

Alaska Interagency Operating Plan for Volcanic Ash Episodes



MAY 1, 2008

Cover:

A plume of volcanic gas and water vapor rises above the summit crater and growing lava dome at Augustine Volcano in southern Cook Inlet. A mantle of light brown ash discolors the snow on the upper flanks. View is towards the southwest. Photograph taken by C. Read, U.S. Geological Survey, January 24, 2006. Alaska Volcano Observatory database image from <http://www.avo.alaska.edu/image.php?id=7051>.

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1.0 Introduction

Volcanic eruption plumes and 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 integrated, multi-agency operations in response to the threat of volcanic ash in Alaska, and an agency-by-agency description of roles and responsibilities during such events. A cohesive, well coordinated response will facilitate 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 U.S. 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 Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM); the Department of Environmental Conservation Air Quality Division (DEC); 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 (FIRs). This plan also includes responsibility for volcanic ash transported from volcanoes outside the United States into Alaskan airspace, such as those in Kamchatka and the Kurile Islands, Russia.

The Interagency Operating Plan for Volcanic Ash Episodes in Alaska is an integral part of the National Oceanic and Atmospheric Administration (NOAA)/FAA Volcano Hazards Implementation Plan that supports the Agreement between NOAA and FAA on volcanic hazards. A Letter of Agreement has added volcano hazards support from the USGS to the NOAA/FAA Agreement. As such, this Alaska plan describes communication links and operational actions necessary to support the NOAA/FAA/USGS Volcano Hazards Implementation Plan. This plan is referenced in the 2007 National Volcanic Ash Operations Plan for Aviation published by the Office of the Federal Coordinator for Meteorological Services (<http://www.ofcm.gov/p35-nvaopa/pdf/FCM-P35-2007-NVAOPA.pdf>).

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 related to public safety, flight safety, integrity of military operations, continuity of government, commerce, transportation, or a combination of these. Individual agency priorities may differ slightly and call-down lists vary from agency to agency. However, the most important element of this plan is ensuring that those at risk receive timely, consistent information. Each agency, therefore, must respond in a coordinated and systematic manner. Integrated response to volcanic ash events involves elements of data collection and processing, information management and coordination, and distribution and dissemination.

1.2 Data Collection and Processing

Each participant agency may be the first to receive a report of volcanic unrest. How that information is treated, that is, validation, processing, and dissemination, is crucial to a successful multi-agency response. DHS&EM, AVO, NWS, DOD, and the FAA may receive reports from very different sources including sophisticated remote and *in situ* instrumentation, trained observers and pilots, law enforcement, municipal workers, or the general public. Considering the comparative rarity of volcanic ash events but high potential for catastrophic loss, all such reports should be taken very seriously.

Any agency receiving a report of volcanic unrest including the possible eruption of ash should immediately attempt to validate the report and relay the information to the NWS and the FAA Anchorage Air Route Traffic Control Center (ARTCC) as soon as possible. It is critical to relay this information quickly because commercial aircraft travel 90 miles in 10 minutes, and ash can reach flight levels in less than one-half that time. Furthermore, airborne ash can begin depositing on surfaces hundreds of miles from the source within hours. Both accuracy and timeliness are essential.

Validation of reports requires calling on the data gathering capabilities of all other agencies participating in this plan. For example, if DHS&EM receives a report from law enforcement in Homer that Iliamna is erupting and ejecting ash, they should call AVO because Iliamna is instrumented. If appropriate, the caller should remain on the line while AVO evaluates monitoring and other data. If an eruption is confirmed, AVO would contact NWS and Anchorage ARTCC (see section 2.2.2.2), freeing DHS&EM to continue with their call-down to the State Emergency Coordination Center, affected political subdivisions, and others (see section 2.1). Alternatively, if AVO receives an eruption report first, they should validate its occurrence (by ground or satellite sensor, contact Anchorage ARTCC for any pilot reports in the vicinity), relay that information to NWS, and proceed with their call-down. In general, the first agency made aware of the report of volcanic unrest validates the report, ensures the report gets to the warning agency, and proceeds with their own call-down.

1.3 Information Management and Coordination

Agencies relaying information about volcanic ash events, the likely trajectory of the ash cloud, and its potential impacts must deliver a consistent message. However, to ensure rapid dissemination to the aviation community, the Alaska Aviation Weather Unit (AAWU) has the lead role in determining the details of the initial eruption [Significant Meteorological Advisory (SIGMET)]. As time allows, collaboration and coordination should take place on all subsequent SIGMETs to ensure a consistent message. Coordination is necessary to better define the ash plume in time and space. At a minimum, at least one formal coordination call 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 minimizes 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), the statewide Alaska television weathercast, and the Emergency Alert System (EAS) in addition to distribution of text and graphics by its own telecommunications Gateway and through telephone facsimile, and the Internet. FAA distributes critical aviation weather forecasts, advisories and warnings from the NWS, as well as flight information, pilot reports, and terminal information via its 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 Alaska Warning and Alert System (AWAS) and the EAS. Details of each agency's procedures for sharing information are provided in individual agency sections. By using diverse methods to disseminate information, the collective ability to reach as many people as possible is optimized.

2.0 Responsibilities of the Participating Agencies

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

2.1 ALASKA 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/WATCH** or Code **RED/WARNING**. The purpose of these actions is 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 activate local emergency operations centers during the Code **ORANGE/WATCH** or Code **RED/WARNING** 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/WATCH** or Code **RED/WARNING** 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), Department of Health and Social Services (Division of Public Health), and DHS&EM. The purpose of this conference call is to:
- (1) Allow AVO and 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 to respond to the situation.
 - (4) Determine if an additional coordinating conference call will be needed, at what time, and what agencies or individuals should participate. The conference call will be scheduled approximately 1 hour after an upgrade to **RED/WARNING**. After normal work hours, the conference call will be scheduled as soon as possible, likely a minimum of 2 hours after notification. After an upgrade to **ORANGE/WATCH**, the need for a conference call will be determined after consultation with AVO and the NWS. 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.

In addition, DHS&EM will work with the Department of Health and Human Services (DHHS) and DEC to ensure that appropriate emergency preparedness information is disseminated.

2.2 ALASKA VOLCANO OBSERVATORY (AVO)

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

- A. To conduct monitoring and other interpretive scientific investigations in order to assess the style, timing, and duration of volcanic activity.
- B. To provide timely and accurate information on volcanic hazards, warnings of dangerous activity, and eruption notifications to local, State, and Federal officials and the public.
- C. To assess hazards associated with anticipated or ongoing activity, including types of events, potential effects, and areas at risk.

2.2.1 Organization

AVO consists of scientists and staff at offices in Fairbanks (UAFGI, ADGGS) and Anchorage (USGS). Geologists and geophysicists at all three agencies share routine data processing, analysis, and hazard communication duties. The AVO facility at the USGS Alaska Science Center in Anchorage serves as the response and operations center during times of increased volcanic activity. Each facility can serve as limited backup to the other.

Managerial responsibility for AVO rests with a Scientist-in-Charge (SIC) and a Coordinating Scientist (CS), as described below. National and regional oversight and coordination are provided by the USGS Volcano Hazards Program Coordinator in Reston, Virginia, and the Director of the USGS Alaska Science Center in Anchorage, Alaska.

PROGRAM COORDINATOR (PC), VOLCANO HAZARDS – USGS – RESTON, VIRGINIA

The PC is based at USGS Headquarters in Reston, Virginia, and is responsible for national oversight and funding of the USGS Volcano Hazards Program, which includes the operations of AVO.

DIRECTOR, ALASKA SCIENCE CENTER (ASC) – USGS – ANCHORAGE, ALASKA

The ASC Director in Anchorage is the lead USGS official in the State of Alaska and as such has managerial responsibility for AVO/USGS staff and operations. The ASC Director facilitates access to ASC resources during a time of increased activity. The ASC Director works with the USGS Volcano Hazards Team Chief Scientist who oversees the four other USGS Volcano Observatories to ensure adequate support for AVO during times of increased workload and eruption response.

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

The SIC is a USGS employee based at the USGS Alaska Science Center in Anchorage, Alaska, and is the official spokesperson and line-manager for AVO/USGS staff. The SIC coordinates all AVO monitoring, hazards assessment, and information dissemination and carries a cell phone 24 hours a day. The SIC ensures that (1) monitoring and hazard assessments are conducted effectively and thoroughly; (2) monitoring and hazard data are adequately analyzed and reviewed; and (3) accurate and timely hazard assessments and supporting scientific information are issued to all concerned parties, including local, State, and Federal officials, and the public.

COORDINATING SCIENTIST (CS), UAFGI/AVO - FAIRBANKS

The CS is based at the UAFGI in Fairbanks and acts as principal liaison between the UAFGI and ADGGS in Fairbanks and the SIC in Anchorage. The CS ensures timely communication of monitoring and scientific information gathered at the UAFGI and/or ADGGS to the SIC and AVO staff. If time allows, the SIC confers with the CS prior to issuance of a volcanic hazard or eruption notification.

DUTY SCIENTISTS, USGS/UAFGI/ADGGS/AVO – ANCHORAGE, FAIRBANKS

Duty Scientists from the AVO/USGS Anchorage staff maintain operational awareness of ongoing or developing volcanic activity, respond to inquiries or incoming calls regarding suspected volcanic activity, check for voice messages on the AVO phone, prepare daily status reports and other routine messages, and carry a cell phone 24 hours a day. This position rotates weekly among staff. AVO also maintains a rotating Duty Seismologist, Duty Remote Sensor, and Duty Webmaster to ensure a single point of contact for key elements of monitoring and web page communication.

2.2.2 General Operational Procedures

During periods of volcanic quiet, AVO staff acquires, interprets, and archives monitoring data, gathers basic geologic information to develop eruption scenarios, conducts research, outreach, and develops hazard assessments of Alaskan volcanoes. During heightened volcanic activity, AVO at the USGS in Anchorage becomes directly responsible for all AVO activities concerning volcanic unrest 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).

AVO issues notification of volcanic activity via telephone call-down to key government agencies (see section 2.2.2.2) as well as e-mail, fax, and web-page postings. AVO communicates with International agencies involved in volcanic ash cloud and ash fall warnings including the Geological Survey of Canada (GSC) and the Canadian Meteorological Centre (CMC). AVO has a formal role in responses to eruptions from Russian volcanoes through operational agreements with the Kamchatka Volcanic Eruption Response Team (KVERT; see section 2.2.4) and the Sakhalin Volcanic Eruption Response Team (SVERT; see section 2.2.5)

2.2.2.1 AVO Hours of Operation and Monitoring Frequency

Normal business hours for AVO are 9:00 a.m. to 5:00 p.m. Monday through Friday. After hours and on weekends, AVO staff can be contacted quickly at any time through the use of an answering service, pagers, and cell phones.

As of the summer of 2007, AVO has a program of real-time seismic monitoring at 31 Alaskan volcanoes extending from Mount Wrangell through Cook Inlet, along the Alaska Peninsula and Aleutian Islands (appendix A). Earthquake activity at these 31 volcanoes is checked at least twice daily.

AVO also conducts a minimum of twice-daily satellite image analysis for volcanoes in Alaska. Satellite data are checked twice daily for Kamchatka and portions of the Kuriles. Four Alaskan volcanoes have real-time deformation instrumentation to detect ground motion related to volcanic unrest. AVO conducts periodic observational overflights, airborne sulfur dioxide, carbon dioxide, and hydrogen sulfide measurements, and other monitoring activities as required.

Once a volcano has become restless and is elevated to **YELLOW/ADVISORY** or **ORANGE/WATCH** status (see section 2.2.7), AVO staff will examine seismic data from this volcano at least three times a day or more frequently as determined by the SIC. Depending on the volcano, AVO also may increase the frequency of satellite image analyses. A daily status report is issued for all volcanoes at **YELLOW/ADVISORY** (see section 2.2.7), or higher.

If a volcano reaches **RED/WARNING** (see section 2.2.7), or at any time the SIC determines that the level of activity warrants around-the-clock surveillance, AVO begins an on-site, 24-hour watch in Anchorage or Fairbanks or both locations.

2.2.2.2 Volcanic Activity Notifications for Seismically Monitored Volcanoes in Alaska

Continuous recording of seismic activity at Alaskan volcanoes, in combination with other monitoring techniques, usually allows AVO to issue warnings of unrest and the possibility of a volcanic eruption hours to weeks in advance. Notifications of eruptions are issued to our interagency call-down list, usually within minutes of onset at seismically instrumented volcanoes.

Once a seismically monitored volcano becomes restless (for example, shows an increasing level of earthquake or other precursory activity), the following actions are taken:

- A. The SIC will be notified and he/she may choose to activate the call-down procedure immediately or take further action to evaluate the situation.
- B. Initial communication of an increased level of volcanic hazard is by telephone call-down to the interagency list, and by fax, e-mail, and Internet notification as needed and as new information becomes available. AVO's primary call-down list as of June 1, 2007 is:

CALL-DOWN RESPONSIBILITY OF AVO FOR ALASKAN VOLCANOES (*back-up number)

Call-down responsibility of AVO Anchorage

1. FAA Anchorage Air Route Traffic Control Center	907-269-1103 907-269-1108*
2. NWS Aviation Weather Unit/Anchorage VAAC	907-266-5110
3. NWS Center Weather Service Unit	907-338-1010 907-269-1145*
4. USAF Elmendorf AFB 11 th Operational Wx Squadron	907-552-2719
5. USAF 2 ND Weather Squadron, AFWA, Offutt AFB	402-294-7264 402-294-1386*
6. NOAA/SAB Washington VAAC	301-763-8444
7. Canadian Meteorological Center	514-421-4635
8. U.S. Coast Guard, Juneau	907-463-2000

Call-down responsibility of AVO Fairbanks

1. DHS&EM	800-478-2337
SECC	907-428-7100*
2. Alaska Governor's Office	907-465-3500
3. Fort Wainwright (U.S. Army)	907-353-7535

Call-down messages are brief and include the following general information:

<p>Name of caller Volcano name and location Nature of activity and source of information (seismicity, pilot report, etc.) Aviation Color Code and Volcano Alert Level status or change in status (see section 2.2.7) Start time of event or activity (if known) Height of eruption cloud, how determined, and direction of cloud motion (if known)</p>

- C. AVO also will contact citizens, pilots, mariners, and other agency personnel at remote sites for additional information, as needed.
- D. A written volcanic activity notification (see section 2.2.3) is transmitted by fax and e-mail and is posted to the AVO web site as soon as possible. At any time, if an eruption is verified and poses a significant hazard to aircraft or a population center, the formal telephone call-down procedure will be repeated.
- E. Call-downs also will occur during each significant change in the status of an eruption or change in aviation color code or alert level (see section 2.2.7).
- F. If warranted, AVO will attempt to fly over and/or land on the volcano to assess the situation. Airborne gas measurements, deployment of portable seismic and other recording instrumentation, increased satellite surveillance, and field visits also may occur depending on the location of the eruption and severity of hazards.

2.2.2.3 Volcanic Activity Notifications for Non-Seismically Monitored Volcanoes in Alaska

AVO does not have seismic monitoring instruments on more than a dozen of the historically active volcanoes of Alaska (appendixes A and B). For these volcanoes, AVO relies primarily on satellite surveillance and reporting from other sources including mariners, flight crews, local citizens, and others. Thus, detection and notification of unrest and eruptive activity may be delayed, and future activity cannot be accurately forecast.

If AVO receives a report of or detects a possible eruption at a seismically unmonitored volcano, the following actions are taken, usually concurrently:

- A. The SIC will be notified and he/she may choose to activate the call-down procedure immediately or take further action to evaluate the situation.
- B. Satellite data, distant seismic data, and other information are analyzed to determine whether volcanic activity can be verified. Telephone contact with nearby communities may be attempted.
- C. Descriptions of past eruptions at a given volcano, maintained in archives and databases at AVO, will be reviewed as indicators of likely activity.
- D. Phone contact is made with the FAA and NWS to alert both agencies to the situation and to the possible need for pilot reports and heightened vigilance.
- E. Procedures are then followed as for seismically instrumented volcanoes, as appropriate.

2.2.3 Written Volcanic Activity Notices

AVO's component agencies have a responsibility to notify authorities and the public of potentially hazardous volcanic activity in Alaska. Timely and accurate notification regarding volcanic activity and associated hazards is the responsibility of the SIC. A formal operational agreement with KVERT also calls for AVO to assist in the dissemination of information regarding hazardous volcanic activity in Kamchatka, Russia. Although no formal agreement is in place between AVO and SVERT, AVO also will assist in relaying written information about eruptions in the Kuriles. The following volcanic activity text products are currently used by AVO; all are posted on the AVO web site. An automated subscription service for email delivery is being developed.

Volcanic Activity Notice (VAN)

Upon verification of an eruption and following the call-down procedure, a formatted text message describing the location, time, type, size of the eruption, and likely hazards is distributed by AVO to Federal, State, and local government agencies, the media, members of the public and private sectors including airlines, by Internet fax service and e-mail systems. This message, called a Volcanic Activity Notice (VAN), also is immediately posted to the AVO web site. Additional VANs are released as needed, depending on changes in volcanic activity, alert levels, or hazards.

Volcano Observatory Notice for Aviation (VONA)

A VONA is a derivative product of the VAN and contains information in a format specifically intended for aviation users of volcano hazard information. A VONA is produced automatically and sent via email to users upon request.

Daily Status Report

AVO issues a Daily Status Report for any Alaskan volcano at an elevated alert level or elevated aviation color code. These daily reports are posted to the AVO web site, sent by email to interested parties, and faxed to CWSU and AAWU.

Weekly Update and Other Information Statements

AVO issues a weekly summary of volcanic activity in Alaska each Friday. These reports are posted to the AVO web site, sent by e-mail to interested parties, and are faxed to recipients by request. AVO also issues other non-scheduled Information Statements that announce new monitored volcanoes, significant operational changes, or offer expanded analyses of volcanic unrest and likely scenarios.

Informal Web Updates

As needed, AVO may institute an informal web-only update message to provide users with a very brief, time-appropriate comment on the status of an erupting volcano.

Recorded Telephone Message and Web Site

AVO maintains a recorded phone message line (907-786-7478) that is updated at least weekly with summations of the latest status of volcanic activity. Information also 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>.

2.2.4 Kamchatka Volcanic Eruption Response Team (KVERT)

KVERT is composed of scientists from the Institute of Volcanology and Seismology (IVS) and the Kamchatkan Branch of Geophysical Services (KBGS) located in Petropavlovsk-Kamchatsky. As of 2007, 11 volcanoes of the Kamchatka Peninsula and Paramushir Island in the northern Kuriles are seismically monitored (see appendixes C and D). KVERT also receives occasional ground observer reports from several field stations and daily satellite data for Kamchatka and the northern Kuriles. AVO assists in the dissemination and clarification of eruption reports from KVERT and shares satellite monitoring results and observations of Russian volcanoes with KVERT. However, KVERT is the authoritative source of information regarding volcanic activity in Kamchatka and on Paramushir Island. KVERT frequently sends e-mail alerts of volcanic activity to a standing list of aviation and meteorology authorities in the region including Anchorage Volcano Ash Advisory Center (VAAC), AVO, Tokyo VAAC, and many others.

KVERT prepares a weekly Information Release describing the status of Kamchatkan volcanoes that is sent by e-mail to many recipients, usually on Thursdays. AVO posts this information to AVO's web site and faxes the information to a list of interested parties. In the event of a major eruption, KVERT immediately makes phone calls to the Hydrometeorological Survey at Elizovo Airport near Petropavlovsk (also known as the Aviation Meteorology Center), the Department of Civil Emergencies, Russian media, and local officials. A level of concern color code is assigned in an Information Release sent by KVERT via e-mail. (Note: KVERT's color code system is slightly different from the one in use in the United States. KVERT's color code definitions are available at http://www.kscnet.ru/ivs/kvert/color_eng.php). AVO in turn sends KVERT notifications by fax to interested parties and posts the information on the AVO web site. KVERT releases additional updates and makes domestic call-downs as needed, depending on changes in volcanic activity or hazard.

AVO in Anchorage conducts a limited call-down to the list below upon receiving information that a Russian volcano is erupting or may be erupting ash to altitudes at or above 20,000 ft ASL. This procedure may be suspended or modified for continuous or chronic eruptions. AVO also conducts a call-down to these recipients upon any change in the color code assignment by KVERT.

CALL DOWN RESPONSIBILITY OF AVO FOR SIGNIFICANT RUSSIAN VOLCANIC ACTIVITY
(*back-up number)

1. FAA Anchorage Air Route Traffic Control Center	907-269-1103 907-269-1108*
2. NWS Aviation Weather Unit/Anchorage VAAC	907-266-5110
3. NWS Center Weather Service Unit	907-338-1010 907-269-1145*
4. USAF Elmendorf AFB 11 th Operational Wx Squadron	907-552-2719
5. USAF 2 ND Weather Squadron, AFWA, Offutt AFB	402-294-7264 402-294-1386*
6. NOAA/SAB Washington VAAC	301-763-8444
7. Canadian Meteorological Center	514-421-4635
8. US Coast Guard Juneau	907-463-2000
9. DHS&EM	800-478-2337
SECC	907-428-7100*

2.2.5 Sakhalin (Kurile) Volcanic Eruption Response Team (SVERT)

The Sakhalin Volcanic Eruption Response Team was formed in 2004 to provide routine observations of the southern and central Kurile Island volcanoes in the Russian Far East (appendixes E and F). SVERT scientists are based at the Institute of Marine Geology and Geophysics in Yuzhno-Sakhalinsk. They report analyses of MODIS satellite imagery of the Kuriles via e-mail to AVO and others usually on a daily basis, Monday through Friday. There are no real-time seismic networks on any Kurile volcano other than Alaid on Atlasova Island near the south tip of Kamchatka. As of 2006, SVERT has a basic eruption response plan that includes telephone notification of Air Traffic Control and Aviation Weather authorities in Sakhalin, and e-mail notification to AVO, the Anchorage and Tokyo VAAC, and others if any sign of volcanic activity is detected. SVERT intends to use a color code similar to that used by KVERT. SVERT has no formal operational budget and is actively seeking support from the Russian government.

In the event of a significant Kurile eruption, AVO will follow procedures similar to those for an eruption in Kamchatka.

2.2.6 Coordination with Other Agencies

AVO maintains frequent telephone contact with NWS, FAA, DOD, DHS&EM, USCG, DEC, and other concerned Federal, State, and local agencies to ensure effective communication of observational data and consistent interpretations of volcanic activity and hazards.

AVO's responsibility overlaps and integrates with that of NWS once an ash cloud has been generated, is drifting with the wind, and has the potential to produce ash fall. AVO and NWS strive to communicate frequently to ensure consistent messages regarding ash cloud height, motion, and potential impacts (including ash fall). AVO and NWS work together to ensure formal NWS warning messages (for example, ashfall advisories, marine weather advisories, SIGMETs, etc.) and AVO volcanic activity notifications are well-coordinated and as accurate as possible.

2.2.7 Aviation Color Code and Volcano Alert Level Terms

Beginning on October 1, 2006, all USGS Volcano Observatories implemented a dual system of alerts. To address aviation hazards, AVO and other US Observatories use a modified Aviation Color Code. AVO and other US Observatories also issue a Volcano Alert Level to indicate the overall status of the volcano and its ground-based hazards (for example, ash fall, lahar or mudflow, pyroclastic flow) that employs the terms '**NORMAL, ADVISORY, WATCH, and WARNING**'. Definitions of these terms are shown in the tables that follow. Changing aviation color codes and volcano alert levels indicate increasing severity and likelihood of potential impacts and are similar to those used by NWS for severe weather alerts. The definitions for aviation color codes have changed slightly since the last Interagency Plan; most importantly, the 25,000 ft distinction between **RED** and **ORANGE** has been removed.

The SIC, in consultation with the CS, also may assign an aviation color code and alert level 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 aviation color code **GREEN**/ alert level **NORMAL** because we cannot definitively say the volcano is quiet. 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.

VOLCANO ALERT LEVELS

NORMAL	<p>Typical background activity of a volcano in a non-eruptive state.</p> <p><i>Or, after a change from a higher level:</i></p> <p>Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.</p>
ADVISORY	<p>Elevated unrest above known background activity.</p> <p><i>Or, after a change from a higher level:</i></p> <p>Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.</p>
WATCH	<p>Volcano is exhibiting heightened or escalating unrest with increased potential for eruptive activity.</p> <p><i>Or:</i></p> <p>A minor eruption is underway that poses limited hazards.</p>
WARNING	<p>Highly hazardous eruption underway or imminent.</p>

AVIATION COLOR CODES

AVO will continue to use the color-coded designation that has been in place since 1990. Colors will now reflect only the hazards posed to the aviation community. Definitions of each color have changed slightly. Typically, aviation color codes indicate the likelihood or presence of airborne ash and ash clouds that threaten aircraft.

GREEN	<p>Volcano is in a normal, non-eruptive state.</p> <p><i>Or, after a change from a higher level:</i></p> <p>Volcanic activity considered to have ceased and volcano reverted to its normal, non-eruptive state.</p>
YELLOW	<p>Volcano is exhibiting signs of elevated unrest above known background levels.</p> <p><i>Or, after a change from a higher level:</i></p> <p>Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.</p>
ORANGE	<p>Volcano is exhibiting heightened unrest with increased likelihood of eruption.</p> <p><i>Or:</i></p> <p>Volcanic eruption underway with no or minor ash emission.</p>
RED	<p>Eruption is forecast to be imminent with significant emission of ash into the atmosphere likely</p> <p><i>Or:</i></p> <p>Eruption is underway with significant emission of ash into the atmosphere.</p>

2.2.8 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 (USGS) 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 (ADGGS) 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 (UAFGI) 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 (DOD)

The 11 OWS has the responsibility of informing key personnel at Joint Task Force Alaska (JTF-AK), Alaskan North American Aerospace Defense Command Region (ANR), United States Army Alaska (USARAK), 11th Air Force, 3rd Wing, 354th Fighter Wing, 176th Wing, 168 Wing, 17 OWS, and the USCG. In the event of a significant volcanic eruption, the 11 OWS and the 17 OWS also will ensure aircrews requesting remote weather briefings are made aware of the estimated horizontal and vertical extent of the ash cloud. The 11 OWS is projected to inactivate in June 2008. Afterwards, the 611 Air Operations Center, Weather Specialty Team (611 AOC/CODW) will assume the responsibilities.

The 3rd Wing Command Post (3 WG/CP) has the responsibility of informing key personnel and units on Elmendorf AFB not covered by 11 OWS/611 AOC WST of volcanic activities affecting Elmendorf AFB and pilots flying the NOPAC routes.

The Eielson AFB Command Post (354 FW/CP) has the responsibility of informing key personnel and units from both the 354th Fighter Wing (354 FW) and the 168th Air Refueling Wing (168 ARW) of volcanic activities affecting Eielson AFB and pilots flying the NOPAC routes.

The 176th Wing Command Post (176 WG/CP) has the responsibility of informing key personnel and units of volcanic activities affecting Kulis Air National Guard Base and pilots flying the NOPAC routes.

The USARAK Command Operations Center has the responsibility of informing key personnel of volcanic activities affecting U.S. Army installations in Alaska.

The United States Coast Guard has the responsibility of informing their key personnel.

NOTE:

The 2d Weather Squadron (WS), Air Force Weather Agency (AFWA) at Offutt Air Force Base (AFB) has the responsibility of informing key personnel at the US Northern Command's Domestic Warning Center, Peterson AFB, Colorado, North American Aerospace Defense Command, Peterson AFB, Colorado. and Air Mobility Command's Tanker Airlift Control Center, Scott AFB, Illinois. of any volcano activity which may affect their operations.

2.3.1 Procedures

The 11 OWS/611 AOC/CODW will coordinate to provide satellite imagery from the Defense Meteorological Satellite Program (DMSP) polar orbiting satellites. DMSP imagery will be made available through normal communication means, 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, 17 OWS and weather units from Elmendorf AFB (3 OSS/OSW), Eielson AFB (354 OSS/OSW), and Fort Wainwright (3 ASOS) 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 Air Route Traffic Control Center (ARTCC) collects and disseminates volcanic information received from various sources, including AVO, the FAA Regional Operations Center (ROC), the Air Force Regional Air Operations Center (RAOC), the Anchorage VAAC, the Tokyo VAAC, KVERT, SVERT, airline operators, pilot reports, other FAA facilities, or the public. 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

The Alaskan Region FAA contact is the Anchorage ARTCC Watch Supervisor. The Anchorage ARTCC Watch Supervisor can be contacted at 907-269-1103.

Upon receiving notification of an eruption or possible eruption, the Anchorage ARTCC Watch Supervisor will verify the occurrence of volcanic activity with AVO. If AVO advises there is increased seismic or other precursory activity, but an eruptive event has not occurred, the Watch Supervisor will notify the following personnel and facilities:

1. Center Weather Service Unit (CWSU).
2. Anchorage ARTCC Front Line Manager (FLM)/Controller-in-Charge (CIC).
3. Anchorage ARTCC Traffic Management Unit (TMU)/Weather Coordinator (WC).
4. FAA Regional Operations Center.
5. Anchorage ARTCC Air Traffic Manager.
6. Anchorage ARTCC Traffic Management Officer (TMO).
7. Flight Service Station (FSS) closest to the volcanic activity.
8. FAA Anchorage Approach (A11) Watch Supervisor.
9. Maintenance Control Center (MCC).
10. Air Traffic Control System Command Center (ATCSCC).

Additionally, an International NOTAM will be issued signifying increased volcanic activity.

If a volcanic eruption is verified, the Watch Supervisor will take the following actions:

1. Notify the CWSU Meteorologist who will issue an Urgent Pilot Report (UUA). If an eruption occurs when the CWSU Meteorologist is not on duty, the WC will issue the UUA, contact the AAWU, and if needed, contact a CWSU Meteorologist to report immediately to Anchorage ARTCC.
2. Issue an FDC Flight Restriction NOTAM (TFR) if it is determined that the volcanic event could endanger airborne aircraft and occupants.
3. Issue a Volcanic Ash Advisory NOTAM, including the aviation color code, when AVO advises the volcano has been upgraded to "ORANGE" or "RED" and ash may be present.
4. Ensure the Volcano Meteorological Impact Statement (MIS) prepared by Anchorage CWSU is disseminated.
5. When requested by AVO, assist them in relaying and/or obtaining information from KVERT through coordination with Petropavlovsk-Kamchatsky Area Control Center (ACC).

The FLM/CIC will ensure that PIREPs are solicited and recorded by controllers as appropriate. They also will disseminate NOTAM, PIREP, TFR, and current conditions information to the air traffic controllers and CWSU personnel on duty.

Air traffic controllers will ensure that all aircraft in the affected area are aware of the most current information available concerning the volcanic eruption and any resultant ash dispersal. They will, with pilot concurrence, suggest headings or reroutes around known ash or possible ash cloud locations. They also will assist VFR aircraft to the extent possible in avoiding known ash cloud locations, solicit PIREP information and forward to the FLM/CIC, and broadcast information received relating to the volcanic event/ash drift.

Anchorage ARTCC TMU will:

1. Review the areas affected by volcanic activity to determine if any Traffic Management Initiatives (TMIs) are required.
2. Prior to initiating TMIs, advise the Watch Supervisor and FLM/CIC.
3. Coordinate TMIs with affected facilities and the ATCSCC.
4. Monitor the affected area and any resulting TMIs.

2.5 NATIONAL WEATHER SERVICE (NWS)

Alaskan NWS offices (AAWU, CWSU, WFOs, and WSOs) provide the Alaska aviation community, other government agencies, and the public with forecasts and warnings for volcanic ash in the atmosphere, including ashfall forecasts. Meteorological information beyond the level of the forecast also is provided to the Alaska Volcano Observatory (AVO), FAA, DOD (Air Force), and DHS&EM. These meteorological details consist of: 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.

In Alaska, detection of ash plumes and confirmation of ash plume height and direction are done in collaboration with internal NWS offices (AAWU, CWSU, and WFO) and external partners (AVO).

2.5.1. NWS Offices

2.5.1.1 Alaska Aviation Weather Unit (AAWU)

The AAWU is the only ICAO Meteorological office in the world that is both a Volcanic Ash Advisory Center (VAAC) and a Meteorological Watch Office (MWO).

The VAAC portion of the AAWU consists of the Alaska FIR boundaries and the far northeast Russia, north of 60 degrees North latitude and east of 150 degrees East longitude. Worldwide, VAACs consist of nine offices and are a designation of the ICAO. VAACs issue Volcanic Ash Advisories (VAA), which are informational messages about volcanic eruptions disseminated through AFTN.

AAWU MWO (another designation of the International Civil Aeronautics Organization [ICAO]) responsibilities are limited to the Alaskan FIR. MWO offices issue Volcanic Ash International SIGMETs and disseminate them to aviation customers through the NWS Telecommunications Gateway.

2.5.1.2 Center Weather Service Unit (CWSU)

The Anchorage CWSU (1 of 21 CWSUs in the United States), located at the FAA's Anchorage ARTCC is staffed by NWS meteorologists and operated 15 hours a day (6:00 a.m. to 9:00 p.m. local time). The Anchorage CWSU staff prepares and disseminates routine (UA) and Urgent (UUA) PIREPS, Center Weather advisories (CWA), Meteorological Impact Statements (MIS), and graphical Volcanic Ash MISs.

The CWSU relays pertinent information to Air Traffic Managers via on-demand briefings, internally and externally disseminated UUAs, SIGMETs, CWAS, MISs, and graphical volcanic ash MISs. The graphical volcanic ash MIS is disseminated to an FAA specified list of users via facsimile.

2.5.1.3 WFOs and WSOs

Weather Forecast Offices (WFO) and Weather Service Offices (WSO) in Alaska participate in the volcanic eruption response by issuing volcanic ashfall statements, advisories, and warnings to the public. These offices also share observations of eruptions and the resulting volcanic ashfall with AVO and other agencies as needed.

2.5.2 NWS Products and Services

2.5.2.1 Alaska Aviation Weather Unit (AAWU)

A. 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 5 minutes from the time of notification of volcanic ash impacting the Anchorage FIR and may contain limited information. If it is determined that volcanic ash is present, a follow-up SIGMET identifies the spatial and vertical extent of a volcanic ash hazard for a 6-hour period. A SIGMET is canceled as soon as it is reliably confirmed an ash hazard no longer exists in an area.

Volcanic Ash Advisory (VAA): In an ash event, the AAWU, as the Anchorage VAAC, issues a VAA, which serves as a guidance product to the aviation, meteorological, and volcanological community. A VAA product contains information on the volcano, volcanic eruption, current aerial 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 6 hours with updates as necessary.

B. Services

The AAWU will act as NWS Anchorage Forecast Center (AFC) liaison to the AVO. In addition, they provide estimated plume height information to the AVO when a volcanic eruption is detected on Doppler radar.

2.5.2.2 Center Weather Service Unit (CWSU)

A. Products

Urgent Pilot Report (UUA): A UUA for an eruption is disseminated long-line by the CWSU immediately upon notification of a volcanic eruption. Russian volcanic eruptions are issued under the Cold Bay Identifier (CDB) and Alaskan volcanic eruptions are issued under the Anchorage Identifier (ANC). Weather Coordinators at Anchorage ARTCC are trained in UUA dissemination during times the CWSU staff is not on duty.

Center Weather Advisory (CWA): The CWA, similar to the SIGMET, contains information about eruptions and location of volcanic ash for a 0-2 hour period. The CWA is an in-flight aviation weather warning for pilots, air traffic controllers, and ARTCC operational staff. The CWA should be issued for volcanic activity that is below SIGMET criteria but still merits attention by aviation operations.

Meteorological Impact Statement (MIS): The MIS is similar to the CWA in that it contains information about eruptions and the location of volcanic ash, but it is not a warning product and is issued for a 0-12 hour period. The MIS is an "in-flight" aviation weather advisory for Air Traffic Managers.

Graphical Volcanic Ash MIS: The Graphical Volcanic Ash MIS is a graphical representation of volcanic ash location and forecasted aerial coverage up to 12 hours. Graphical MISs is issued when an AAWU SIGMET or VAA has not been issued. Once an AAWU SIGMET or VAA is issued, the Graphical MIS is no longer in effect.

B. Services

The CWSU's primary mission is to support Air Traffic Management decisions. The CWSU provides on-demand briefings during volcanic ash eruptions and distributes UUAs, AAWU warning products (i.e. VAA, SIGMET), and CWSU warning products (i.e., Graphical Volcanic Ash MISs) to the appropriate Air Traffic Manager and/or sector.

2.5.2.3 Alaska Region Weather Forecast Office (WFO) and Weather Service Office (WSO)

A. Products:

Public and Marine Ashfall Statements: Public and/or Marine Ashfall Statements are advisory products designed to alert the public when ashfall is expected in the WFO and/or WSO area of responsibility. This advisory contains the spatial extent and progress of the ash as coordinated with other NWS products and the AVO.

B. Services

The WFO and WSO provide support for the AAWU and CWSU by soliciting spotter and/or pilot reports, monitoring radar and satellite observations, and forwarding all pertinent information to the AAWU and CWSU. The WFO and WSO also respond to public inquiries during a volcanic eruption.

2.5.3 NWS Collaboration

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 AAWU, AVO, CWSU, ARTCC, DOD (Air Force), the NWS AWC in Kansas City, other VAACs, the WFOs, etc. is vital in determining the extent and severity of a volcanic ash event.

2.5.3.1 NWS Collaboration Partners

The AAWU is the primary NWS liaison for volcanic ash forecasts and warnings. However, the AAWU, CWSU, and WFO collaborate with many of the same internal and external partners resulting in some overlap in the following descriptions.

A. Internal NWS Partners

AAWU/CWSU: The AAWU and CWSU collaborate on possible and confirmed volcanic eruptions that may affect (or are affecting) the Alaskan FIR, the products that are the most appropriate for the situation, and on the details of those products (aerial coverage, height, direction, etc.). The CWSU also solicits PIREPs and forwards critical information to the AAWU.

AAWU/CWSU/WFO/WSO: The AAWU and Alaska Region WFOs and WSOs collaborate when a volcanic eruption may result in ashfall over populated and/or active ground based areas (including marine). Collaboration includes information sharing on the volcano's activity (spotter reports, PIREPs, radar analysis, AVO information etc.) and volcanic ashfall forecasts and warnings. The WFOs and WSOs pass along pertinent information to AAWU and CWSU.

AAWU/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 during the running of the Volcanic Ash Forecast Transport and Dispersion (HYSPLIT) model, satellite imagery interpretation, transfer of VAAC responsibility, and/or the ending of an event.

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

B. External NWS Partners

AAWU/CWSU/WFO/AVO (KVERT): The AAWU, CWSU, and WFO receive and/or request information from AVO (or KVERT or SVERT) for geologic information such as seismic data, ground-based observations, and preliminary estimation of plume height and/or direction. AVO also provides background knowledge of eruptive history and type of eruptions that can be expected. Collaboration on satellite imagery interpretation also may occur.

AVO also can provide information on suspected volcanic eruptions occurring on the Kamchatka Peninsula/Kurile Islands of Russia.

WFO/AVO: The WFO collaborates with AVO when determining ashfall potential over populated areas, including marine areas.

AAWU/CWSU/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 and CWSU 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 (spotter reports) as well as to share volcanic information, products, and warnings.

AAWU/CWSU/FAA Anchorage Air Route Traffic Control Center (ARTCC): CWSU (AAWU if CWSU is closed) solicits PIREPs and shares volcanic information, products and warnings, with FAA Anchorage ARTCC Air Traffic Managers. Anchorage ARTCC Air Traffic Managers forward pertinent PIREPs and other volcanic information to the CWSU and/or AAWU.

AAWU/Tokyo VAAC: AAWU and JMA Tokyo use a multi-lingual telephone fax form to conduct two-way collaboration and sharing of information, including resulting text and graphics products, for possible and confirmed volcanic eruptions over the Kamchatka Peninsula and Northern Kuriles.

AAWU/Montreal VAAC (Canadian Meteorological Centre, Meteorological Services of Canada (MSC)): AAWU collaborates with the Montreal VAAC to run the Canadian Emergency Response Model (CANERM), coordinate event details and products involving ash in the vicinity of Canadian airspace and the possible transfer of VAAC responsibility.

2.5.4 NWS Procedures

Notification of a potential volcanic ash hazard can be made by the AAWU (using satellite data, webcams, online seismic data, etc), the CWSU (PIREP, satellite data, webcams, online seismic data, etc.), WFOs (satellite, radar, spotter report, etc.), WSOs (spotter and/or PIREPs) and/or by AVO (seismic, satellite, etc.). Collaboration and information sharing phone calls and conversations are sometimes made simultaneously by the AAWU, CWSU, and AVO.

The following are the procedures following notification of a volcanic eruption.

2.5.4.1 AAWU Procedures

A. Once the AAWU has been notified of a potential volcanic ash hazard, the AAWU immediately contacts the CWSU (or the Watch Supervisor at Anchorage ARTCC if the CWSU is closed) and AVO to collaborate on the details of the eruption and/or to confirm an eruption occurred.

B. A collaboration call is made to the CWSU and AVO to discuss the possible ash height, volume, and trajectory of the eruption and to ask the CWSU to solicit additional PIREPs.

C. A preliminary SIGMET is issued, if required, within 5 minutes of the eruption, if possible.

D. A request is sent, if required, for the SDM at NCEP to initiate and disseminate the HYSPLIT.

E. A second call is made to the CWSU to collaborate on products (i.e., VAA, follow-up SIGMET, and/or Graphical Volcanic Ash MIS) that will be issued, if required, by the CWSU and AAWU and the information that will be contained in those products.

F. Subsequent coordination is made with other partner organizations when the volcanic ash hazard is expected to impact or is impacting those partner areas of responsibility. Partner organizations include the Washington VAAC, Tokyo VAAC, Montreal VAAC, the AWC, and affected Alaska NWS offices.

G. Handoffs to partner VAACs and/or the ending of an event are preceded by a conference call with the CWSU, AVO, and any other principle units involved in the event (except Tokyo VAAC where handoffs are accomplished via the bi-lingual fax) to achieve a consensus on further actions.

2.5.4.2 CWSU Procedures

A. Once a report of a volcanic eruption or volcanic ash is forwarded to the CWSU (via PIREP, AVO, and/or AAWU collaboration call), the CWSU meteorologist enters the report as an UUA.

B. The UUA is disseminated to the Anchorage ARTCC Watch Supervisor, TMU, front line managers (FLMs), and controllers; preliminary information is shared; and PIREPs are solicited.

C. A phone call is made to the AAWU and AVO to collaborate on the possible ash height, volume, and trajectory.

D. A second phone call is made to the AAWU to collaborate on products (i.e. VAA, follow-up SIGMET, and/or Graphical Volcanic Ash MIS) that will be issued, if required, by the CWSU and AAWU and the information that will be contained in those products.

E. Any SIGMETs pertaining to the eruption are copied and disseminated to the Anchorage ARTCC Watch Supervisor, TMU, FLMs, and controllers. Informal briefings, including additional information and clarification, are conducted at this time.

F. A Graphical Volcanic Ash MIS, if required, is prepared and faxed to the Anchorage ARTCC TMU defined list of customers.

G. A graphic of either the SIGMET or Graphical Volcanic Ash MIS is prepared and transmitted to the seven internal briefing terminals within the Anchorage ARTCC.

H. Follow-up briefings and collaboration calls and/or collaborative sessions on the Volcanic Ash Collaboration Tool (VACT) take place as needed.

2.5.4.3 WFO and WSO Procedures

A. Once notified of an eruption that may produce ashfall on a populated area, including marine areas, the WFO collaborates with the AAWU who then calls AVO to collaborate on location and forecast movement of ash.

B. A collaboration call is made to AVO regarding potential ashfall rates, depth, and aerial coverage.

C. A collaboration call is made to the affected WSO(s), CWSU, and AAWU to share information and solicit spotter reports and PIREPS.

D. A collaboration call is made to the DHS&EM.

E. WFOs and WSOs may issue warnings and statements as public and marine products when volcanic ash is present or is expected to be present within the next **4** 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 or provided in the graphical volcanic ash MISs issued by the CWSU.

F. The WFO(s) and WSO(s) refer all public questions on the effects of ash fallout relating to public health and safety to the DHSS and DEC.

G. The WFO(s) and WSO(s) refer all public questions on the geological aspects of the eruption to the AVO in Anchorage.

H. Follow-up collaboration calls with the AVO, DHS&EM, AAWU, WSO(s), and CWSU are conducted as needed.

2.5.5 Volcanic Ash Data and Forecast Models

2.5.5.1 Reliable Reports for Volcanic Eruptions with Ash

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 Alaskan FIR also is valuable for inclusion in the VAAs, the Volcanic Ash SIGMETs, Volcanic Ash UUA's, Volcanic Ashfall forecasts, and Graphical MISs.

The NWS determination of the reliability of a report of an eruption accompanied by volcanic ash depends on the source of information and the location of that eruption. However, every report of volcanic ash from an eruption is subject to confirmation.

- a. An eruption with ash is assumed to have occurred within the Alaskan FIR when reported by at least one of the following:
 - (1) Pilot report.
 - (2) Ground (land or water) observer.
 - (3) Information from AVO.
 - (4) Satellite or weather radar imagery.
 - (5) NWS operations staff.
 - (6) National Centers [Washington VAAC, the National Center for Environmental Prediction (NCEP), or the 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) Pilot Report.
 - (2) Japan Meteorological Agency (JMA).
 - (3) Environment Canada.
 - (4) CMC.
 - (5) KVERT or SVERT.
 - (6) VAACs.
 - (7) MWOs.

2.5.5.2 Ash Trajectory Forecasts and Numerical Computer Models Used in the Forecast Process

When a volcano with a high potential to impact the Alaskan FIR goes to color code ORANGE, the AAWU may request that NCEP produce automatic 3 hourly HYSPLIT model runs. In addition, AVO scientists at the Geophysical Institute in Fairbanks produce automatic Puff model runs available on their public website for every volcano in Alaska and Russia at color code **YELLOW** or higher. This provides much needed quick reference model runs for those critical minutes following notification of a significant or major eruption as defined below.

NWS Meteorological definitions of minor, significant, and major eruptions:

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.

A. Puff Model

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. The Puff model also is 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.

B. HYSPLIT

The primary eruption response ash tracking model is the NWS HYSPLIT model. The HYSPLIT is initiated by a request from the Anchorage VAAC. The VAAC should initiate the HYSPLIT for all significant or major eruptions affecting Alaska FIRs. Issuing the HYSPLIT 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).

The HYSPLIT products from the request are automatically sent to the AAWU via File Transfer Protocol (FTP) and AVO via telephone facsimile. The AAWU should initiate the HYSPLIT 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 operations once an eruption has begun.

A request from the AAWU forecaster to the SDM at NCEP is required for dissemination of the HYSPLIT products to external customers. HYSPLIT products should be disseminated for significant and major eruptions to airlines operating in Alaska, DOD, USCG, and the FAA Flight Service Stations; and the World Area Forecast Service (WAFS) to government, national commercial, and international commercial customers.

There are two modes of HYSPLIT Alert 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 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 aviation 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 HYSPLIT is not available, a request should be made by the AAWU lead forecaster for the CANERM through the CMC. The request is made by calling CMC in Montreal, Canada. Output from the CANERM is available via telephone, fax, or the Internet.

2.5.6 Dissemination of Products

Meteorological information, products, and warnings from the NWS about volcanic ash are disseminated through operational communications systems, such as:

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

B. FAA's Aeronautical Information System Replacement (AISR) via WMSCR for text CWAs, MISs, and PIREPs (routine and urgent).

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

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

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

F. The WAFS for HYSPLIT graphic products.

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

H. Internet Fax Service for the Graphical Volcanic Ash MIS.

These operational dissemination systems are reliable and maintenance is on call 24 hours a day, 7 days a week. Volcanic ash advisories, public and marine text/graphic products, HYSPLIT, 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 business hours 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 (<http://www.ak-prepared.com>). This network reaches the majority of the emergency services organizations in Alaska.

2.6 UNITED STATES COAST GUARD (USCG)

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.

During eruptions, the USCG may issue a Marine Information Broadcast to alert mariners of hazardous conditions related to volcanic activity.

2.7 DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF AIR QUALITY (DEC AQ)

Once an ash cloud is reported and the levels of ash due to ash cloud motion and fallout are expected to exceed the National Ambient Air Quality Standards (NAAQS) for particulates or monitoring data indicates that high levels of ash exist, DEC AQ will issue an air quality advisory. The decision to issue the advisory is based on input from the NWS and AVO regarding the intensity and movement of the ash cloud. Advisories are often forecast in nature and will be adjusted once observations of ash or actual monitoring data are received. Standards are violated when the average concentration of ash greater than 10 microns in diameter (PM-10; considered inhalable) exceeds $150 \mu\text{g}/\text{m}^3$ for 24 hours. This is equivalent to an Air Quality Index (AQI) value of 100 (see table below).

The air quality advisory will contain information concerning the predicted movement of the ash cloud, where ash is expected to fall, anticipated duration of poor air quality, and how bad the air quality is expected to become. The advisory also identifies steps the public can take to protect their health and the health of other sensitive individuals if they encounter ashfall. The following chart depicts air quality categories:

PM-10 Particulate Levels and the Air Quality Index

Categories	Cautionary Statements	AQI
Good	None	0 - 50
Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.	51 - 100
Unhealthy for Sensitive Individuals	People with respiratory or heart disease, the elderly and children should limit prolonged exertion.	101 - 150
Unhealthy	People with respiratory or heart disease, the elderly and children should avoid prolonged exertion; everyone else should limit prolonged exertion.	151 - 200
Very Unhealthy	People with respiratory or heart disease, the elderly and children should avoid outdoor activity; everyone else should avoid prolonged exertion.	201 - 300
Hazardous	Everyone should avoid outdoor exertion; people with respiratory or heart disease, the elderly and children should remain indoors.	301 - 500

Advisories will be posted to the State DEC AQ webpage at: http://www.dec.state.ak.us/air/am/aq_sr.htm. Advisories also will be disseminated via email to numerous personnel within local and State government, as well as any other individuals who request updates. Such requests can be made through the web page via the DEC Information Officer.

During an ashfall event, the Alaska State Department of Health and Social Services (DHSS) coordinates with Department of Environmental Conservation (DEC) to include appropriate health information and guidance in Public Service Announcements for the general public and special needs populations such as those with chronic respiratory conditions. People who experience respiratory difficulty during an ashfall event are advised to contact their local healthcare provider. After ash fallout, DHSS coordinates with DEC to assure that personnel performing recovery operations are aware of health risks and personal protection required during clean up.

Upon notification of increased seismic or volcanic activity in Alaska, the DEC Air Quality staff will evaluate the need for deploying particulate monitors to measure levels of airborne ash in the event of an eruption. Monitoring site location(s) will be selected based on the potential ashfall trajectory, ability to physically site a monitor, and the protection of public health. Additional consideration will be given to local emergency response needs, availability of onsite technical support, proximity to population centers and anticipated duration of the event.

Other DEC programs will be contacted to provide technical assistance as needed.

3.0 Plan Management

This is the fifth edition of the Alaska Interagency Operating Plan for Volcanic Ash Episodes. The plan should be reviewed and updated every 2 years. The plan will be maintained by the National Weather Service Alaska Region (Environmental and Scientific Services Division) or other plan participant as needed.

Prior editions of the plan from 1994, 1997, 2001, and 2004 are on file at the Alaska Volcano Observatory in Anchorage.

4.0 List of Acronyms

AAWU	Alaska Aviation Weather Unit
ADGGS	Alaska Division of Geological and Geophysical Surveys
AFB	Air Force Base
AFTN	Aeronautical Fixed Telecommunications Network
AFWA	Air Force Weather Agency
AISR	Aeronautical Information System Replacement
ALCOM	Alaskan Command
ANR	Alaska North American Aerospace Defense Command
AQ	Air Quality
AQI	Air Quality Index
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
DEC	Department of Environmental Conservation
DHS&EM	Division of Homeland Security and Emergency Management
DHHS	Department of Health and Social Services
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
FLM	Front Line Manager
FSS	Flight Service Station
FTP	File Transfer Protocol
GSC	Geological Survey of Canada
HF	High Frequency
HVO	Hawaiian Volcano Observatory
ICAO	International Civil Aviation 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
METSAT	Meteorological Satellite
MIS	Meteorological Impact Statement

MSC	Meteorological Services of Canada
MWO	Meteorological Watch Office
NAAQS	National Ambient Air Quality Standards
NCEP	National Center for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NOPAC	NOth 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
PM-10	Particulate Matter, 10 microns and smaller
ROC	Regional Operations Center
SAB	Satellite Analysis Branch
SDM	Senior Duty Meteorologist
SECC	State Emergency Coordination Center
SIC	Scientist-In-Charge
SIGMET	SIGNificant METEorological Information
SVERT	Sakhalin Volcanic Eruptions Response Team
TFR	Temporary Flight Restriction
3 WG/CP	3 rd Wing Command Center
354 FW/CP	354 th Fighter Wing Command Center
TMO	Traffic Management Officer
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
VACT	Volcanic Ash Collaboration Tool
VAFTAD	Volcanic Ash Forecast Transport and Dispersion
VAN	Volcanic Activity Notice
VONA	Volcano Observatory Notice for Aviation
VHF	Very High Frequency
WAFS	World Area Forecast Service
WARP	Weather and Radar Processor
WFO	Weather Forecast Office
WMSCR	Weather Message Switching Center Replacement
WS	Weather Squadron
WSO	Weather Service Office
YVO	Yellowstone Volcano Observatory

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5.0 Principal Contacts and Agency Web Pages

ALASKA VOLCANO OBSERVATORY

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

<http://volcanoes.usgs.gov>

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://aawu.arh.noaa.gov>

CWSU: <http://cwsu.arh.noaa.gov>

UNITED STATES AIR FORCE

Air Force Weather Agency: <https://weather.afwa.af.mil>

(.mil or .gov domain sites only)

UNITED STATES COAST GUARD

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

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Main Website: <http://www.dec.state.ak.us/index.htm>

Air Quality Advisories: http://www.dec.state.ak.us/air/am/aq_sr.htm

Volcanic Ash Info: <http://www.dec.state.ak.us/air/volcano.htm>

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6.0 Signature Page

<u>24 March 2008</u> Date	<u>//Signed//</u> John Madden Director Division of Homeland Security and Emergency Management
<u>15 February 2008</u> Date	<u>//Signed//</u> Thomas L. Murray Scientist-in-Charge Alaska Volcano Observatory Alaska Science Center U.S. Geological Survey
<u>4 April 2008</u> Date	<u>//Signed//</u> William J. Carle, Lt Col, USAF Joint METOC Officer Joint Task Force Alaska
<u>28 March 2008</u> Date	<u>//Signed//</u> Michael A. Cirillo Regional Administrator Federal Aviation Administration Alaskan Region
<u>15 April 2008</u> Date	<u>//Signed//</u> Laura K. Furgione Director National Weather Service Alaska Region
<u>1 April 2008</u> Date	<u>//Signed//</u> Michael T. Trimpert, Commander, USCG Commander (drm) Chief, Incident Response Branch Seventeenth Coast Guard District
<u>11 April 2008</u> Date	<u>//Signed//</u> Larry Hartig Commissioner Department of Environmental Conservation

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- APPENDIX A ACTIVE VOLCANOES OF ALASKA – LIST OF VOLCANOES, IAVCEI CATALOG NUMBER, LOCATION IN LATITUDE AND LONGITUDE, LAST HISTORICAL ERUPTION, ELEVATION IN FEET AND METERS
- APPENDIX B MAP OF ACTIVE VOLCANOES OF ALASKA
- APPENDIX C ACTIVE VOLCANOES OF KAMCHATKA AND THE NORTHERN KURILES – LIST OF VOLCANOES, IAVCEI CATALOG NUMBER, LOCATION IN LATITUDE AND LONGITUDE, LAST HISTORICAL ERUPTION, ELEVATION IN FEET AND METERS
- APPENDIX D MAP OF ACTIVE VOLCANOES OF KAMCHATKA
- APPENDIX E ACTIVE VOLCANOES OF THE KURILE ISLANDS – LIST OF VOLCANOES, IAVCEI CATALOG NUMBER, LOCATION IN LATITUDE AND LONGITUDE, LAST HISTORICAL ERUPTION, ELEVATION IN FEET AND METERS
- APPENDIX F MAP OF ACTIVE VOLCANOES OF THE KURILES
- APPENDIX G PUBLIC PHONE NUMBERS FOR VOLCANIC ASH EPISODES IN GREATER COOK INLET
- APPENDIX H PUBLIC WEB SITES FOR VOLCANIC ASH EPISODES IN GREATER COOK INLET

APPENDIX A

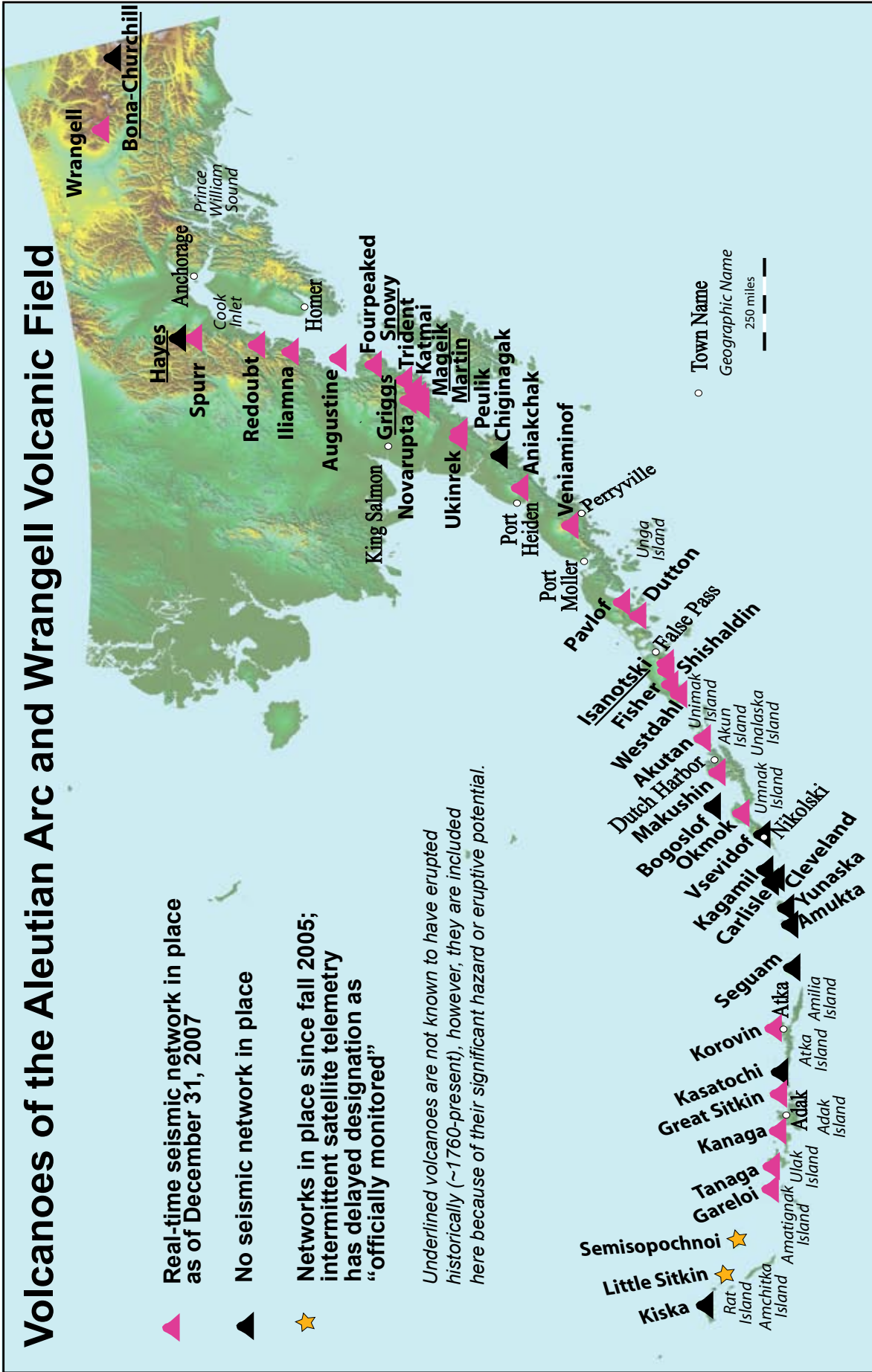
ACTIVE VOLCANOES OF ALASKA

MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
1	<i>Bona-Churchill</i>	1105-03	61°23'N, 141°45'W	**	16,420'; 5005 m
2	Wrangell	1105-02	62°00'N, 144°01'W	1902	14,163'; 4,317 m
3	<i>Hayes</i>	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	<i>Iliamna</i>	1103-02	60°02'N, 153°04'W	**	10,016'; 3,053 m
7	Augustine	1103-01	59°23'N, 153°26'W	2005-2006	4,134'; 1,260 m
8	Fourpeaked	1102-26	58°46'N, 153°40'W	2006	6,903'; 2,104 m
9	<i>Snowy</i>	1102-20	58°20'N, 154°41'W	**	7,090'; 2,161 m
10	<i>Griggs</i>	1102-19	58°21'N, 155°06'W	**	7,602'; 2,317 m
11	Katmai	1102-17	58°16'N, 154°59'W	1912	6,716'; 2,047 m
12	Novarupta	1102-18	58°16'N, 155°09'W	1912	2,759'; 841 m
13	Trident	1102-16	58°14'N, 155°07'W	1953-74	3,599'; 1,097 m
14	<i>Mageik</i>	1102-15	58°11'N, 155°14'W	**	7,103'; 2,165 m
15	<i>Martin</i>	1102-14	58°10'N, 155°21'W	**	6,102'; 1,860 m
16	Peulik	1102-13A	57°45'N, 156°21'W	1852?	4,836'; 1,474 m
17	Ukinrek	1102-13B	57°50'N, 156°30'W	1977	299'; 91 m
18	<i>Chiginagak</i>	1102-11	57°08'N, 157°00'W	1971?	7,005'; 2,135 m
19	Aniakchak	1102-09	56°53'N, 158°10'W	1931	4,400'; 1,341 m
20	Veniaminof	1102-07	56°10'N, 159°23'W	2002-2008	8,225'; 2,507 m
21	Pavlof	1102-03	55°25'N, 161°54'W	2007	8,261'; 2,518 m
22	<i>Dutton</i>	1102-011	55°11'N, 162°16'W	**	4,833'; 1,473 m
23	<i>Isanotski</i>	1101-37	54°45'N, 163°44'W	**	8,025'; 2,446 m
24	Shishaldin	1101-36	54°45'N, 163°58'W	1999	9,373'; 2,857 m
25	Fisher	1101-35	54°39'N, 164°26'W	1830?	3,648'; 1,112 m
26	Westdahl	1101-34	54°31'N, 164°39'W	1991-92	5,118'; 1,560 m
27	Akutan	1101-32	54°08'N, 165°58'W	1992	4,275'; 1,303 m
28	Makushin	1101-31	53°53'N, 166°56'W	1995	6,680'; 2,036 m
29	<i>Bogoslof</i>	1101-30	53°56'N, 168°02'W	1992	492'; 150 m
30	Okmok	1101-29	53°24'N, 168°10'W	1997	3,520'; 1,073 m
31	<i>Vsevidof</i>	1101-27	53°08'N, 168°41'W	1957?	7,050'; 2,149 m
32	<i>Kagamil</i>	1101-26	52°58'N, 169°43'W	1929?	2,930'; 893 m
33	<i>Carlisle</i>	1101-23	52°54'N, 170°03'W	1987?	5,315'; 1,620 m
34	<i>Cleveland</i>	1101-24	52°49'N, 169°57'W	2005-08	5,676'; 1,730 m
35	<i>Yunaska</i>	1101-21	52°38'N, 170°38'W	1937	1,804'; 550 m
36	<i>Amukta</i>	1101-19	52°30'N, 171°15'W	1996	3,497'; 1,066 m
37	<i>Seguam (Pyre Peak)</i>	1101-18	52°19'N, 172°31'W	1993	3,458'; 1,054 m
38	Korovin (Atka Is.)	1101-16	52°23'N, 174°09'W	2006	5,029'; 1,533 m
39	<i>Kasatochi</i>	1101-13	52°11'N, 175°30'W	1899?	1,030'; 314 m
40	Great Sitkin	1101-12	52°05'N, 176°08'W	1974	5,709'; 1,740 m
41	Kanaga	1101-11	51°55'N, 177°10'W	1993-96	4,288'; 1,307 m
42	Tanaga	1101-08	51°53'N, 178°08'W	1914	5,925'; 1,806 m
43	Gareloi	1101-07	51°47'N, 178°48'W	1996?	3,458'; 1,573 m
44	Semisopochnoi (Cerberus)	1101-06	51°56'N, 179°35'E	1987	2,625'; 800 m
45	Little Sitkin	1101-05	51°57'N, 178°32'E	1900?	3,898'; 1,188 m
46	<i>Kiska</i>	1101-02	52°06'N, 177°36'E	1990	4,003'; 1,220 m

Bold: Volcanoes with functioning seismic monitoring networks as of December 2007. Little Sitkin and Semisopochnoi have networks but telemetry is unreliable and AVO does not consider these volcanoes seismically monitored.

**Italics: Volcanoes with no historical (AD 1760–present) eruptions but considered hazardous because of vigorous fumarolic activity, intense earthquake swarms, or their pre-historic eruption record.

Data sources: (1) Miller, T.P. and others., 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) published and unpublished AVO reports and internal files; (5) AVO's web site and online database of volcanoes called GEODIVA. Some inconsistencies among data sources remain unresolved and this list may change slightly through time as new information becomes available.



APPENDIX C ACTIVE VOLCANOES OF KAMCHATKA and the NORTHERN KURILES

MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
SECTION NORTH					
1	Sheveluch	1000-27	56°39'N, 161°21'E	1980-2008 active lava dome	10,768'; 3,283 m ~8,200 ft; ~2,500 m
2	Klyuchevskoy	1000-26	56°03'N, 160°39'E	2007	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	2008	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	<i>Ichinsky</i>	<i>1000-28</i>	<i>55°40'N, 157°43'E</i>	**	<i>11,877'; 3,621 m</i>
SECTION CENTER					
8	Kizimen	1000-23	55°12'N, 160°19'E	1927-28	8,151'; 2,485 m
9	<i>Gamchen</i>	<i>1000-21</i>	<i>54°58'N, 160°42'E</i>	**	<i>8,449'; 2,576 m</i>
10	<i>Komarov</i>	<i>1000-22</i>	<i>55°04'N, 160°43'E</i>	**	<i>6,790'; 2,070 m</i>
11	Kronotsky	1000-20	54°45'N, 160°30'E	1922-23	11,572'; 3,528 m
12	<i>Krashenninikov</i>	<i>1000-19</i>	<i>54°35'N, 160°16'E</i>	**	<i>6,088'; 1,856 m</i>
13	<i>Kikhpinych</i>	<i>1000-18</i>	<i>54°29'N, 160°14'E</i>	**	<i>5,091'; 1,552 m</i>
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	1996-2008	4,874'; 1,486 m
18	<i>Dzenzursky</i>	<i>1000-11</i>	<i>53°37'N, 159°00'E</i>	**	<i>7,497'; 2,285 m</i>
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	Zheltoovsky	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	<i>Kambalny</i>	<i>1000-01</i>	<i>51°18'N, 156°54'E</i>	**	<i>7,072'; 2,156 m</i>
Other potentially active volcanoes of Kamchatka					
30	<i>Khodutka</i>	<i>1000-053</i>	<i>52°04'N, 157°42'E</i>	**	<i>6,855'; 2,090 m</i>
31	<i>Kurile Lake</i>	<i>1000-022</i>	<i>51°28'N, 157°06'E</i>	**	<i>400'; 122 m</i>
32	<i>Khangar</i>	<i>1000-272</i>	<i>54°45'N, 157°22'E</i>	**	<i>6,560'; 2,000 m</i>
SECTION ATLASOVA AND PARAMUSHIR ISLANDS (Northern Kuriles)					
33	Alaid	0900-39	50°52'N, 155°34'E	1986	7,674'; 2,339 m
34	Ebeko	0900-38	50°41'N, 156°01'E	2005	3,793'; 1,156 m
35	Chikurachki	0900-36	50°19'N, 155°28'E	2005	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

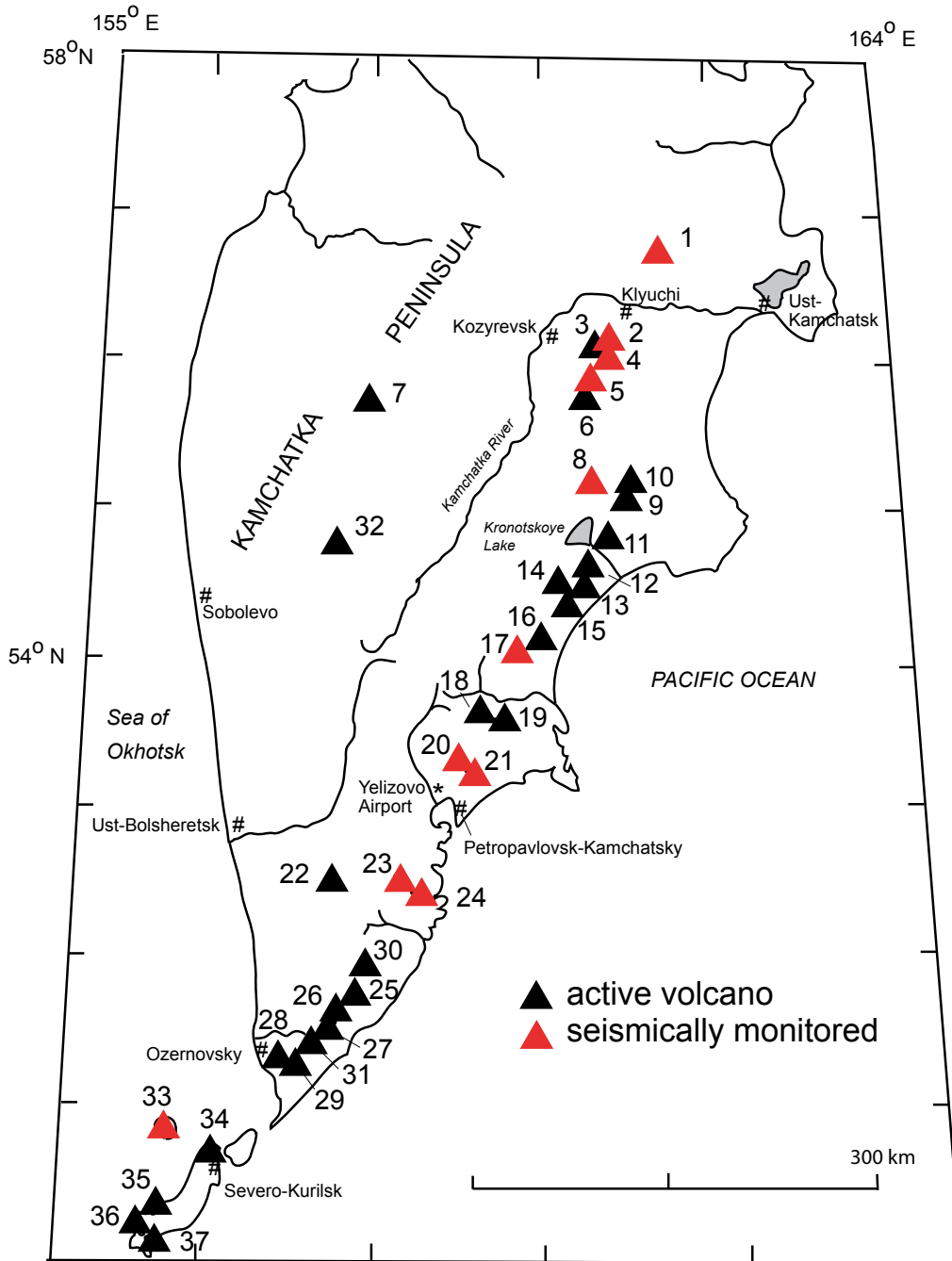
Bold: Seismically monitored volcanoes. **Kizimen volcano is considered only marginally monitored by one distant seismic station.**

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.

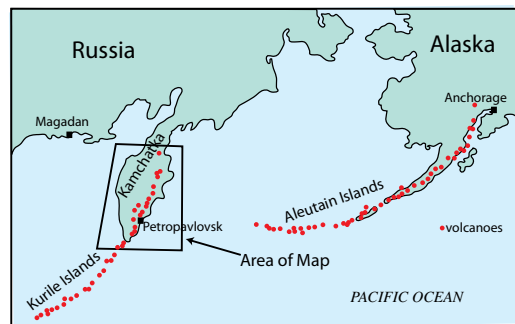
VOLCANOES OF KAMCHATKA AND THE NORTHERN KURILE ISLANDS



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

Northern Kuriles:

- | | |
|-----------------|---------------------|
| 33) Alaid | 36) Fuss Peak |
| 34) Ebeko | 37) Karpinsky Group |
| 35) Chikurachki | |



APPENDIX E
ACTIVE VOLCANOES OF THE KURILE ISLANDS

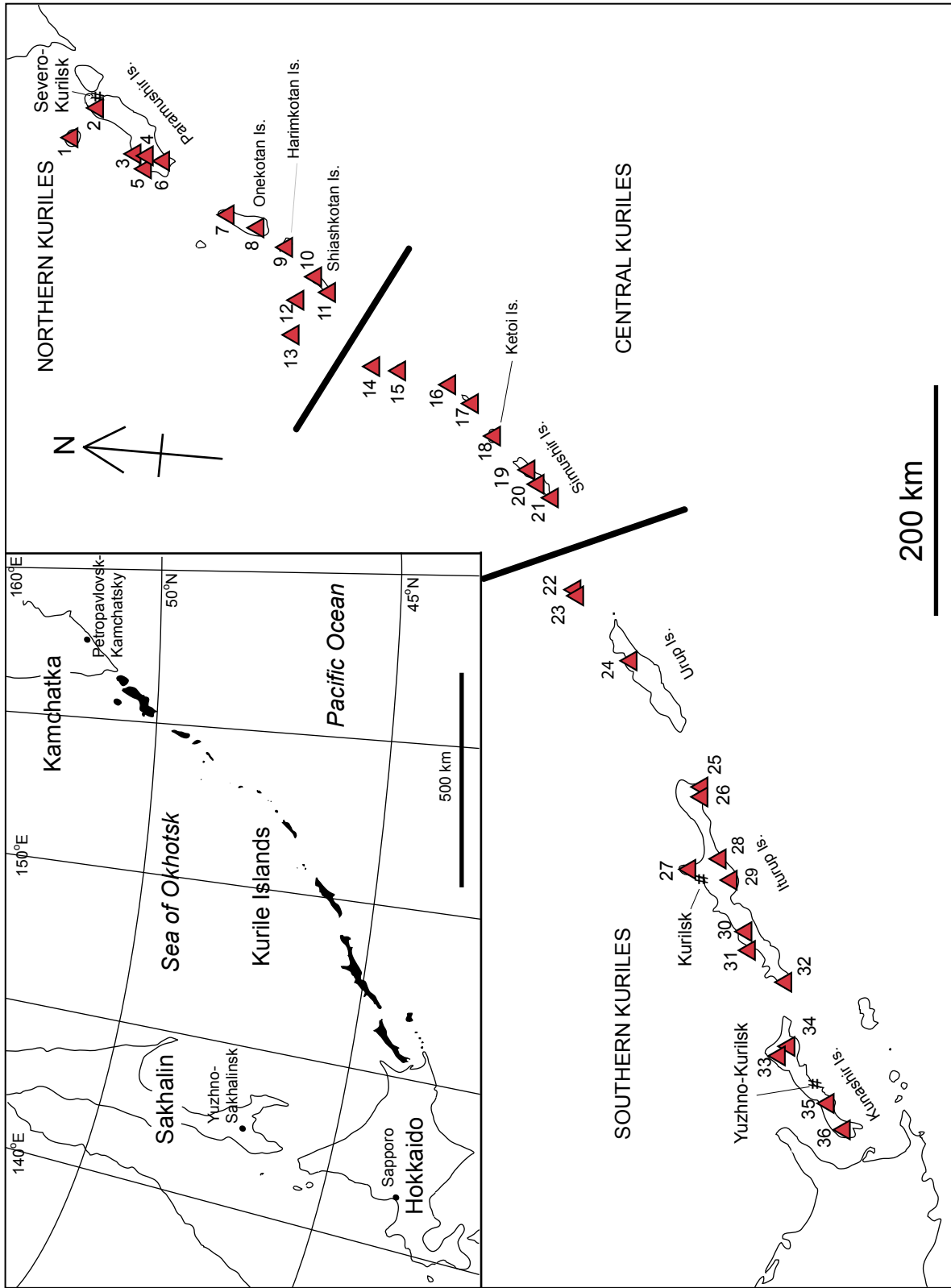
MAP#	NAME	IAVCEI CATALOG#	LOCATION	LAST HISTORICAL ERUPTION	ELEVATION
NORTHERN KURILES (1-6 Also shown on Kamchatka Map, Appendix D)					
1	Alaid (Atlasova Is.)	0900-39	50°52'N, 155°34'E	1986	7,674'; 2,339 m
2	Ebeko (Paramushir Is.)	0900-38	50°41'N, 156°01'E	2005	3,793'; 1,156 m
3	Chikurachki (Paramushir Is.)	0900-36	50°19'N, 155°28'E	2007	5,956'; 1,816 m
4	<i>Tatarinova (Paramushir Is.)</i>	--	<i>50°18'N, 155°27'E</i>	**	<i>5,020'; 1,530 m</i>
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
7	Nemo Peak (Onekotan Is.)	0900-32	49°34'N, 154°48'E	1938	3,342'; 1,019 m
8	Krenitzyn Peak (Tao-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	2007?	3,796'; 1,157 m
10	Sinarka (Shiashkotan Is.)	0900-29	48°52'N, 154°11'E	2003?	3,064'; 934 m
11	Kuntomintar (Shiashkotan Is.)	0900-28	48°45'N, 154°01'E	1924	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	2004	2,375'; 724 m
CENTRAL KURILES					
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	Rasshua (Rasshua Is.)	0900-22	47°45'N, 153°01'E	1957?	3,113'; 949 m
17	<i>Ushishir (Yankich Is.)</i>	<i>0900-21</i>	<i>47°31'N, 152°48'E</i>	**	<i>1,276'; 389 m</i>
18	Ketoi (Pallas Peak; Ketoi Is.)	0900-20	47°20'N, 152°29'E	1960	3,248'; 990 m
19	Prevo Peak (Simushur Is.)	0900-19	47°01'N, 152°07'E	1914	4,462'; 1,360 m
20	Zavaritzii (Simushur Is.)	0900-18	46°55'N, 151°57'E	1957	2,050'; 625 m
21	Goryachaya sopka (Simushur Is.)	0900-17B	46°50'N, 151°45'E	1944?	2,923'; 891 m
SOUTHERN KURILES					
22	Cherny (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1857	2,047'; 624 m
23	Snow (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1982	1,296'; 395 m
24	Berga (Kolokol Group, Urup Is.)	0900-12	46°03'N, 150°04'E	2007?	3,215'; 980 m
25	Kudryavy (Medvezhii; Iturup Is.)	0900-10	45°23'N, 148°50'E	1999	3,235'; 986 m
26	<i>Men'shiy Brat (Iturup Is.)</i>	<i>0900-10</i>	<i>45°23'N, 148°47'E</i>	<i>~400 yrs BP</i>	<i>1,847'; 563 m</i>
27	Chirip cluster (Bogdan Khmelnitzky; Iturup Is.)	0900-09	45°23'N, 147°55'E	1860?	5,131'; 1,564 m
28	Baransky (Iturup Is.)	0900-08	45°06'N, 148°01'E	1951	3,717'; 1,133 m
29	Ivan Grozny (Iturup Is.)	0900-07	45°01'N, 147°52'E	1989	3,802'; 1,159 m
30	<i>Stokap (Iturup Is.)</i>	--	<i>44°50'N, 147°20'E</i>	**	<i>5,361'; 1,634 m</i>
31	Atsonupuri (Iturup Is.)	0900-05	44°48'N, 147°08'E	1932	3,953'; 1,205 m
32	<i>Berutarube (Iturup Is.)</i>	<i>0900-04</i>	<i>44°27'N, 146°56'E</i>	<i>1812</i>	<i>4,003'; 1,220 m</i>
33	<i>Ruruy (Kunashir Is.)</i>	<i>0900-032</i>	<i>44°27'N, 146°08'E</i>	**	<i>4,872'; 1,485 m</i>
34	Tyatya (Kunashir Is.)	0900-03	44°27'N, 146°15'E	1973	5,968'; 1,819 m
35	Mendelev (Kunashir Is.)	0900-02	43°59'N, 145°44'E	1977	2,910'; 887 m
36	<i>Golovnin (Kunashir Is.)</i>	<i>0900-01</i>	<i>43°51'N, 145°30'E</i>	<i>~1900 yrs BP</i>	<i>1,775'; 541 m</i>

Bold: Seismically monitored volcanoes.

** *Italics: Last eruption date unknown or highly uncertain. These volcanoes often display thermal/fumarolic activity at the surface.*

Data sources: (1) Alexander Rybin and Marina Chibasova, IMG (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>). Some inconsistencies between sources remain unresolved. This list and details will change as new geological information becomes available.

Appendix F.



APPENDIX G. **PUBLIC** Phone Numbers for Volcanic Ash Episodes in Greater Cook Inlet

GENERAL PREPAREDNESS

Alaska Homeland Security and Emergency Management
(907) 428-7000 or 1-800-478-2337

ASHFALL WARNINGS, MARINE ADVISORIES and SIGMETS (NOAA/NWS)

SIGMETS Alaska Aviation Weather Unit Lead Desk
(907) 266-5110

Ash fall and Marine Advisories

(907) 266-5105 use Option 1 for recorded info, use Option 4 to speak with a forecaster

Alaska Weather Information Line

(907) 266-5145 or 1-800-472-0391

Media line (newspapers, TV and radio)

(907) 266-5141

FLIGHT RESTRICTIONS (FAA)

Anchorage Air Route Traffic Control Center Watch Desk
(907) 269-1103

MARINE SAFETY

USCG

Command Center District 17 Search and Rescue or related topics

1-800-478-5555 or (907) 463-2000

Coast Guard Sector Anchorage (Kodiak, Cook Inlet, Prince William Sound)

(907) 271-6700

HEALTH – ASH IMPACTS

Alaska Department of Health and Social Services: Section of Epidemiology

Public Health Emergencies

(907) 269-8000 or (800) 478-0084 after hours

AIR QUALITY MONITORING

AK Department of Environmental Conservation - Division of Air Quality

(907) 269-7676

Municipality of Anchorage Air Quality Hotline

(907) 343-4899

LAND MANAGER

Alaska Department of Natural Resources

(907) 269-8566

Alaska Region NPS Public Relations (Anchorage)

(907) 644-3513 and (907) 644-3512

Katmai National Park and Preserve (King Salmon)

(907) 246-3305,

**APPENDIX G. PUBLIC Phone Numbers for Volcanic Ash Episodes in
Greater Cook Inlet—Continued**

LOCAL BOROUGHS

Bristol Bay Borough

(907) 246-4224

Lake and Peninsula Borough

(907) 246-3421 and 800-764-3421

Kenai Peninsula Borough Office of Emergency Management

(OEM) (907) 262-4910

Kodiak Borough Manager's Office

(907) 486-9300

VOLCANO / VOLCANIC ACTIVITY INFORMATION

Alaska Volcano Observatory (AVO)

(907) 786-7497

AVO Recording on the Status of Alaska's Volcanoes

(907) 786-7478

APPENDIX H. PUBLIC web sites for Volcanic Ash Episodes in Greater Cook Inlet

GENERAL PREPAREDNESS

Alaska Department of Homeland Security and Emergency Management
<http://www.ak-prepared.com/>

ASHFALL WARNINGS, MARINE ADVISORIES and SIGMETS (NOAA/NWS)

Ash fall and Marine Advisories <http://pafc.arh.noaa.gov/>
SIGMET, AIRMET <http://aawu.arh.noaa.gov/>
HYSPLIT wind trajectories http://www.arl.noaa.gov/ready/traj_alaska.html
King Salmon RADAR <http://www.arh.noaa.gov/radar/latest/DS.p19r0/si.pakc.shtml>
Anchorage Volcanic Ash Advisory Center <http://vaac.arh.noaa.gov>

TSUNAMI WARNINGS

West Coast Alaska Tsunami Warning Center <http://wcatwc.arh.noaa.gov/>

FLIGHT RESTRICTIONS (FAA)

TFRs <http://tfr.faa.gov/tfr2/list.jsp>
NOTAMs <https://www.notams.faa.gov/>

MARINE SAFETY

US Coast Guard District 17 Search and Rescue <http://www.uscg.mil/d17/>
US Coast Guard Alaska Public Affairs <http://www.uscgalaska.com>

HEALTH – ASH IMPACTS

Alaska State Health and Human Services; Volcano Information
<http://www.epi.hss.state.ak.us/volcanoes/default.htm>

AIR QUALITY MONITORING

AK Department of Environmental Conservation - Division of Air Quality
http://www.dec.state.ak.us/air/am/air_sr.htm

LAND MANAGERS

Alaska Department of Natural Resources <http://www.dggs.dnr.state.ak.us/>
Katmai National Park and Preserve <http://www.nps.gov/katm/>
Alaska Region NPS Press “Room” <http://www.nps.gov/akso/>

LOCAL BOROUGHS

Bristol Bay Borough <http://www.theborough.com/>
Lake and Peninsula Borough <http://www.lakeandpen.com/>
Kenai Peninsula Borough <http://www.borough.kenai.ak.us/emergency/>
Kodiak Borough <http://www.kodiakak.us/>

VOLCANIC ACTIVITY INFORMATION

Alaska Volcano Observatory (AVO) <http://www.avo.alaska.edu/>