisory Traffic Management Coordinator-in-Charge
TFR	Temporary Flight Restriction
3 WG/CP	3rd Wing Command Center
354 FW/CP	354th Fighter Wing Command Center
TMU	Traffic Management Unit
UAFGI	University of Alaska Fairbanks Geophysical Institute
USARAK	United States Army Alaska
USCG	United States Coast Guard
USGS	United States Geological Survey
UUA	Urgent Pilot Report
VAAC	Volcanic Ash Advisory Center
VAA	Volcanic Ash Advisory
VAFTAD	Volcanic Ash Forecast Transport and Dispersion
VHF	Very High Frequency
WAFS	World Area Forecast Service
WARP	Weather and Radar Processor
WFO	Weather Forecast Office
WSO	Weather Service Office
YVO	Yellowstone Volcano Observatory

5.0 PRINCIPAL CONTACTS AND PHONE NUMBERS

ALASKA VOLCANO OBSERVATORY ANCHORAGE (USGS)

24 Hour Pager Access 907-786-7497
This is the main crisis room number – if someone is there and available they will answer it. Otherwise a recorded message will instruct you how to proceed. If it is an emergency, you will be instructed to press "0" and you will be connected to an answering service that will take a message and then start down the list of numbers until they reach an AVO staff member. Rarely, the answering service may put you on hold for a short time.

Scientist-in-Charge	cell phone	907-250-1716
	pager	907-267-7327
Duty Scientist	cell phone	907-250-3539
	pager	907-267-7326
Crisis Room		907-786-7497
Recorded Message (General)		907-786-7478
Recorded Message (Aviation)		907-786-7477
Fax		907-786-7450/7425

ALASKA VOLCANO OBSERVATORY FAIRBANKS (UAFGI/ USGS/ DGGS)

Coordinating Scientist	cell phone	907-322-4084
Acting Coordinating Scientist	cell phone	907-322-4085
Duty Seismologist	cell phone	907-322-2014
	pager	907-496-3588
		(enter your telephone number after tone)
Seismology Lab		907-474-5681/5682
Recorded Message (General)		907-786-7320
Fax		907-474-5618

DIVISION OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT

DHS&EM Duty Officer (24 Hour) . . . . . 907-428-7000 or 1-800-478-2337

SECC (when activated) . . . . . SECC Manager 907-428-7293

Planning/Coordination . . . . . State/Federal Planner 907-428-7000

FEDERAL AVIATION ADMINISTRATION

Anchorage ARTCC STMCIC 907-269-1103
Fax 907-269-1343

TMU Manager 907-269-1108

FAA Regional Operations Center 907-271-5936
Fax 907-276-7261

Kenai AFSS Operations Floor 907-283-8469
Fax 907-283-4228

Fairbanks AFSS Operations Floor 907-474-4952
Fax 907-474-0766

Juneau AFSS Operations Floor 907-586-7351
Fax 907-586-2374

NATIONAL WEATHER SERVICE

National Volcanic Ash Program Manager/Regional Aviation Meteorologist 907-271-5132
Fax 907-271-3711

CoastWatch Manager/Regional Scientist 907-271-3886
Fax 907-271-3711

AAWU 907-266-5110
Fax 907-266-5188

CWSU 907-338-1010
Fax 907-338-1510

WFO Anchorage 907-266-5105
Fax 907-266-5188

WFO Fairbanks 907-456-0247
Fax 907-456-0381

WFO Juneau 907-586-7493
Fax 907-586-7122

UNITED STATES AIR FORCE

Theater Satellite Coordinator 907-552-5045

Operations Flight, 11th Operation Weather Squadron 907-552-2719
Fax 907-552-8351

Duty Forecaster, 3 OSS/OSW 907-552-4903

Duty Forecaster, 354 OSS/OSW 907-377-3140

UNITED STATES COAST GUARD

Seventeenth District Command Center 907-463-2001

6.0 PRINCIPAL CONTACTS WEB PAGES

ALASKA VOLCANO OBSERVATORY ANCHORAGE (USGS)

http://www.avo.alaska.edu/

DIVISION OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT

http://www.ak-prepared.com

FEDERAL AVIATION ADMINISTRATION

http://www.faa.gov
Alaskan Region: http://www.alaska.faa.gov

NATIONAL WEATHER SERVICE

Alaska Region: http://www.arh.noaa.gov
AAWU: http://www.aawu.arh.noaa.gov
CWSU: http://cwsu.arh.noaa.gov

UNITED STATES AIR FORCE

11th Operational Weather Squadron: https://131.37.248.63
(.mil or .gov domain sites only)

UNITED STATES COAST GUARD

http://www.uscg.mil/d17/

7.0 SIGNATURE PAGE

May 7, 2004 //signed//
Date
Dave Liebersbach
Director
Division of Homeland Security & Emergency Management

April 21, 2004 //signed//
Date
Thomas L. Murray
Scientist-in-Charge
Alaska Volcano Observatory
U.S. Geological Survey

April 15, 2004 //signed//
Date
Jay S. Fitzgerald, Lt Col, USAF
Senior METOC Officer
Alaskan Command

April 12, 2004 //signed//
Date
Patrick N. Poe
Administrator
Federal Aviation Administration
Alaskan Region

June 17, 2004 //signed//
Date
Laura K. Furgione
Acting Director
National Weather Service
Alaska Region

June 15, 2004 //signed//
Date
Commander Michael E. Kendall
Chief, Search and Rescue Branch
Seventeenth Coast Guard District

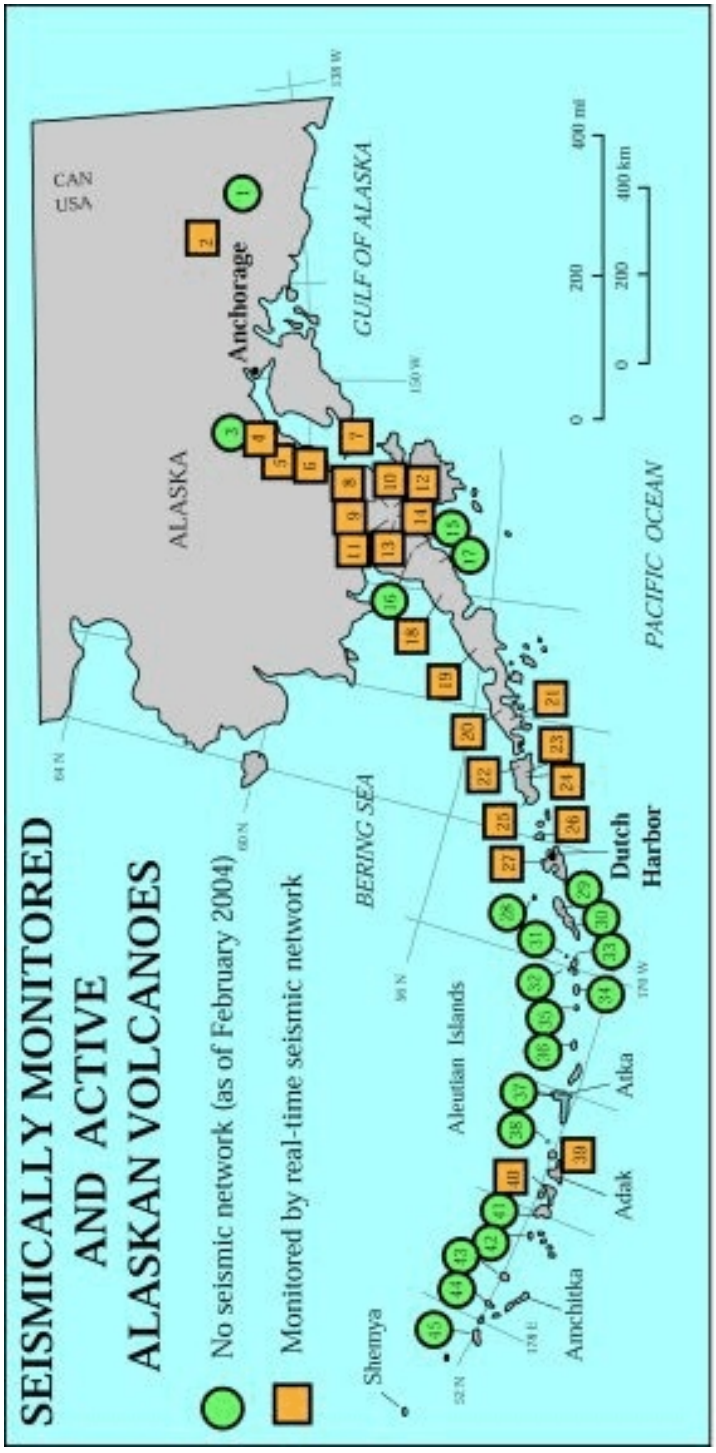
APPENDIX A ACTIVE VOLCANOES OF ALASKA

MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
1	*Bona-Churchill*	*1105-03*	*61°23'N, 141°45'W*	**	*16,420'; 5,005 m*
2	**Wrangell**	**1105-02**	**62°00'N, 144°01'W**	**1902**	**14,163'; 4,317 m**
3	*Hayes*	*1103-05*	*61°37'N, 152°29'W*	**	*9,147'; 2,788 m*
4	**Spurr**	**1103-04**	**61°18'N, 152°15'W**	**1992**	**11,070'; 3,374 m**
5	**Redoubt**	**1103-03**	**61°28'N, 152°45'W**	**1989-90**	**10,197'; 3,108 m**
6	***Iliamna***	***1103-02***	***60°02'N, 153°04'W***	**	***10,016'; 3,053 m***
7	**Augustine**	**1103-01**	**59°23'N, 153°26'W**	**1986**	**4,134'; 1,260 m**
8	***Snowy***	***1102-20***	***58°20'N, 154°41'W***	**	***7,090'; 2,161 m***
9	***Griggs***	***1102-19***	***58°21'N, 155°06'W***	**	***7,602'; 2,317 m***
10	**Katmai**	**1102-17**	**58°16'N, 154°59'W**	**1912**	**6,716'; 2,047 m**
11	**Novarupta**	**1102-18**	**58°16'N, 155°09'W**	**1912**	**2,759'; 841 m**
12	**Trident**	**1102-16**	**58°14'N, 155°07'W**	**1953-74**	**3,599'; 1,097 m**
13	**Mageik**	**1102-15**	**58°11'N, 155°14'W**	**1946?**	**7,103'; 2,165 m**
14	**Martin**	**1102-14**	**58°10'N, 155°21'W**	**1953-54?**	**6,102'; 1,860 m**
15	Peulik	1102-13A	57°45'N, 156°21'W	1852	4,836'; 1,474 m
16	Ukinrek	1102-13B	57°50'N, 156°30'W	1977	299'; 91 m
17	Chiginagak	1102-11	57°08'N, 157°00'W	1971?	7,005'; 2,135 m
18	**Aniakchak**	**1102-09**	**56°53'N, 158°10'W**	**1931**	**4,400'; 1,341 m**
19	**Veniaminof**	**1102-07**	**56°10'N, 159°23'W**	**1993-95**	**8,225'; 2,507 m**
20	**Pavlof**	**1102-03**	**55°25'N, 161°54'W**	**1996-97**	**8,261'; 2,518 m**
21	***Dutton***	***1102-011***	***55°11'N, 162°16'W***	**	***4,833'; 1,473 m***
22	**Isanotski**	**1101-37**	**54°45'N, 163°44'W**	**1845**	**8,025'; 2,446 m**
23	**Shishaldin**	**1101-36**	**54°45'N, 163°58'W**	**1999**	**9,373'; 2,857 m**
24	**Fisher**	**1101-35**	**54°39'N, 164°26'W**	**1830?**	**3,648'; 1,112 m**
25	**Westdahl**	**1101-34**	**54°31'N, 164°39'W**	**1991-92**	**5,118'; 1,560 m**
26	**Akutan**	**1101-32**	**54°08'N, 165°58'W**	**1992**	**4,275'; 1,303 m**
27	**Makushin**	**1101-31**	**53°53'N, 166°56'W**	**1995**	**6,680'; 2,036 m**
28	Bogoslof	1101-30	53°56'N, 168°02'W	1992	492'; 150 m
29	**Okmok**	**1101-29**	**53°24'N, 168°10'W**	**1997**	**3,520'; 1,073 m**
30	Vsevidof	1101-27	53°08'N, 168°41'W	1957?	7,050'; 2,149 m
31	Kagamil	1101-26	52°58'N, 169°43'W	1953-54	2,930'; 893 m
32	Carlisle	1101-23	52°54'N, 170°03'W	1987	5,315'; 1,620 m
33	Cleveland	1101-24	52°49'N, 169°57'W	2001	5,676'; 1,730 m
34	Yunaska	1101-21	52°38'N, 170°38'W	1937	1,804'; 550 m
35	Amukta	1101-19	52°30'N, 171°15'W	1996	3,497'; 1,066 m
36	Seguam (Pyre Peak)	1101-18	52°19'N, 172°31'W	1993	3,458'; 1,054 m
37	Korovin (Atka Is.)	1101-16	52°23'N, 174°09'W	1998	5,029'; 1,533 m
38	Kasatochi	1101-13	52°11'N, 175°30'W	1828	1,030'; 314 m
39	**Great Sitkin**	**1101-12**	**52°05'N, 176°08'W**	**1974**	**5,709'; 1,740 m**
40	**Kanaga**	**1101-11**	**51°55'N, 177°10'W**	**1993-95**	**4,288'; 1,307 m**
41	Tanaga	1101-08	51°53'N, 178°08'W	1914	5,925'; 1,806 m
42	Gareloi	1101-07	51°47'N, 178°48'W	1989	3,458'; 1,573 m
43	Cerberus (Semisopochnoi)	1101-06	51°56'N, 179°35'E	1987	2,625'; 800 m
44	Little Sitkin	1101-05	51°57'N, 178°32'E	1900?	3,898'; 1,188 m
45	Kiska	1101-02	52°06'N, 177°36'E	1990	4,003'; 1,220 m

Bold: Seismically monitored volcanoes as of February 2004.

Italics: No historical (AD 1760–present) eruptions; these volcanoes have at present or have had vigorous fumarolic activity and/or intense earthquake swarms or are considered to be hazardous based on studies of their pre-historic eruption record.

Data sources: This list changes as we increase our geologic understanding of volcanoes in Alaska. Here we combine information from (1) Miller, T.P., McGimsey, R.G., Richter, D.H., Riehle, J.R., Nye, C.J., Yount, M.E., and Dumoulin, J.A., 1998, Catalog of the historically active volcanoes of Alaska: U.S. Geological Survey Open-File Report 98-582, 104 p; (2) Simkin, T., and Siebert, L., 1994, Volcanoes of the world, Tucson, Arizona, Geoscience Press, Inc., 349 p; (3) the on-line database of the Global Volcanism Program of the Smithsonian Institution (http://www.volcano.si.edu/gvp/world/index.cfm); (4) and other published and unpublished AVO reports and internal files. Some inconsistencies among data sources remain unresolved.


SEISMICALLY MONITORED
AND ACTIVE
ALASKAN VOLCANOES
No seismic network (as of February 2004)
Monitored by real-time seismic network
CAN
USA
ALASKA
Anchorage
GULF OF ALASKA
BERING SEA
PACIFIC OCEAN
Aleutian Islands
Dutch
Harbor
Shemya
Amchitka
Adak
Atka
64 N
60 N
56 N
52 N
178 E
178 W
150 W
138 W
0
200
400 mi
0
200
400 km
1. Bona-Churchill
2. Wrangell
3. Hayes
4. Spurr
5. Redoubt
6. Iliamna
7. Augustine
9. Griggs
10. Katmai
11. Novarupta
12. Trident
13. Mageik
14. Martin
15. Peulik
16. Ukinrek
17. Chiginagak
18. Aniakchak
19. Veniaminof
20. Pavlof
21. Dutton
22. Isanotski
23. Shishaldin
25. Westdahl
26. Akutan
27. Makushin
28. Bogoslof
29. Okmok
30. Vsevidof
31. Kagamil
32. Carlisle
33. Cleveland
34. Yunaska
35. Amukta
36. Seguam
37. Korovin
38. Kasatochi
39. Great Sitkin
40. Kanaga
41. Tanaga
42. Gareloi
43. Cerebus
44. Little Sitkin
45. Kiska

APPENDIX B ACTIVE VOLCANOES OF KAMCHATKA

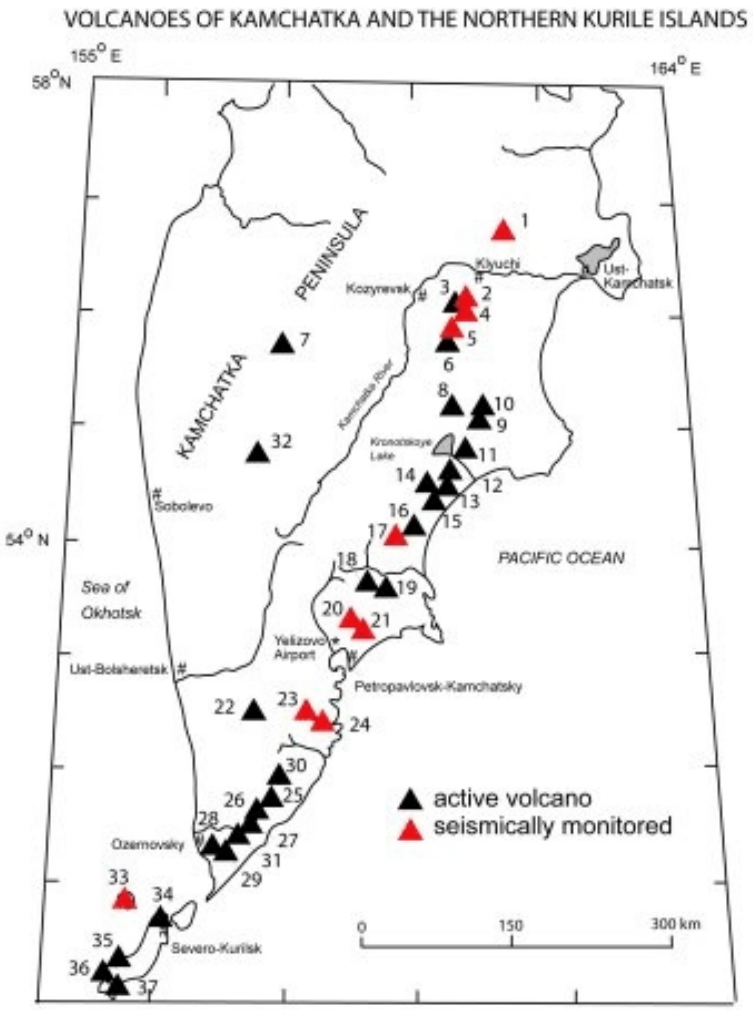
MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
			SECTION NORTH		
1	**Sheveluch**	**1000-27**	**56°39'N, 161°21'E**	**1980-2004**	**10,768'; 3,283 m**
				active lava dome	~8,200'; ~2,500 m
2	**Klyuchevskoy**	**1000-26**	**56°03'N, 160°39'E**	**2004**	**15,584'; 4,750 m**
3	Ushkovsky	1000-261	56°04'N, 160°29'E	1890	12,933'; 3,943 m
4	**Bezymianny**	**1000-25**	**55°58'N, 160°36'E**	**2004**	**9,498'; 2,895 m**
5	**Plosky Tolbachik**	**1000-24#**	**55°49'N, 160°24'E**	**1975-76**	**10,121'; 3,085 m**
6	New Tolbachik	1000-24*	55°30'N, 160°12'E	1975-76	2,886'; 880 m
7	*Ichinsky*	*1000-28*	*55°40'N, 157°43'E*	**	*11,877'; 3,621 m*
			SECTION CENTER		
8	Kizimen	1000-23	55°12'N, 160°19'E	1927-28	8,151'; 2,485 m
9	*Gamchen*	*1000-21*	*54°58'N, 160°42'E*	**	*8,449'; 2,576 m*
10	*Komarov*	*1000-22*	*55°04'N, 160°43'E*	**	*6,790'; 2,070 m*
11	Kronotsky	1000-20	54°45'N, 160°30'E	1922-23	11,572'; 3,528 m
12	*Krasheninnikov*	*1000-19*	*54°35'N, 160°16'E*	**	*6,088'; 1,856 m*
13	*Kikhpinych*	*1000-18*	*54°29'N, 160°14'E*	**	*5,091'; 1,552 m*
14	Uzon	1000-17	54°30'N, 159°55'E	1986	5,303'; 1,617 m
15	Bolshoi Semiachik	1000-15	54°19'N, 160°01'E	1953?	5,642'; 1,720 m
16	Maly Semiachik	1000-14	54°08'N, 159°40'E	1952	5,117'; 1,560 m
17	**Karymsky**	**1000-13**	**54°03'N, 159°27'E**	**1996-2004**	**4,874'; 1,486 m**
18	*Dzenzursky*	*1000-11*	*53°37'N, 159°00'E*	**	*7,497'; 2,285 m*
19	Zhupanovsky	1000-12	53°35'N, 159°08'E	1959	9,702'; 2,958 m
20	**Koryaksky**	**1000-09**	**53°19'N, 158°41'E**	**1956-57**	**11,336'; 3,456 m**
21	**Avachinsky**	**1000-10**	**53°15'N, 158°51'E**	**1991**	**8,890'; 2,751 m**
			SECTION SOUTH		
22	Opala	1000-08	52°32'N, 157°20'E	1894	8,118'; 2,475 m
23	**Gorely**	**1000-07**	**52°33'N, 158°02'E**	**1984-1986**	**6,000'; 1,829 m**
24	**Mutnovsky**	**1000-06**	**52°27'N, 158°12'E**	**1960-61**	**7,621'; 2,323 m**
25	Ksudach	1000-05	51°49'N, 157°32'E	1907	3,539'; 1,079 m
26	Zheltovsky	1000-04	51°35'N, 157°20'E	1923	6,406'; 1,953 m
27	Iliyinsky	1000-03	51°30'N, 157°12'E	1901	5,176'; 1,578 m
28	Koshelev	1000-02	51°21'N, 156°45'E	1690?	5,943'; 1,812 m
29	*Kambalny*	*1000-01*	*51°18'N, 156°54'E*	**	*7,072'; 2,156 m*
			OTHER POTENTIALLY ACTIVE VOLCANOES OF KAMCHATKA		
30	*Khodutka*	*1000-053*	*52°04'N, 157°42'E*	**	*6,855'; 2,090 m*
31	*Kurile Lake*	*1000-022*	*51°28'N, 157°06'E*	**	*400'; 122 m*
32	*Khangar*	*1000-272*	*54°45'N, 157°22'E*	**	*6,560'; 2,000 m*
			SECTION ATLASOVA AND PARAMUSHIR ISLANDS (NORTHERN KURILES)		
33	**Alaid**	**0900-39**	**50°52'N, 155°34'E**	**1981**	**7,674'; 2,339 m**
34	Ebeko	0900-38	50°41'N, 156°01'E	1987-90	3,793'; 1,156 m
35	Chikurachki	0900-36	50°19'N, 155°28'E	2003	5,958'; 1,816 m
36	Fuss Peak	0900-34	50°16'N, 155°15'E	1854	5,814'; 1,772 m
37	Karpinsky Group	0900-35	50°08'N, 155°22'E	1952	4,413'; 1,345 m

Bold: Seismically monitored volcanoes.

Italics: Last eruption date unknown or highly uncertain.

Data sources: (1) Simkin, T., and Siebert, L., 1994, Volcanoes of the world, Tucson, Arizona, Geoscience Press, Inc., 349 p; (2) the on-line database of the Global Volcanism Program of the Smithsonian Institution (http://www.volcano.si.edu/gvp/world/index.cfm); (3) Active Volcanoes of Kamchatka, S.A. Fedotov and Yu. P. Masurenkov, (eds.), Moscow Nauka Publishers (Moscow), vols. 1, 2; (4) KVERT information and other published and unpublished AVO reports and internal files. Some inconsistencies among data sources remain unresolved.

The Volcanoes of the World Catalog lists Tolbachik as one entry with a single number; New Tolbachik refers to vents as far as 28 km from the summit of Plosky Tolbachik.



1) Sheveluch
2) Klyuchevskoy
3) Ushkovsky
4) Bezymianny
5) Plosky Tolbachik
6) New Tolbachik
7) Ichinsky
8) Kizimen
9) Gamchen
10) Komarov
11) Kronotsky
12) Krashneninnkov
13) Kikhpinych
14) Uzon
15) Bolshoi Semiachik
16) Maly Semiachik
17) Karymsky
18) Dzenzursky
19) Zhupanovsky
20) Koryaksky
21) Avachinsky
22) Opala
23) Gorely
24) Mutnovsky
25) Ksudach
26) Zheltovsky
27) Ilyinsky
28) Koshelev
29) Kambalny
30) Khodutka
31) Kurile Lake
32) Khangar

Northern Kuriles:
33) Alaid
34) Ebeko
35) Chikurachki

36) Fuss Peak 37) Karpinsky Group

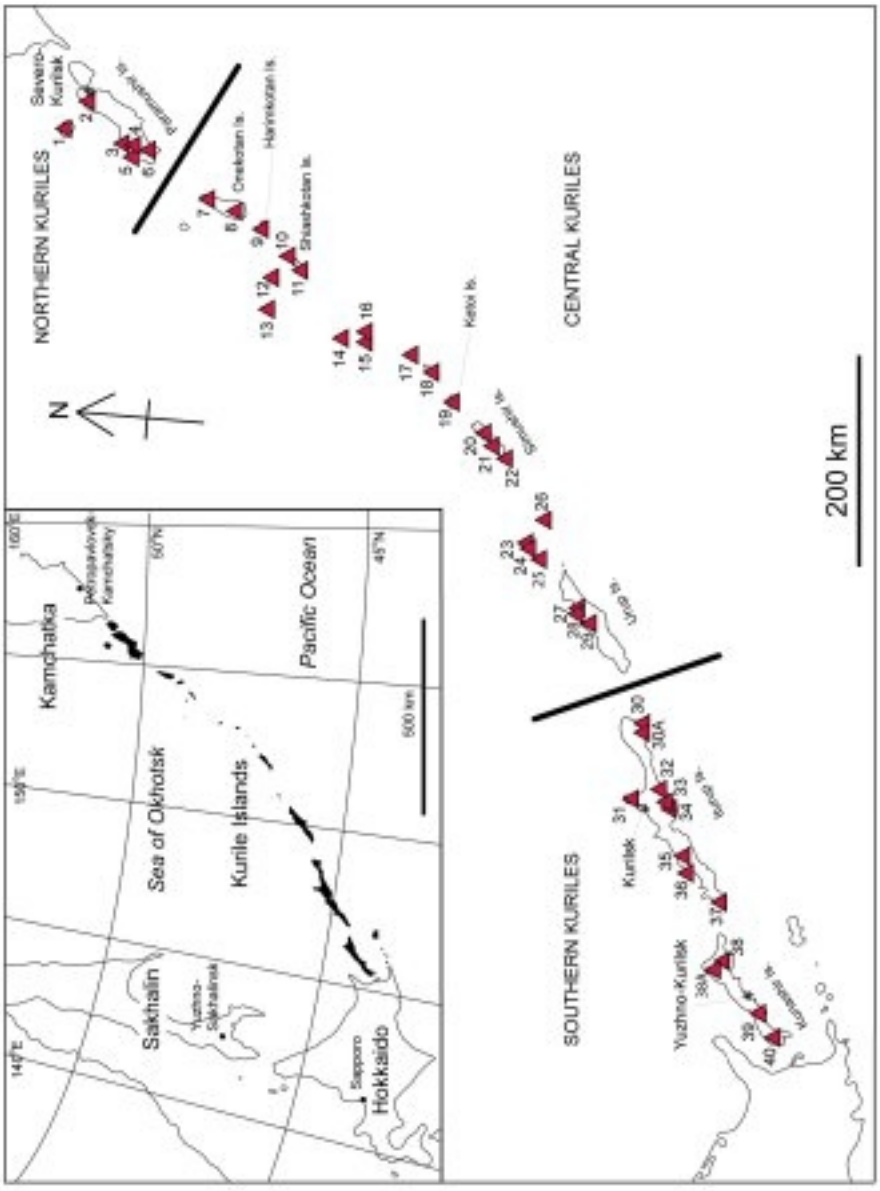
APPENDIX C ACTIVE VOLCANOES OF THE KURILE ISLANDS

MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
	NORTHERN KURILES (ALSO SHOWN ON KAMCHATKA MAP, APPENDIX B)				
1	**Alaid (Atlasova Is.)**	**0900-39**	**50°52'N, 155°34'E**	**1981**	**7,674'; 2,339 m**
2	Ebeko (Paramushir Is.)	0900-38	50°41'N, 156°01'E	1987-90	3,793'; 1,156 m
3	Chikurachki (Paramushir Is.)	0900-36	50°19'N, 155°28'E	2003	5,958'; 1,816 m
4	*Tatarinova (Paramushir Is.)*	--	*50°18'N, 155°27'E*	**	*5,020'; 1,530 m*
5	Fuss Peak (Paramushir Is.)	0900-34	50°16'N, 155°15'E	1854	5,814'; 1,772 m
6	Karpinsky Group (Paramushir Is.)	0900-35	50°08'N, 155°22'E	1952	4,413'; 1,345 m
	CENTRAL KURILES				
7	Nemo Peak (Onekotan Is.)	0900-32	49°34'N, 154°48'E	1938	3,343'; 1,019 m
8	Krenitzyn Peak (Tau-Rusyr Caldera; Onekotan Is.)	0900-31	49°21'N, 154°42'E	1952	4,344'; 1,324 m
9	Severgin (Harimkotan Is.)	0900-30	49°07'N, 154°30'E	1933	3,796'; 1,157 m
10	Sinarka (Shiashkotan Is.)	0900-29	48°52'N, 154°11'E	1878	3,064'; 934 m
11	Kuntomintar (Shiashkotan Is.)	0900-28	48°45'N, 154°01'E	1872	2,717'; 828 m
12	Ekarma (Ekarma Is.)	0900-27	48°57'N, 153°56'E	1980	3,842'; 1,171 m
13	Chirinkotan (Chirinkotan Is.)	0900-26	48°59'N, 153°28'E	1980	2,375'; 724 m
14	Raikoke (Raikoke Is.)	0900-25	48°17'N, 153°15'E	1924	1,808'; 551 m
15	Sarychev Peak (Matua Is.)	0900-24	48°06'N, 153°12'E	1976	4,744'; 1,446 m
16	Submarine volcano (E of Matua)	0900-23	48°05'N, 153°20'E	1924	-492'; -150 m
17	Rasshua (Rasshua Is.)	0900-22	47°45'N, 153°01'E	1957	3,113'; 949 m
18	Ushishir (Yankiche Is.)	0900-21	47°31'N, 152°48'E	1884	1,276'; 389 m
19	Ketoi (Pallas Peak; Ketoi Is.)	0900-20	47°20'N, 152°29'E	1962	3,248'; 990 m
20	Prevo Peak (Simushur Is.)	0900-19	47°01'N, 152°07'E	1914 (?)	4,462'; 1,360 m
21	Zavaritzky (Simushur Is.)	0900-18	46°55'N, 151°57'E	1957	2,051'; 625 m
22	Goryachaya sopka (Simushur Is.)	0900-17B	46°50'N, 151°45'E	1944	2,923'; 891 m
23	Cherny (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1857	2,047'; 624 m
24	Snow (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1982	1,296'; 395 m
25	Brat Chirpoi (Brat Chirpoi Is.)	0900-14	46°28'N, 150°48'E	**	2,457'; 749 m
26	Submarine (E. of Brat Chirpoi)	0900-16	~46°28'N, 151°17'E	1972	-1,647'; -502 m
27	*Trezubetz (Kolokol Grp, Urup Is.)*	--	*~46°03'N, 150°03'E*	**	*3,337'; 1,017 m*
28	Berg (Kolokol Grp, Urup Is.)	0900-12	46°03'N, 150°04'E	1973	3,779'; 1,152 m
29	*Kolokol Group (Urup Is.)*	*0900-12*	*46°03'N, 150°03'E*	**	*4,350'; 1,326 m*
	SOUTHERN KURILES				
30	Kudryavy (Medvezhia; Iturup Is.)	0900-10	45°23'N, 148°50'E	1999	3,136'; 986 m
30A	Menshy Brat (Iturup Is.)	0900-10	45°23'N, 148°47'E	~400 yrs BP	1,847'; 563 m
31	Chirip (Bogdan Khmelnitzky; Iturup Is.)	0900-09	45°23'N, 147°55'E	1860?	5,130'; 1,564 m
32	Baransky (Iturup Is.)	0900-08	45°06'N, 148°01'E	1951	3,717'; 1,133 m
33	Tebenkov (Iturup Is.)	--	~45°01'N, 147°52'E	**	3,976'; 1,212 m
34	Ivan Grozny (Iturup Is.)	0900-07	45°01'N, 147°52'E	1989	3,802'; 1,159 m
35	*Stokap (Iturup Is.)*	--	*~44°50'N, 147°20'E*	**	*4,928'; 1,502 m*
36	Atsonupuri (Iturup Is.)	0900-05	44°48'N, 147°08'E	1932	3,953'; 1,205 m
37	Berutarube (Iturup Is.)	0900-04	44°27'N, 146°56'E	1812	4,003'; 1,220 m
38	Tyatya (Kunashir Is.)	0900-03	44°27'N, 146°15'E	1973	5,968'; 1,819 m
38A	*Ruruy (Kunashir Is.)*	*0900-032*	*44°27'N, 146°08'E*	**	*4,872'; 1,485 m*
39	Mendeleev (Kunashir Is.)	0900-02	43°59'N, 145°44'E	1880	2.910'; 887 m
40	Golovnin (Kunashir Is.)	0900-01	43°51'N, 145°30'E	~1900 yrs BP	1,775'; 541 m

Bold: Seismically monitored volcanoes.

Italics: Last eruption date unknown or highly uncertain.

Data sources: (1) unpublished lists from Alexander Rybin, IMGG (working from Russian maps at scales of 1:50,000 and 1:200,000), (2) Simkin, T., and Siebert, L., 1994, Volcanoes of the world, Tucson, Arizona, Geoscience Press, Inc., 349 p; (3) the on-line database of the Global Volcanism Program of the Smithsonian Institution (http://www.volcano.si.edu/gvp/world/index.cfm); (4) map analysis by Tina Neal. It is considered preliminary. Some inconsistencies between sources remain unresolved.



Historically active and potentially active volcanoes of the Kurile Islands (eruptions suspected or confirmed since the early 1800s and/or vigorous fumarolic activity.) Figure after Ishizuka (2001) with volcano information from 1) Alexander Rybin, IMGG; 2) Olga Girina, IVGG; 3) Smithsonian Institution Global Volcanism Program; 4) map analysis by Tina Neal. Approximately 5000 people live in Iturup Island and about 6500 people live on Kunashir Island in the southern Kuriles. In the northern Kuriles, about 3000 people live on Paramushir Island. There are no permanent settlements in the Central Kuriles. Only Alaid Volcano on Atlasova Island (#1) is seismically monitored.