

U.S. Fish & Wildlife Service



Environmental Assessment

The Alaska Volcano Observatory Seismic Monitoring Network

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Volcano Observatory Seismic Monitoring Network within the
National Wildlife Refuge System, Alaska

Lead Agency: U.S. Fish and Wildlife Service, Region 7, Alaska

Preparer: Cyndie Wolfe
U.S. Fish and Wildlife Service
Division of Realty
1011 E. Tudor Road
Anchorage, Alaska 99503

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Abstract: The U.S. Geological Survey, Alaska Volcano Observatory has requested a right-of-way permit to expand their seismic monitoring network to 20 volcanoes within the National Wildlife Refuge System in Alaska. Establishing the new links in the seismic network would necessitate installing an array of on-the-ground seismic monitoring stations around each historically active volcano in the Aleutian arc, including stations on lands designated as Wilderness. The expanded network would be used to monitor volcanic unrest and provide advance warning of potential hazards to local residents and to jet aircraft using the north Pacific air routes. The two alternatives considered in this document are: (A) issuance of the right-of-way permit for the seismic network; and (B) no action; denial of permit. The preferred alternative of the U.S. Fish and Wildlife Service is Alternative A.

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1.0 Purpose of and Need for Action

1.1 Introduction: Purpose and Need

Proposed Action. The Alaska Volcano Observatory, a subunit of the U.S. Geological Survey, has applied for a right-of-way permit to install, operate and maintain seismic monitoring equipment on 20 volcanoes within the boundaries of the Alaska Maritime and the Alaska Peninsula/Becharof National Wildlife Refuges (Figure1). The ROW permit would enable the AVO to expand its real-time seismic monitoring network to all of the historically active volcanoes in Alaska. In this case, “historically active” refers to volcanoes that have erupted in the period since 1760 when explorers and inhabitants began to keep written records in Alaska. Since that date there have been at least 265 eruptions reported from 41 volcanic centers (Miller et. al. 1998). Over half of these volcanoes, including 10 within refuge boundaries, are currently being monitored by the AVO. If granted the ROW permit, the AVO would instrument each of the remaining 20 volcanoes as time and budgets allow over the next 15 years.

Around each volcano, the AVO would install an array of at least six to eight seismometers, the minimum necessary to completely monitor seismic activity. All seismic data collected would be automatically telemetered by radio frequency to telephone downlinks, and then transmitted to AVO laboratories in Anchorage or Fairbanks. The right-of-way permit would authorize installation and use of the seismic monitoring equipment, as well as necessary maintenance visits (approximately one visit every three to five years) over the course of the project. The seismic network would be operated and maintained by AVO for approximately 25 years, or as long as this type of technology is needed to monitor volcanic unrest.

The seismic stations would be accessed by helicopter or by a combination of boat and foot travel. Helicopter access is often the only reasonable means of transporting people and equipment to on-the-ground sites in these remote locations. However, a boat would be used to access those islands whose small size would make it difficult to avoid disturbing sensitive wildlife populations if helicopters were used.

Currently, the on-the-ground seismometers used by AVO are the minimum tool necessary to adequately monitor volcanic unrest. All equipment would be removed from the refuge when monitoring ceases, or when alternative technology becomes available that would preclude the need for on-the-ground equipment.

Purpose and Need. The AVO was created in 1988 to provide hazard assessments, updates, and warnings of volcanic activity in Alaska. There are 36 historically active volcanoes along the Alaska Peninsula and Aleutian Islands that have the potential to jeopardize both local populations and passing aircraft. Thirty of these are on refuge lands (Figure 1).

Local populations in the Aleutians are limited to a few islands. The once thriving Aleut population has dwindled to a fraction of what it was when the first Russians arrived in the mid 18th century. Although evidence of former villages exist on nearly every island, modern villages exist only on Atka, Umnak, Unalaska, Akutan, Unimak and Adak islands. While many of the active volcanoes in the Aleutians are not a threat to these local inhabitants, they may still pose a threat to human life because of burgeoning air traffic overhead.

Volcanic ash from Alaskan volcanoes can be a serious hazard to aircraft in the busy north Pacific air routes. Airborne ash can damage flight control systems and jet engines, yet is difficult to distinguish from ordinary clouds. In minor cases, ash can cause mechanical abrasion of the moving parts of an engine. Engine abrasion results in reduced efficiency, but is typically not life-threatening. Large jets and ash clouds, however, can be a lethal mix. Large jet engines operate near the melting temperature of volcanic ash. Ingestion of ash into a hot engine can clog fuel nozzles and turbine parts, resulting in loss of thrust and, ultimately, engine failure.

Alaskan airspace is extremely busy. All direct flights between the United States and Asia pass along the north Pacific air routes. In addition, most of the air freight between Europe and Asia is routed through Alaska for refueling. Currently, about 25,000 passengers and millions of dollars of cargo traverse the north Pacific region daily and traffic has been increasing by approximately 10% per year. This rapidly expanding air traffic passes over one of the most geologically active areas in the world. One or two Alaska volcanoes have erupted each year since the early 1900s (Alaska Division of Geological & Geophysical Surveys 1998). Since 1980, more than 15 aircraft have been damaged by flying through ash clouds in the north Pacific air route. Fortunately, all have been able to land without loss of life.

In response to the potential hazard to local populations and aircraft, Congress has been appropriating funds in the Federal Aviation Administration budget for the AVO to expand seismic monitoring capabilities to volcanoes throughout the Aleutian arc. By monitoring the changes that occur deep beneath a volcano, the AVO may anticipate eruptive activity and issue advance warning of possible hazards. Over the next 15 years, the AVO proposes to expand their existing real-time seismic monitoring network to all the historically active volcanoes in Alaska.

Data collected from the seismic network would also provide supplemental information for other advance warning systems. The seismic data would be integrated into Alaska's regional tectonic network to be used by both the Alaska Earthquake Information Center and the Alaska Tsunami Warning Center.

Project Objectives

- # Help air carriers avoid volcanic debris, especially ash clouds, by providing early warning.
- # Provide local residents with advance warning of impending eruptions.
- # Provide seismic information that will be integrated into Alaska's regional tectonic network to provide advance warning of earthquakes and tsunamis.

1.2 Land Status

Active volcanoes are located throughout the Alaska Peninsula and Aleutian Islands. Seismic arrays around these volcanoes would be located on refuge lands, including selected lands, and on lands conveyed to Native corporations. Wherever the AVO is proposing to work on non-refuge land, the AVO must obtain permission from the respective landowner before initiating any action on these lands.

Many of the proposed seismic stations in the western Aleutians would be located within the Aleutian Islands Wilderness. There are 13 active volcanoes within the Wilderness area.

A brief discussion of the land status of the affected area follows.

Aleutian Island Unit, Alaska Maritime Refuge. Sixteen of the unmonitored volcanoes are located on islands within the external boundaries of the Aleutian Islands Unit of Alaska Maritime National Wildlife Refuge. These islands were withdrawn in 1913 as the Aleutian Islands Reservation (Executive Order 1733) and renamed the Aleutian Islands National Wildlife Refuge in 1940. They became part of the Aleutian Islands Unit of the Alaska Maritime Refuge in 1980 with the passage of the Alaska National Interest Lands Conservation Act. At that time, about 68% of the land was designated as Wilderness. Excluded from Wilderness designation

were private lands, lands being used by the military or U.S. Coast Guard, and other land unsuitable for Wilderness designation.

Of the nearly 3.9 million acres within the Aleutian Islands Unit, about 23% has been selected by Native corporations or the State of Alaska. Many of the former are “overselections” that will eventually be relinquished. Another 15% of the total acreage has been conveyed out of Federal ownership.

Alaska Peninsula/Becharof Refuge . The remaining 4 volcanoes are located within the Alaska Peninsula or Becharof refuges . Both refuges were established with the passing of ANILCA in 1980 and have been managed as a complex since 1983. The decision to manage the two refuges as a complex was based on both biology and logistics. The two northern units of the Alaska Peninsula Refuge (Ugashik and Chignik units), the 9,900 acre Seal Cape area of Alaska Maritime Refuge, and the Becharof Refuge share common resources and resource issues and can be easily accessed from the refuge headquarters in King Salmon. On the other hand, distance and weather create barriers to managing the two southern units (Pavlof and North Creek) from the King Salmon office. Management of these units was assumed by the Izembek Refuge, headquartered in Cold Bay.

Of the 4,932,600 acres within the Alaska Peninsula/Becharof Refuge, 910,050 acres (18%) are either selected by or conveyed to Native corporations, the State of Alaska, or private entities. Ten ANCSA village corporations, representing 12 villages, have selections and/or conveyances within the refuge. Most conveyances to village corporations (85%) are in the Chignik unit near the villages of Ivanof Bay, Perryville, Chignik, Chignik Lagoon, Chignik Lake, and Port Heiden.

1.3 Related NEPA Documents

The present action would complete AVO’s long-term goal to instrument all of the potentially active volcanoes in the Aleutian chain. By the end of 2000, a total of 22 volcanoes were instrumented and being monitored by AVO. Much of this previous work was accomplished under annual permits from various land managers, right-of-way permits, or letters of nonobjection from appropriate Native landowners. Compliance with the National Environmental Policy Act was required if the work involved right-of-way permits issued by Federal agencies.

In 1989, the National Park Service, Katmai National Park and Preserve, prepared an Environmental Assessment and a Finding of No Significant Impact (FONSI) in response to a request for a Special Use Permit for geophysical investigations,

including the installation of seismic monitoring equipment, within the Valley of Ten Thousand Smokes, a designated Wilderness area.

The U.S. Fish and Wildlife Service, Division of Realty, prepared two Environmental Assessments that each resulted in a FONSI. In 1998, an EA was prepared in response to a request from AVO to install and maintain seismic equipment on the Izembek National Wildlife Refuge. In response to a second ROW request in 1999, an EA was prepared to analyze the impacts of installing seismic monitoring equipment on Great Sitkin and Kanaga volcanoes within the Alaska Maritime National Wildlife Refuge.

Prior to 1998, projects initiated by the AVO on refuges were permitted by refuge Special Use Permits. In 1996, the Alaska Maritime Refuge issued a 5-year Special Use Permit to the AVO for the installation, operation and maintenance of seismic equipment around Mukushin Volcano (Unalaska Island) and Akutan Volcano. In 1997, the Izembek Refuge issued a Special Use Permit for the installation of seismic equipment on Pavlof Volcano.

The previous EAs and SUPs were prepared in response to specific permit requests by the AVO for subsets of the entire seismic monitoring network. Ideally, an analysis of the entire network, including cumulative impacts, would have preceded the issuance of permits for specific subunits of the network. However, a variety of factors, including public safety concerns and time and budget constraints, focused attention on the short-term goals of immediately monitoring those volcanoes with a high potential for imminent catastrophic eruptions. The present EA will consider the impacts of all seismic monitoring on refuge lands. If the ROW permit presently under consideration is issued, it would authorize the continuing operation and maintenance of all previously permitted seismic stations.

Any permits issued by the Service for work on refuge lands must be consistent with current refuge management plans. Refuge management in Alaska is guided by individual Environmental Impact Statements prepared for each refuge. The expansion of the seismic network would impact lands in two refuges. The Alaska Maritime and the Alaska Peninsula/Becharof refuges are each managed according to a Record of Decision based on the *Final Comprehensive Conservation Plan, Environmental Impact Statement, and Wilderness Review* developed for each refuge. These EIS documents describe and evaluate the effects of implementing different management alternatives.

1.4 Helicopter Use in Wilderness

The Wilderness Act of 1964 generally prohibits the landing of aircraft in Wilderness areas, except in those areas where aircraft use became established prior to Wilderness designation. However, the passage of ANILCA in 1980 amended the Wilderness Act for Alaska Wilderness. ANILCA specifically permits the use of aircraft for traditional activities and for travel to and from villages and homesites, subject to reasonable regulations to protect the Wilderness. Service policy does not specifically preclude helicopter use within Alaskan Wilderness areas. However, the Service does not allow indiscriminate use of helicopters within Wilderness.

The statutory purposes of Wilderness include both scientific and educational uses, among other purposes. If the proposed scientific or educational use is compatible with refuge purposes it will generally be allowed, although site specific stipulations may be imposed. The Service may permit helicopter use for these purposes (scientific research or educational purposes) after considering if (1) the desired information is essential and cannot be obtained from a location outside of wilderness; (2) the use is compatible with the refuge purpose and consistent with the Wilderness Management Plan; (3) alternative methods of access are not available; and (4) a minimum requirement analysis is applied. The minimum requirement analysis is a documented process used for determining the appropriateness of all actions affecting wilderness. A key component of the analysis is the “minimum tool” concept. Actions within wilderness areas must employ the least intrusive means to accomplish a task while also achieving wilderness management objectives.

Helicopter landings within refuge Wilderness areas are managed specifically by guidance outlined in the Record Of Decision for the Refuge Comprehensive Conservation Plan. The Alaska Peninsula/Becharof CCP is currently under revision. The new guidance on helicopter use in the draft CCP states that helicopter landings for volcano monitoring and geologic hazards assessments may be allowed under permit or other authorization, subject to site-specific stipulations. Helicopter use on Alaska Maritime Refuge requires a permit or must be covered under a cooperative agreement or memorandum of understanding (USFWS Memorandum 1997).

Any permit issued by the Service would be subject to stipulations and special conditions that would mitigate impacts on the environment and on other users of the refuge and Wilderness. Potential disruption of Wilderness character and resources, and applicable safety concerns, are given considerably more weight than economic efficiency when weighing the decision to authorize specific uses. If a right-of-way permit is granted to AVO it would include authorization for helicopter use as the minimum necessary tool required for installation of monitoring equipment in these

remote locations. A few small islands (e.g. Kasatochi, Amukta, and Bogoslof islands) would be accessed by boat to avoid disturbance to wildlife. However, in most cases accessing the sites by helicopter would result in fewer environmental impacts than skidding housings and equipment to the site overland.

1.5 Other Permits or Authorizations Required

The permittee would be responsible for obtaining other necessary permits and complying with all Federal and State requirements (such as the State Coastal Zone Consistency Determination) before the project could be implemented. Letters of non-objection from landowners or managers would be necessary for any work planned on private lands.

NMFS Permits. Under the provisions of 50 CFR §222 Subpart C, the Assistant Administrator of the National Marine Fisheries Service may issue permits authorizing activities that would otherwise be prohibited. A permit from NMFS would be required if any work is proposed within buffer areas of Steller sea lion rookeries listed in Table 1 of 50 CFR §223.202. Boats are prohibited from approaching within 3 nautical miles of a listed rookery. Land approaches are restricted within ½ mile, or within sight of a listed rookery, whichever is greater.

During the period from June 1 to October 15, no person except those authorized by a representative of the NMFS, or accompanied by an authorized employee of NMFS, may approach a fur seal rookery. The AVO proposes to install one seismic station on Bogoslof Island, the only fur seal rookery in the project area. The AVO would be responsible for obtaining the necessary authorization from NMFS, scheduling the installation during the winter non-breeding season, or scheduling the visit in conjunction with a U.S. Fish and Wildlife Service visit to the island. The Service holds a NMFS permit for monitoring work on Bogoslof and could accompany the AVO and supervise the seismic station installation and maintenance.

The AVO has indicated their intent to plan installation schedules and locations in order to avoid activities that would require a permit from NMFS. However, because the project has a projected completion date of 2016, it is likely that changes to the regulations (or AVO personnel) may occur over this time frame. The AVO would be responsible for complying with all regulations in effect at the time of the action and for obtaining necessary permits prior to initiating work in restricted areas.

Compatibility Determination. The National Wildlife Refuge System Improvement Act of 1997 requires that refuge managers determine whether proposed uses of refuge lands are compatible with the purposes for which the refuge was established and with the mission of the refuge system.

The mission of the refuge system is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” Preserving the ecological integrity of refuge lands is a key component of the mission. Any use that might be expected to fragment or reduce the quality or quantity of habitat would not be compatible.

Proposed uses must also be compatible with the purposes for which the refuge was established. For each refuge established by ANILCA, a list of founding purposes were identified. The purposes for which the Alaska Peninsula Refuge [ANILCA §302(1)(B)], Becharof [§302(2)(B)] and Alaska Maritime [§303(1)(B)] were established and shall be managed include those listed below. Unless otherwise noted, the purposes apply to all three refuges.

Refuge Purposes:

***Alaska Maritime,
Alaska Peninsula,
Becharof Refuges***

"...(i)[Alaska Maritime only] to **conserve fish and wildlife populations and habitats in their natural diversity** including, but not limited to marine mammals, marine birds and other migratory birds, the marine resources upon which they rely, bears, caribou and other mammals;

(i) [Alaska Peninsula only] to **conserve fish and wildlife populations and habitats in their natural diversity** including, but not limited to brown bears, the Alaska Peninsula caribou herd, moose, sea otters and other marine mammals, shorebirds and other migratory birds, raptors, including eagles and peregrine falcons, and salmonids and other fish;

(i) [Becharof only] to **conserve fish and wildlife populations and habitats in their natural diversity** including, but not limited to brown bears, salmon, migratory birds, the Alaska Peninsula caribou herd, and marine mammals and birds;

(ii) to **fulfill the international treaty obligations** of the United States with respect to fish and wildlife and their habitats;

(iii) to **provide** in a manner consistent with subparagraphs (i) and (ii), **the opportunity for continued subsistence use by local residents;**

(iv) [Alaska Maritime only] to **provide** in a manner consistent with subparagraphs (i) and (ii), **a program of national and international scientific research** on marine resources; and

[(iv) Alaska Peninsula/Becharof] or [(v) Alaska Maritime] to **ensure**, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), **water quality and necessary water quantity within the refuge."**

A compatible use is one that does not materially interfere with or detract from the ability of the refuge to carry out its purposes or fulfill the mission of the refuge system. The compatibility determination is a written determination, based on sound professional judgement, signed and dated by the Refuge Manager and Regional Chief. Consistent with the National Wildlife Refuge System Improvement Act, the Refuge Manager also provides an opportunity for public review and comment on the proposed action.

A compatibility determination, prepared in 1999, for a proposed seismic monitoring network on Adak and surrounding islands in the Alaska Maritime Refuge determined that the use was compatible. The current proposal would extend this compatible use to additional areas of the refuge. The public is being invited to comment on the extension of this use to new refuge areas. Because no previous compatibility determination has been prepared for seismic monitoring within the Alaska Peninsula/Becharof Refuge a compatibility determination is currently in preparation.

1.6 Decisions to be Made

The decisions that must be made regarding this proposal are: (1) whether the proposed action would have a significant impact on the refuge or Wilderness, requiring an environmental impact statement; (2) whether to issue or deny the right-of-way permit to AVO; and (3) if a permit is issued, what management constraints or mitigative measures could be implemented to minimize or compensate for environmental damage or disturbance to Wilderness values. This might include denying access to certain volcanoes to avoid disturbance of sensitive wildlife populations.

1.7 Relevant Issues

Five issues of concern were identified and explored in this environmental assessment:

Issue 1. Wilderness values

- # The Wilderness Act of 1964 defines the special values of a Wilderness to include natural integrity, degree of naturalness, opportunities for solitude and primitive recreation, and other special and unique [ecological] features. Some of these special Wilderness values

might be compromised by the intrusion of humans and human technology.

- # The installed instrumentation and associated housing might visually detract from the natural integrity and naturalness of the Wilderness landscape.
- # AVO's use of helicopter transport within the Wilderness area might degrade the Wilderness experiences of solitude and primitive recreation of other visitors to the refuge.

Issue 2. Wildlife Impacts

- # Noise produced by helicopter traffic could disturb nesting seabirds and Aleutian Canada geese. Numerous seabird colonies exist throughout the Aleutian chain and Alaska Peninsula. Hundreds of islands and rocks provide nesting habitat for approximately 10 million seabirds. If helicopter flight routes are within visual and hearing range of seabird colonies, disturbance to the colony could result. Cliff-nesting species could dislodge eggs and young from the nest during sudden flight reactions. Eggs and young chicks of all species could be exposed to potentially lethal weather conditions if incubating adults are flushed from nests for long periods of time.

Similar concerns apply to Aleutian Canada geese. Aleutian Canada geese, formerly on the endangered species list, nest and roost on several western Aleutian Islands. Once severely depleted, the population has rebounded significantly in recent years, resulting in recent delisting. To aid the continuing recovery of this species, disturbance during the nesting season should be minimized.

- # Helicopter traffic over the islands could disturb marine mammals, including harbor seals, northern fur seals, sea otters, and Steller

sea lions, an endangered species. All inhabit area waters, and the latter are known to use many sites near the Alaska Peninsula and throughout the Aleutian Islands as haulouts and rookeries. According to the provisions of Section 7 of the Endangered Species Act, consultation with the National Marine Fisheries Service would be required prior to granting a permit for work in the area.

Issue 3. Vegetation Impacts

There is the potential for disruption of the vegetation cover around the seismic stations. The vegetative mat in the Aleutian Islands and the Alaska Peninsula is thin and not well anchored in many locations, and is subject to erosion and sloughing. Disturbed vegetation is extremely slow to recover due to the persistent winds and harsh weather.

Several species of rare plants occur in the Aleutian Islands and on the Alaska Peninsula. Several of these endemic species grow at elevations where they might be encountered by the AVO scientists during installations.

Issue 4. Solid Waste Generation

There would be a potential for solid wastes, such as 12-volt batteries, equipment housings, supplies used during equipment installations, etc., to be left on the island.

Issue 5. Human Life-safety

The potential for dangerous encounters between aircraft and volcanic ash would be reduced. The early warning system would enhance the safety of human populations living in the Aleutian Islands.

2.0 Alternatives

2.1 Range of Alternatives Considered

This chapter describes the range of alternatives being considered and the recommended mitigation measures for offsetting potential adverse impacts. Because of the nature of the proposed action (issuance of a right-of-way permit) only two alternatives are being considered. The action alternative would involve issuing a right-of-way permit that would allow the AVO to expand its existing seismic monitoring network to all the active volcanoes on the Alaska Peninsula and Aleutian chain. The no action alternative would maintain the status quo by denying the permit application. The AVO would continue to monitor those volcanoes that were permitted under previous right-of-way permits, but would not be allowed to expand the seismic network to other volcanoes. The alternatives are discussed in more detail below.

Alternative A: Issue right-of-way permit

Alternative A is the alternative preferred by the Service. Under this alternative, the Service would issue the requested right-of-way permit for the expansion of the seismic network to the remaining 20 unmonitored volcanoes on the Alaska Peninsula and Aleutian Islands.

The AVO would extend the seismic network as rapidly as budgets and available personnel allow. The current projection is to complete installation of the seismic network by the year 2016.

The right-of-way permit would authorize installation, long-term operation and maintenance of the seismic monitoring network. The network would be operated and maintained by AVO for approximately the next 25 years, or as long as this type of technology is needed for monitoring volcanic unrest. Currently, the on-the-ground seismometers used by AVO are the minimum necessary tool to adequately monitor volcanic activity.

Installation/maintenance procedures. Installation of each seismic array would be completed by a crew of two or three scientists, usually with helicopter support, over a two to four week period during spring, summer or fall. Seismic arrays would usually consist

of six to eight stations per volcano. Data resolution increases with the number of seismic stations; six to eight stations per volcano provide the minimum necessary data resolution. Arrays of this size enable the AVO to detect and locate earthquakes at depths of several kilometers or more below the volcano.

Equipment would typically be transported to the installation sites by helicopter. In the case of some Aleutian volcanoes on small islands, the islands would be accessed by boat and materials packed to the installation sites on foot. Installing and testing the signal transmittal would require approximately 6 to 8 hours of ground time at each site. Seismic stations installed one year would be adjusted the following year. Once adjusted, future maintenance would be required only every 3 to 5 years, except in cases of an actual eruption, which could require additional geological work. Routine maintenance would require approximately 2 hours of ground time at each site. Any post-eruption work, including sampling or geophysical explorations, would require a Special Use Permit issued by the refuge.

Monitoring. After installation, signals from each seismometer would be continuously telemetered by radio frequency to the nearest village site where they would be transferred to leased telephone downlinks for real-time transmission to AVO laboratories in Anchorage or Fairbanks. There, scientists would determine the locations, sizes, numbers and types of earthquakes. These data would provide clues to impending unrest. In the weeks or days prior to an eruption, the number, size and types of earthquakes will often increase. In many cases, the earthquakes will move to progressively shallower depths beneath the volcanic vent (AVO 1998).

If patterns in the data suggest an imminent eruption, the AVO would issue an advance warning to local populations and the FAA. Data collected by the seismometers would also be incorporated into Alaska's regional tectonic network to supplement data collected by the Alaska Tsunami Warning Center and the Alaska Earthquake Information Center.

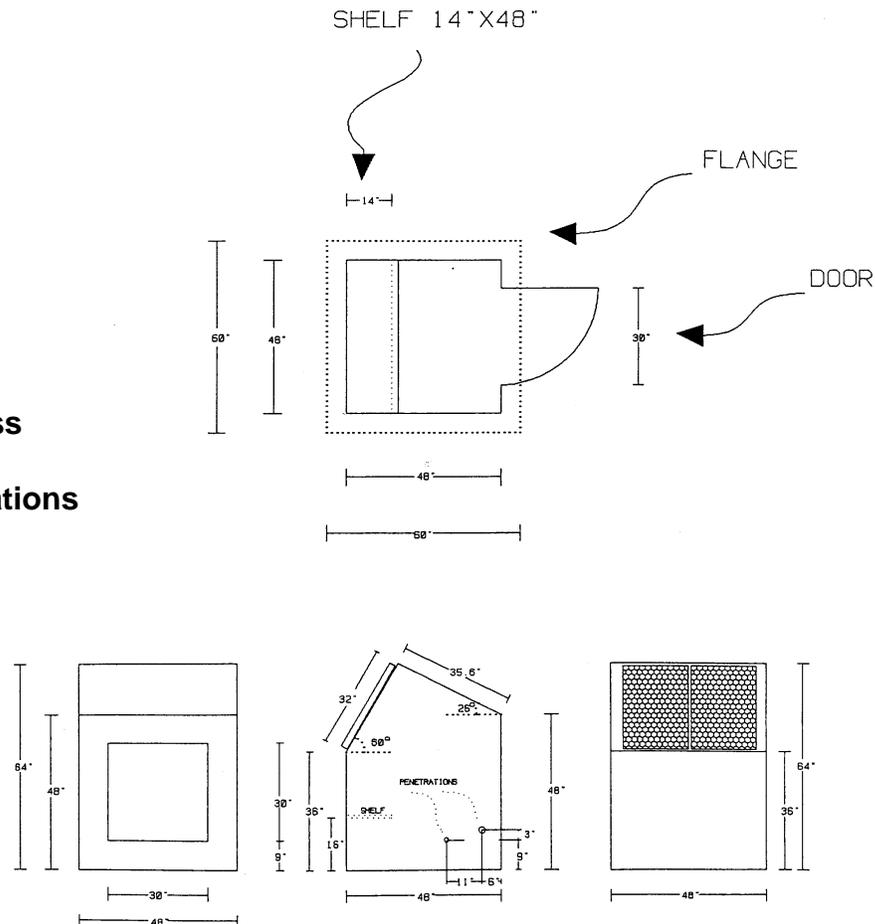
Seismic station equipment and housing. The equipment necessary to acquire and radio-transmit the data in real time includes a seismometer, a computer, small radio, and power backup batteries. All equipment would be housed inside a 55-gallon drum with an antennae extending outward. The drum would be further protected

from the elements and inquisitive wildlife by enclosure in a metal box (21" x 28" x 24") or a 4' x 4' fiberglass hut (Figure 2), mounted with solar collectors. The peak height of the hut with solar collectors would be approximately 5' 4". Solar cells would provide the primary power source, with 12- volt air/alkaline batteries available as a backup.

Equipment housings are designed to be as small and visually unobtrusive as possible and still provide adequate protection to the equipment. If a metal box is used to house equipment, the box would be partially camouflaged by an apron of rock, earth, or scree. Fiberglass huts would be a dull, earth tone color designed to blend with the background (Figure 3). The use of cement and guy wires would be necessary to firmly anchor the housings to the ground.

All materials used in the housing and its support and all monitoring equipment would be removed from the site, at project's end. Monitoring would continue for as long as on-the-ground seismometers are needed to monitor volcanic unrest. Used batteries would be removed from the site during each maintenance visit and properly disposed as detailed in the permit stipulations.

**Figure 2.
Fiberglass
Hut
Specifications**



Metal box housing



Fiberglass hut with solar panels

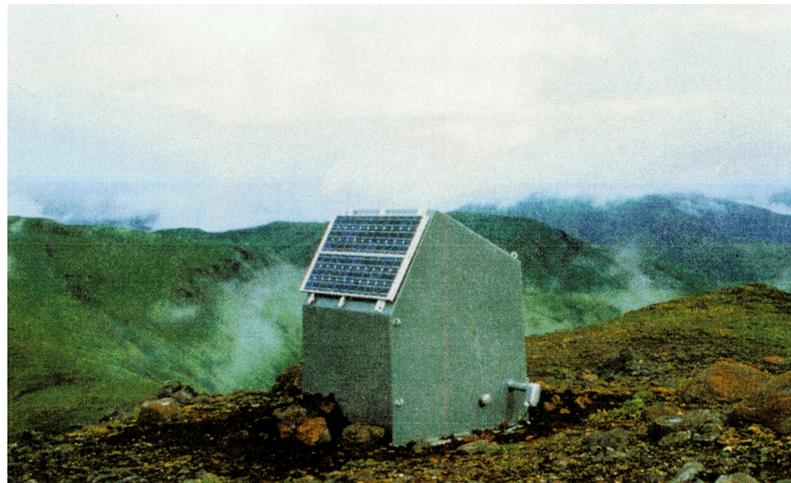


Figure 3. Metal boxes or fiberglass huts mounted with solar panels would be used to house seismic equipment.

Installation priorities. Those volcanoes that have been the most active during the last century would be instrumented first and the

least active volcanoes last. The first priority, during the summer of 2001, would be to extend the seismic network to Veniaminof Volcano within the Alaska Peninsula/Becharof Refuge. Then, between 2002 and 2005, the AVO proposes to install instruments on Mount Peulik, Ukinrek Maars, and Chiginagak Volcano on the Alaska Peninsula, Okmok Caldera on Umnak Island, and Korovin Volcano on Atka Island. However, installation priorities are subject to change since they are strongly influenced both by funding levels and by indications of impending volcanic activity.

The remaining 14 volcanoes would be prioritized and instrumented as funding becomes available. Prior to beginning on-the-ground work on any volcano, the AVO would notify the Service of the anticipated dates of installation and the proposed locations and numbers of seismic stations to be installed. The Service would review the proposed locations and advise the AVO of any additional stipulations or restrictions that would apply on a case-by-case basis. Consultation with both the National Marine Fisheries Service and the Service (regarding endangered species issues) and with the State Historic Preservation Officer (regarding cultural resources) would be initiated each time the AVO identifies proposed seismic station locations.

The AVO has identified the number and tentative locations of seismic stations planned for installation during FY2001-FY2005. In addition, the AVO is proposing to deploy a new type of geodetic and seismic instrumentation on Akutan Volcano during FY2002. The following is a brief discussion of the proposed work plan.

Veniaminof Volcano (FY2001). During the summer of 2001, a crew of three scientists would install nine seismic stations and associated radio telemetry equipment around Veniaminof Volcano (Figure 4). All stations would be located on refuge land. The crew would access the installation sites by helicopter from staging locations in Perryville, Chignik and Port Heiden. Installation would take approximately two to four weeks, depending on weather, during July/August.

After installation, signals from each seismometer would be continuously telemetered by radio frequency to Port Heiden where they would be transferred to leased telephone downlinks for real-time transmission to AVO laboratories in Anchorage or Fairbanks.

The proposed locations of the nine seismic stations are indicated in Figure 4. However, the exact location of each seismic station would be determined in the field. All seismic stations must have direct line of sight transmission to the telephone downlink, or to a repeater with direct line of sight to the downlink. Therefore, seismic stations would tend to be located high on the slopes of volcanoes or on nearby hills or mountains. Data resolution increases if the seismometers are not all located on the flanks of the volcano. Locating one or more stations away from the volcano allows monitoring of volcanic activity at greater depths.

Mt. Peulik, Ukinrek Maars, Chiginagak Volcano (FY2002). In order to adequately monitor the remaining volcanic centers on the Peninsula (Mt. Peulik, Ukinrek Maars, and Chiginagak Volcano) an additional eight seismic stations would be needed. Four of these proposed stations would be located on refuge land (Figure 4). Three of the four sites located on private lands are outside of the map range and are not illustrated in Figure 4. Installation would occur during July/August 2002 unless priorities change due to increased volcanic activity elsewhere.

Akutan Volcano (FY2002). A total of seven seismic stations were installed around Akutan Volcano (Figure 5) under a Special Use Permit issued by the refuge in 1996. During FY2002, the AVO is proposing to deploy a more sophisticated and sensitive type of geodetic and seismic instrumentation around Akutan Volcano that would enhance the AVO's ability to forecast eruptions worldwide.

The instrumentation would consist of five "borehole strain meter-borehole seismometer" systems and eight continuously recording Global Positioning System geodetic instruments (five of which would be co-located with the borehole instruments). The equipment would be installed in boreholes at depths of 200 to 300 feet within the earth's crust. Installing the equipment would require drilling five boreholes around the volcano. Three to four of the boreholes would likely be located on Native conveyed land, the remaining site(s) would be on Native selected land. Tentative locations of the drill sites are illustrated in Figure 5.

Field reconnaissance would be conducted during the summer

of FY2001. This would involve 7 to 10 days of helicopter-supported work to visit proposed installation sites, evaluate the type of drilling equipment required, and assess data telemetry needs and options. At the completion of the site visit, the AVO would be able to identify the exact locations of the proposed drill sites and have more information on the type of drill that would be required. All reconnaissance work planned for FY2001 has been permitted under a 5-year Special Use Permit issued by the refuge.

Drilling of the boreholes and installation of the equipment would be planned for the summer of FY2002. Approximately six weeks of helicopter-supported work would be required to complete the drilling and installation procedure. The AVO would also conduct additional geologic and geodetic surveys during this time.

Okmok Caldera, Umnak Island (FY2003-05). The Okmok seismic array would consist of six seismic stations on Umnak Island and one in interior Unalaska Island (Figures 6 and 7). Five of the proposed sites are located on land selected by both the Aleut Regional Corporation and the Shumagin Village Corporation. One station would be located on lands selected by the Aleut Corporation and one would be on Native conveyed land. The seismic array would be installed over a two to four week period (depending on weather) between FY2003 and FY2005.

Korovin Volcano, Atka Island (FY2003-05). The Korovin seismic array would consist of nine seismic stations, including eight on Atka Island and one station on nearby Amlia Island. Figure 8 shows the locations of the proposed seismic stations. Eight of the proposed sites are on refuge land, including one within the Aleutian Islands Wilderness (Amlia Island station). As currently proposed, the two northernmost sites are within ½ mile of a Steller sea lion haulout. However, the AVO has indicated that both sites would be relocated further south, away from the haulout area. The seismic array would be installed sometime between FY2003 and FY2005, depending on priorities at the time.

Remaining volcanoes (FY2006-FY2016). Instruments would be installed on the remaining 14 volcanoes during FY2006 through FY2016. The AVO has not yet identified

locations of proposed seismic stations for these volcanoes. The series of maps included in the Appendix (Figures 15-24) indicate the locations of seabird colonies, Steller sea lion rookeries/haulouts and rare plant species in relation to these volcanoes.

Helicopter Use. Most of the work proposed by the AVO would be accomplished with helicopter support. Helicopter use within the refuge boundaries and the Aleutian Island and Becharof Wilderness areas are not specifically precluded by the refuge CCPs, Service policy, nor ANILCA. However, landing a helicopter anywhere on an Alaskan refuge requires a permit, cooperative agreement or memorandum of understanding (USFWS Memorandum 1997).

As discussed in Section 1.4, Service policy authorizes use of a helicopter in a Wilderness area only if it is the minimum necessary tool. The size and weight of the seismic equipment and housings would make it impossible to pack the materials to remote sites on foot. The proposed seismic locations are often located high on the slopes of volcanos in remote areas that are inaccessible by other forms of transport (i.e. boat, motor vehicle, or floatplane) and would satisfy the requirement for helicopter use as the minimum necessary tool. However, on some small islands, a combination of boat access and foot travel would be possible and helicopter access would not be necessary. Helicopter use within refuge boundaries would be subject to whatever restrictions and conditions are deemed necessary to protect refuge resources, Wilderness values, and other public uses.

As detailed in the permit stipulations, the AVO would provide advance flight plans to the respective Refuge Manager to avoid possible conflicts with other refuge uses, especially in the case of Wilderness work. The permit stipulations would restrict flights over noise sensitive areas such as seabird colonies and marine mammal haulouts and rookeries, or prohibit flights when animals are present. Pilots would maintain a flying altitude of 2,000 feet or more when flying over designated Wilderness areas to the work locations.

Alternative B: No Action (Deny Right-of-Way Permit)

Under this alternative, the AVO would not expand the existing seismic network to other refuge lands. The Service would continue to manage both the refuges and the Wilderness areas as it has since the refuges were established. See Chapter 3 (Affected Environment) for a profile of the current environmental conditions on the affected refuge lands.

In the absence of seismic monitoring, the potential for hazardous encounters between aircraft and volcanic ash would persist. No advance warning could be provided to the residents of the Aleutian Islands in the event of a volcanic eruption.

2.2 Comparison of Environmental Consequences

The environmental consequences of each alternative are briefly summarized below.

Comparison of Potential Effects		
	Alt A	Alt B
	(Issue ROW Permit)	(Deny ROW Permit)
Wilderness values (Issue 1)	Low	None
Wildlife Impacts (Issue 2)	None-Low [*]	None
Vegetation Impacts (Issue 3)	Low ⁺	None
Solid Waste Generation (Issue 4)	None-Low [*]	None
Human Life-safety Enhancement (Issue 5)	High	None

^{*}None-Low impacts have a high probability of not occurring or are not measurable using standard techniques.

[>]The housings for each seismic station would cover approximately 16 ft² of ground. In most cases, stations would be installed on the rocky slopes of volcanoes where vegetation is naturally sparse.

3.0 Affected Environment

This chapter describes the relevant resource components of the existing environment (baseline conditions) that could affect, or could be affected by, the proposed and no action alternatives. In addition, important resources that may occasionally be found in the project area (such as endangered species) are briefly discussed, regardless of whether they would be affected by the proposed action.

3.1 Physical Environment

Alaska Peninsula/Becharof Refuge: The Alaska Peninsula/Becharof Refuge is located on the Alaska Peninsula, which extends approximately 450 miles from mainland Alaska to the Aleutian Islands. The peninsula has a moderate polar maritime climate characterized by high winds, mild temperatures, protracted cloud cover and frequent precipitation. Precipitation varies with elevation and distance to the coast, ranging from less than 20 inches annually in the western lowlands to as much as 160 inches in the east. Cyclonic storms frequently move across the peninsula from the Bering Sea, dominating weather for most of the year.

The landscape of the Alaska Peninsula is dominated by the rugged Aleutian Range, part of the Aleutian arc chain of volcanoes. Historically active volcanoes within the refuge boundaries include Veniaminof, Peulik and Chiginagak volcanoes. The Ukinrek Maars are a pair of explosion vents that were created on a low ridge 12 miles northwest of Peulik Volcano during a violent 12-day eruption in 1977. The East Maar is the larger of the two (300 m in diameter and 70 m deep) and has a 49 meter high central lava dome that is now partially covered by a crater lake.

Mount Veniaminof is a broad conical mountain, truncated by a spectacular steep-walled caldera. An ice field fills the caldera and glaciers descend valleys on the mountains steep flanks through gaps on the rim. The volcano has erupted sporadically during the last century, most recently between 1993 and 1995. In recognition of its unique geological properties, the volcano was designated a National Natural Landmark in 1970.

Throughout the Aleutian Range, cinder beds radiate outward from the volcanoes. Bare rock is common above 2,000 feet (600 m) in elevation. North and west of the Aleutian Range, the land slopes gradually toward the Bering Sea and becomes flat and poorly drained. On the Pacific side, the mountain flanks often end abruptly at the coastline, forming rugged cliffs bordering the sea.

Aleutian Islands Unit (Alaska Maritime Refuge): The islands that comprise the Aleutian chain are the crests of an arc of submerged volcanoes that extend for more than 1,100 miles westward from the Alaska Peninsula. This arc forms the northern segment of the Pacific “Ring of Fire”.

The Aleutian Islands have a maritime climate, characterized by persistently overcast skies, frequent cyclonic storms, and high winds. Total mean precipitation is about 64 inches per year, with an average snowfall of greater than 98 inches. The marine waters surrounding the islands are influenced by warm currents flowing in a clockwise direction across the northern Pacific Ocean, resulting in a highly productive marine environment.

Island topography varies. Some islands are wave-cut platforms, less than 600 feet above sea level. Others exceed 9,000 feet and are topographically rugged and ecologically diverse. Intense glaciation and extensive erosion have resulted in many deep stream valleys, precipitous mountain slopes, rock-basin lakes, and coastal fjords.

There are 24 historically active volcanoes along the Aleutian chain. Many of these have been active in the last few decades.

3.2 Biological Resources

Alaska Peninsula/Becharof Refuge

Vegetation. The flora is generally restricted to low-growing species that can withstand cool summer temperatures, frequent storms with strong winds, shallow soils and a short growing season. Grasses, sedges, saxifrages, composites and heaths are among the most common of the higher plant families that occur on the refuge. Generally this low maritime tundra vegetation gives way to barren ground, snow cover or ice fields at higher elevations.

Rare Plants. Several rare species of vascular plants occur at elevations where they may be encountered by the AVO scientists during installation and maintenance of the seismic stations. The species listed below are among those that could be encountered during field installations (Michaelson pers. comm. 2001, Lipkin and Murray 1997). Most are either narrow endemic species that are found only at a few clustered sites, or regional endemics that are also known from a few sites areas in Russia.

Botrychium ascenden is a moonwort that occurs in

hummocky heath habitat. It has only been collected from the north side of Baldy Mountain on the Alaska Peninsula, but may occur at other locations.

Papaver alboroseum, a member of the poppy family, has been collected along the Cinder River on the Alaska Peninsula, growing in ash from Aniakchak Volcano (Figure 9). It may occur in other areas where very dry cinder or ash soils predominate.

Rumex beringensis, a sorrel in the buckwheat family has been identified only near the community of Cold Bay, but may also occur in other locations.

Seabirds. Approximately 31 breeding colonies, and an estimated 60,000-100,000 seabirds are found on the peninsula along the Pacific coastline (Figures 9 and 10). Species that nest on the refuge include cormorants (double-breasted [*Phalacrocorax auritus*], red-faced [*Phalacrocorax urile*] and pelagic [*Phalacrocorax pelagicus*]), glaucous-winged gulls (*Larus glaucescens*), black-legged kittiwake (*Rissa tridactyla*), common murre (*Uria aalge*), thick-billed murre (*Uria lomvia*), pigeon guillemots (*Cephus columba*), horned puffins (*Fratercula corniculata*), and tufted puffins (*Fratercula cirrhata*).

Threatened and Endangered Species

Steller sea lion. The western population of Steller sea lions (*Eumetopias jubatus*) was listed as endangered (62 FR 86) under the Endangered Species Act, in response to declines of nearly 70 percent of the population in the Gulf of Alaska and the Aleutian Islands. Table 1 of 50 CFR §223.202 lists five Steller sea lion rookeries in the western Gulf of Alaska off the Alaska Peninsula. All are located on offshore rocks or islands more than 30 miles from the nearest historically active volcano.

According to the National Marine Fisheries Service, there are an additional 11 major haulout sites in the western Gulf of Alaska. Most haulout sites are located on rocks or islands offshore of the peninsula. However, in 1976 more than 3,000 sea lions were counted at a haulout in Puale Bay, approximately 30 miles from Mt. Peulik. Puale Bay counts in recent years have been substantially lower, ranging from 143 in 1997 to 84 in 2000. Figures 9 and 10 show the locations of rookeries and haulouts in relation to the active

volcanoes.

Aleutian Canada goose. The Aleutian Canada goose (*Branta canadensis leucopareia*) may use the refuge during spring and fall migrations, however use is probably limited. No nesting occurs in the area.

Steller's eider. The Alaska breeding population of Steller's eiders was declared a threatened species in June 1997 (62 FR 112). In the fall, Steller's eiders (*Polysticta stelleri*) congregate to molt in protected lagoons, bays and estuaries on the north side of the Alaska Peninsula, primarily in Izembek Lagoon. Annual surveys have suggested that molting eiders declined by 54% during the period from 1975-1990 (USFWS 1999).

After molting, many Steller's eiders disperse to the south side of the peninsula or the Aleutian Islands. Most of the Pacific population overwinter in shallow, near-shore marine habitats along the peninsula and eastern Aleutian Islands. Steller's eiders feed by diving and dabbling for molluscs, amphipods and crustaceans in shallow marine waters. In the spring, they congregate once again on the north side of the peninsula before flying north to breeding grounds. Designated critical habitat includes three lagoons (Seal Islands, Nelson, and Izembek lagoons) on the north side of the peninsula (Figure 10).

Spectacled eider. The spectacled eider (*Somateria fischeri*) was listed as a threatened species under the Endangered Species Act in May 1993 (58 FR 88). Spectacled eiders may be observed off the Alaska Peninsula in nearshore or offshore marine waters. However, no breeding or molting habitats occur on the refuge.

Humpback and fin whales. The status of endangered whales in the waters adjacent to the refuge is not well known. Commercial fishermen and local residents have reported seeing humpback (*Megaptera novaeangliae*) and fin (*Balaenoptera physalus*) whales in near shore waters.

Marine mammals. In addition to the endangered marine mammals (discussed above), harbor seals (*Phoca vitulina*), northern fur seals (*Callorhinus ursinus*), and sea otters (*Enhydra lutris kenyoni*) occur along the Alaska Peninsula coastline. During the past few summers, approximately 2,000 to 3,000 Pacific walrus (*Odobenus rosmarus*) have hauled out on Cape Seniavin near Port Moller, approximately 35 miles

northwest of Mt Veniaminof (Figure 10). Walrus are regular visitors to waters on the north side of the peninsula. Elephant seals are occasionally spotted in waters on the south side of the peninsula. Several whale and porpoise species can be found in near shore or offshore waters.

Harbor seals. Harbor seals (*Phoca vitulina*) migrate up and down the coast and frequently haul out on refuge lands and intertidal areas. Fifty years ago, the Pacific harbor seal was so abundant in Alaska that it was perceived as a threat to commercial fisheries. The State issued a bounty for the animal that continued until the early 1970s. Since that time, the numbers of harbor seals in areas of Alaska have declined dramatically—up to 90% at some haul-out sites. The population in southeast Alaska appears to be stable. However, numbers in the Gulf of Alaska have declined. Surveys in 1996 by the National Marine Fisheries Service and the Alaska Department of Fish and Game arrived at an estimate of 3,200 seals on the south side of the Alaska Peninsula and 29,175 throughout the Gulf of Alaska.

Sea otter. The sea otter (*Enhydra lutris*) population in the area is estimated to number about 6,500. They are commonly observed in coastal areas and may come ashore regularly during inclement weather. However, sea otters do not regularly haulout in specific areas as do sea lions and harbor seals. The northern sea otter population in the Aleutian Islands has undergone dramatic declines in recent years and was recently designated a candidate species under the Endangered Species Act. The designation did not include the Alaska Peninsula population.

Cetaceans. In addition to the endangered whales discussed above, local residents report sightings of gray (*Eschrichtius robustus*), killer (*Orcinus orca*), and minke (*Balaenoptera acutorostrata*) whales in near shore waters. Gray and killer whales regularly come into Chignik Lagoon within the refuge boundary in early spring. Belugas (*Delphinapterus leucas*) enter the mouth of the Egegik River, and may enter other estuaries, to feed on salmon smolts emigrating to the ocean. Harbor porpoises (*Phocoena phocoena*) and Dall's porpoises (*Phocoenoides dalli*) can be observed year-round on the south side of the peninsula. Both species use the north side of the peninsula primarily during the summer months.

Aleutian Islands Unit, Alaska Maritime Refuge

Vegetation. In general, the vegetation of the islands can be characterized as maritime or alpine tundra, depending on the elevation. With the exception of a few trees (primarily spruce) planted by the military during World War II, the islands are treeless and dominated by low-growing species that can withstand a temperate maritime climate, characterized by cool, wet summers, frequent strong winds, shallow acidic soils and a short growing season.

Areas bordering the ocean are often dominated by beach rye (*Elymus* sp.) and other grasses, along with beach pea (*Lathyrus* sp.), cow parsnip (*Heracleum lanatum*), wild celery (*Angelica lucida*), and various sedges (*Carex* sp.). Moist lowland areas are often dominated by black crowberry (*Empetrum nigrum*), sedges (*Carex saxatilis*, *C. pluriflora*, *C. lingyaei*), hair moss (*Dicranum* sp.), cow parsnip, wild celery, and reindeer lichen (*Cladonia* sp.). Mosses, herbs and dwarf shrubs (especially willows, *Salix* sp.) are often present. Other common vascular plant species include nootka reedgrass (*Calamagrostis nutkaensis*) and bog blueberry (*Vaccinium uliginosum*). Alpine tundra is generally comprised of sparse, low-growing species including various lichens, mosses, dwarf willow, and black crowberry.

In many areas, the vegetative mat is thin and not well anchored, and is subject to erosion and sloughing. Wind-caused “blowouts” are common on exposed ridge lines, convex hilltops, and areas where the vegetative mat has been disturbed by human activities. Areas which lose vegetative cover are extremely slow to revegetate naturally.

Rare plants. Several rare species of vascular plants occur at elevations where they may be encountered by the AVO scientists during installation and maintenance of the seismic stations. Most are either narrow endemic species that are found only at a few clustered sites, or regional endemics that are also known from a few sites in Russia.

Figures 11-13 indicate known occurrences of rare plant species in relation to the proposed installation sites. In addition, there are probably undiscovered populations elsewhere in the Aleutian Islands. The following are rare species that could be encountered by the AVO scientists (Michaelson pers. comm. 2001, Lipkin and Murray 1997).

Aleutian wormwood (*Artemisia aleutica*) is endemic to Kiska and the Rat Islands in the western Aleutians. It grows as scattered rosettes on barren patches between heath vegetation and can be found at elevations of 700 to at least 1,200 feet. It has been collected from fell fields on ridge crests on the south side of Rat Island.

Aleutian whitlow-grass (*Draba aleutica*) is endemic to the Aleutian and Pribilof Islands and has been identified on Rat, Kiska and Atka islands. It grows in the gravely, moving soils of high peaks, close to the limit of vegetation.

The Aleutian saxifrage (*Saxifraga aleutica*) is endemic to the central and western Aleutian Islands, including locations on Adak, Atka, Amlia, Kiska, Rat and Buldir islands. It grows on windswept ridges and summits in fine and coarse scree and talus slopes to at least 2,000 feet elevation. It is a distinctive endemic species whose closest relatives are found in the Himalaya Mountains.

Gaultheria miqueliana is a dwarf shrub with small, globular white fruits that grows on mountain slopes. The species was originally described from specimens collected in Japan. In the Aleutian Islands, it has only been collected from Haycock Rock on Kiska Island, although other populations may exist.

Claytonia artica is a small alpine tundra species in the purslane family that has been identified on Atka, Kiska and Rat islands. It was collected from a fell field at approximately 1,900 feet near the headwaters of Chunliisxax Creek north of the community of Atka, within 13 miles of Korovin Volcano.

The globeflower (*Trollius riederianus*), a member of the crowfoot family, has orange-yellow flowers and deeply lobed and dentated leaves. The species grows primarily in moist meadows and has been identified on the south side of Kiska.

Melica subulata is a meadow grass that has been identified at two locations on Unalaska Island, including Summer Bay near Dutch Harbor and Reese Bay to the east of Makushin Volcano.

The Aleutian shield-fern (*Polystichum aleuticum*), currently known to exist only on Adak Island, is the only Aleutian plant species listed

as endangered under the Endangered Species Act. It is discussed under the Endangered Species section below.

Seabirds. The Aleutian Islands Unit has the largest total nesting population of seabirds in North America (>10 million), and is one of the few refuge areas that is managed primarily for seabirds. Population estimates should be considered minimum values because of the inherent difficulty of accurately censusing seabirds throughout the nearly 200 islands that make up the unit. Figures 11-14 show the locations of seabird colonies in relation to the historically active volcanos proposed for monitoring. Some of the dominant species in the Aleutian Islands include:

Northern fulmar: The largest known North American colony--nearly a million birds--of northern fulmar (*Fulmarus glacialis*) nests on Chagulak Island, in the Islands of Four Mountains group (see Appendix). Much smaller colonies occur on Buldir, Gareloi, and Seguam islands.

Storm-petrels: Both fork-tailed (*Oceanodroma furcata*) and Leach's (*Oceanodroma leucorhoa*) storm-petrels are found throughout the Aleutian Islands. The largest colonies are found on Buldir (approximately 3 million birds) and Chagulak islands (over 2 million birds). Population estimates are difficult because storm-petrels are nocturnal burrow nesters.

Cormorants: Three species of cormorants nest in the Aleutians. The red-faced cormorant (*Phalacrocorax urile*) is the most numerous, followed by the pelagic cormorant (*Phalacrocorax pelagicus*). Double-crested cormorants (*Phalacrocorax auritus*) occur in much smaller numbers, in the eastern Aleutians only. All are ledge-nesting species. Major cormorant colonies are located on Agattu, Amchitka, and Amak islands.

Puffins: Tufted puffins (*Fratercula cirrhata*) and horned puffins (*Fratercula corniculata*) constitute about 15 % of the total number of nesting seabirds in the Aleutians. Puffins nest in crevices in coastal bluffs and rocks. Alaska's largest colony of tufted puffins (>100,000 birds) occurs on tiny Kaligagan Island, off the northeast coast of Tigalda Island. Other major nesting areas include Egg Island (off Sedanka I.) and Buldir, Ogchul and Vsevidof islands (off Umnak Island).

Auklets: The least auklet (*Aethia pusilla*) is the most abundant seabird in the Aleutians, followed by the crested auklet (*Aethia cristatella*). The world's largest known colony of crested and least auklets (nearly 2 million birds) is found on Kiska Island in the western Aleutians. Buldir and Gareloi islands also support large numbers of crested auklets. Large colonies (>100,000 birds) of Cassin's auklets (*Ptychoramphus aleuticus*) occur on Chagulak and Unga islands. The whiskered auklet (*Aethia pygmaea*) nests only in the Aleutian Islands, but its numbers and biology are not well known. Colonies of more than 2,000 individuals occur on Buldir and Yunaska islands.

Kittiwakes: Both black and red-legged kittiwakes occur in the Aleutians. The red-legged kittiwake (*Rissa brevirostris*) is much less abundant in the Aleutian chain and nests only on Buldir and Bogoslof islands. The black-legged kittiwake (*Rissa tridactyla*) nests throughout the chain, but the largest colony is found on Buldir (>29,000 birds).

Murres: Both thick billed murres (*Uria lomvia*) and common murres (*Uria aalge*) occur in the Aleutian Islands. Large colonies are found on Bogoslof, Attu, Agattu, Buldir, and Chagulak, and Kagamil islands.

The nesting habits of each species can influence the vulnerability of eggs and chicks to outside disturbances, such as aircraft noise. Ledge nesting seabird species are particularly vulnerable to disturbance during egg and chick brooding when flight reactions can fatally dislodge eggs and flightless chicks from the nest. Ledge or cliff nesting species include northern fulmar, cormorant species, murre species, and black-legged kittiwake.

Burrow nesting species are probably disturbed the least by aircraft overflights, but are particularly vulnerable to ground-based disturbance. Burrows are often well camouflaged and collapse easily if stepped upon. Burrow and crevice nesting seabirds include several species of petrels, shearwaters, puffins, and auklets.

Ground nesting seabirds include glaucous-winged gull (*Larus glaucescens*), Aleutian tern (*Sterna aleutica*), and Arctic tern (*Sterna paradisaea*). Black oystercatchers (*Cyclorhynchus psittacula*) and several species of guillemots nest primarily on boulder rubble (USFWS 1999).

Marine Mammals. Marine mammals commonly found in the area include harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), sea otters (*Enhydra lutris kenyoni*) and several species of whales and porpoises. Pacific walrus (*Odobenus rosmarus*) occur sporadically in the eastern Aleutians. Northern elephant seals (*Mirounga angustirostris*) are occasionally sighted in the Aleutians and have been caught incidentally in offshore fisheries in the area.

A brief discussion of important non-endangered marine mammals follows below. Excluded are those species that are listed as threatened or endangered under the Endangered Species Act. They are discussed under the Endangered Species section beginning on page 43.

Harbor seal. Harbor seals are year-round residents in the Aleutians. They are often observed in near-coastal or estuarine areas and may swim several miles up rivers. They haul out in groups of several to thousands of individuals on remote sandbars or rocky shores. Although harbor seals have declined in some areas of Alaska, including the Aleutian Islands, the population is thought to be stable overall. Joint surveys conducted by the National Marine Fisheries Service and the Alaska Department of Fish and Game in 1994 estimated that there are approximately 1,600 harbor seals in the eastern Aleutian Islands and approximately 3,400 throughout the chain. The population trend for the Aleutian Islands is unclear at this point because the 1994 survey was the most complete census to date (Withrow and Loughlin 1994).

Northern fur seal. Northern fur seals are endemic to the north Pacific Ocean and are depleted throughout their range. In the eastern Pacific, fur seals range from the Pribilof Islands in the Bering Sea to the Channel Islands off southern California. During the summer breeding season, more than 70 percent of all fur seals can be found in the Pribilof Islands. However, there are five smaller rookeries between Russia and California, including Bogoslof Island in the Aleutian chain. Pups were first observed on Bogoslof Island in 1980, when researchers counted a total of 78 seals. A decade later nearly 1,500 seals, including 181 pups were counted on the island. There are no other fur seal rookeries in the project area.

When not at rookeries, northern fur seals are primarily pelagic and may be encountered in Aleutian waters during spring and fall migrations to and from the Pribilof and Bogoslof rookeries. Seals

begin returning to rookeries in May, with older territorial bulls arriving first. By November, the pups have been weaned and both young and adult seals migrate south through passes in the Aleutian Islands. Unimak Pass is extensively used during migration and is used year round by some juvenile seals. Akutan and Umnak passes are also common migration routes (Figures 11 and 14). Adult males are believed to migrate only as far south as the Gulf of Alaska, but females and pups may travel further south into the north Pacific Ocean. Pups typically remain at sea in the north Pacific for about 22 months before returning through the Aleutian passes to their birth island as 2-year olds.

Sea otter: Sea otters (*Enhydra lutris kenyoni*) inhabit the near shore marine waters surrounding the islands. Recent sea otter surveys indicate a decline of approximately 70% in the past eight years. Elevated mortality is suspected as the reason for the decline, but the cause of the mortality is uncertain. Suspected causes include an increase in depredation or environmental contaminants. The Aleutian Island population of the species was recently elevated to candidate status under the Endangered Species Act. Unlike the Steller sea lion and other marine mammals that aggregate at haulouts and rookeries, the sea otter gives birth at sea and does not congregate at established haulout sites. At this time there are no known areas where sea otters concentrate in large numbers on a regular basis.

Cetaceans: According to the National Marine Fisheries Service, several species of non-endangered cetaceans occur in Aleutian Island waters, including minke (*Balaenoptera acutorostrata*), sperm (*Physeter macrocephalus*) beaked (*Berardius bairdii*) and killer (*Orcinus orca*) whales. Harbor porpoises (*Phocoena phocoena*) and Dall's porpoises (*Phocoenoides dalli*) may also be found in area waters.

Threatened and Endangered Species

Aleutian shield fern. A population of approximately 130 "clumps" of the endangered Aleutian shield fern (*Polystichum aleuticum*) occurs on the steep cliff faces of the Mount Reed ridge system on Adak Island. The species was originally described from collections made on Atka Island in 1932, but has not been observed there since. Presently, the only known occurrence is the Adak population.

Steller sea lion. The Steller sea lion (*Eumetopias jubatus*) was listed as endangered (62 FR 86) under the Endangered Species Act, in response to declines of nearly 70 percent of the population in the Gulf of Alaska and the Aleutian Islands. Table 1 of 50 CFR §223.202 lists 25 Steller sea lion rookeries within the Aleutian Island chain. According to the National Marine Fisheries Service there are an additional 40 major haulout sites in the Aleutians. Figures 11-14 and Appendix Figures 15 - 24 show the locations of rookeries and haulouts in relation to the active volcanos.

Aleutian Canada goose. The decline of the Aleutian Canada goose (*Branta canadensis leucopareia*) was precipitated by the introduction of arctic foxes to most of their nesting islands. The Aleutian Canada goose was originally listed as endangered in 1967; a formal recovery program was initiated in the mid-1970's. The species began to recover when an intensive fox eradication program was combined with the active re-introduction of geese to former nest islands.

By 1991, the population had recovered sufficiently to be reclassified as threatened and was proposed for delisting in 1999. It was formally delisted on March 20, 2001 (66 FR 54). Under the provisions of Section 4(g)(1) of the Endangered Species Act the population will continue to be monitored for the next five years. Data collected during the monitoring program will be used to evaluate the status of the population and the need for additional action, such as extending the monitoring period or relisting the subspecies.

Today, the subspecies is regularly observed throughout the western Aleutians during spring and fall migrations. Nesting populations have been reestablished on two islands with historically active volcanoes, Yunaska and Amukta islands. In addition, several other nesting populations are in close proximity to islands with active volcanos, including populations on Little Kiska, Segula, and Skagul islands.

Short-tailed albatross. The short-tailed albatross (*Phoebastria albatrus*) is a large pelagic seabird that visits land only during nesting and chick rearing. It nests in Japan, but is a rare but regular visitor to Aleutian waters during the summer nonbreeding season. After fledging, juvenile albatrosses as well as adults spend the summer at feeding grounds across the north Pacific. Most summer sightings are in the Aleutian Islands, Bering Sea or Gulf of Alaska.

Cetaceans. Several species of endangered whales occur in waters off the Aleutian Islands. The humpback whale (*Megaptera novaeangliae*) may occur seasonally and has been documented in near shore waters. There have been a few sightings of fin (*Balaenoptera borealis*), blue (*Balaenoptera musculus*) and right (*Balaena glacialis*) whales in the northern Gulf of Alaska and/or the southern Bering Sea (Pennoyer 1998).

3.2 Cultural Resources

Alaska Peninsula/Becharof Refuge . The refuge preserves a rich cultural legacy. Prehistorically ten major cultures used the Alaska Peninsula. One of Alaska's most important cultures, the Norton tradition, may have originated on the Alaska Peninsula. Much more recently the peninsula served as a crossroads where prehistoric cultures from the Aleutians, Kodiak, north Alaska and the Alaskan interior met and merged, creating unique local cultures and sending cultural impulses throughout the North American arctic. There are 272 known archeological sites within the refuge, with the majority located within the Becharof Refuge or in the adjoining unit of the Alaska Peninsula Refuge (Ugashik Unit). Most sites are on or near coastlines or lake shores.

The peninsula was important in the early history of Alaska with Russian explorers and trappers active in the region. During the American period the northern part of the Refuge was the scene of some of the earliest scientific oil exploration efforts in the world. The region played an important role in the early development of Alaska's fishing industry. A more complete discussion of the history and prehistory of the peninsula is presented in the Cultural Resource Guide (USFWS 1996).

There are no known cultural resource sites near the proposed seismic stations on the Alaska Peninsula (Debra Corbett, USFWS, and Judith Bittner, State Historic Preservation Officer, pers. comm.) and given the elevation and inland location of most of the seismic stations, it is unlikely that anything would be found there. Any seismic station locations proposed in the future by AVO would be screened by the Regional Archeologist to ensure that seismic sites are not installed in close proximity to known archeological sites.

Aleutian Islands Unit. Archeological sites have been well documented in some areas of the Aleutians, especially where there are now permanent villages. One particularly significant site is located off the coast of Umnak Island. Materials at the site date to about 6,000 B.C. Many islands, however, have not yet been extensively surveyed and there are probably many more sites yet to be discovered.

In general, most archeological sites are coastal. The virtual lack of terrestrial mammals and the abundance of marine life fostered a culture that was highly dependent on the resources of the sea. Local whale species and other marine mammals, fish, invertebrates, seabirds and their eggs were all harvested for food.

At the time of European contact in the 18th century, there was a thriving population of about 15-25 thousand Aleut inhabitants in the Aleutian Islands. However, the introduction of disease and outright warfare by the Russian fur traders quickly decimated the Native population. By the 1830s there were only about 2,000 Aleuts remaining on 16 islands (USFWS 1986).

The introduction of foxes (arctic and red) during the early 1900s led to a thriving fur ranching industry in the Aleutians. A precipitous drop in fur prices in the mid-1940s caused the collapse of the industry. Former trappers cabins and cemetery plots, as well as remnant fox populations, remain on some islands as reminders of this period of history.

The Aleutian Islands also played a significant role in the events of World War II. The invasion and occupation of the outer Aleutian Islands of Attu and Kiska stimulated the rapid construction of a series of American strategic bases along the Aleutian chain. Today, signs of past military activity persist in the form of old airfields and encampments, barracks, Quonset huts, ordnance and other military debris. Several sites in the chain, including Attu and Kiska, are now designated as National Historic Landmarks for the role they played in World War II.

There are no known cultural resource sites near the proposed seismic stations in the Aleutian Islands (Debra Corbett, USFWS, and Judith Bittner, State Historic Preservation Officer, pers. comm.) and given the elevation and inland location of the seismic stations, it is unlikely that undiscovered sites would be found in these locations.

4.0 Environmental Consequences

This Section describes the probable impacts of each alternative on the issues identified in Section 1.0. A comparison of the likely environmental impacts between the alternatives are summarized below.

Issues	Alternative A (Issue ROW)	Alternative B (No Action)
Wilderness Values	Helicopter noise may detract from a visitor's solitude or primitive recreation experience. Equipment housing modifies naturalness of area. Visual impacts would be minimized by designing equipment housing to blend with the natural setting.	No impacts
Wildlife Impacts	Colonial seabirds, nesting geese and marine mammals could be disturbed by helicopter overflights. Disturbance would be minimized or eliminated by restricting flights near colonies, haul outs, and rookeries or by prohibiting helicopter access during the nesting/pupping season.	No impacts
Vegetation Impacts	Small areas of vegetative cover (approximately 16ft ² per station) could be disrupted.	No impacts
Solid Waste Generation	Used batteries, equipment housings, other supplies, may be inadvertently left at site.	No impacts
Human Life-safety	Aircraft and residents would be warned of dangerous eruptions.	Hazardous encounters between aircraft and ash clouds possible.

4.1 Effects of Alternative A, the Preferred Alternative: Issue Right-of-Way Permit

Wilderness values. One refuge concern is the potential disturbance of other Wilderness users that may be within hearing range of the helicopter flight route. Among other things, Wilderness areas provide outstanding

opportunities for solitude--a retreat from the sights, sounds, and presence of others, and from the developments and evidence of man. Helicopters can be a glaring intrusion on a visitor's opportunity for solitude or enjoyment of a primitive recreational experience. Although current visitation to the Aleutian Islands and Becharof Wilderness areas are low, use may increase over the life of the proposed project.

Noise impacts would be short-term and transitory since the network would only require maintenance visits every 3-5 years (of 1-2 weeks in duration, depending on weather) after the initial installation and adjustment is completed. However, during those periodic maintenance periods, there could be an irretrievable loss of solitude and Wilderness character for anyone seeking a Wilderness experience in the area.

The noise level could be reduced by requiring the helicopter pilots to fly at a minimum altitude of 2,000 feet, as detailed in the Federal Aviation Administration (FAA) Advisory Circular 91-36C, "Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas".

It is also possible that Wilderness users could encounter equipment housings during their visit to the area, thus detracting from the naturalness and integrity of the Wilderness. However, visitors to these far-off Wilderness areas are few, and the small size, nondescript coloration, and high, remote locations of the housings would minimize the potential for this kind of visual impact on Wilderness users.

The AVO's ultimate goal to monitor every active Aleutian volcano would increase the cumulative impact on Wilderness values since 18 of these are within Wilderness areas. The Wilderness Act defines Wilderness as undeveloped land that appears to have been affected "primarily by the forces of nature, with the imprint of man's work substantially unnoticeable". Wilderness lands are intended to retain their "primeval character and influence, without permanent improvements or human habitation", and must be protected and managed to preserve these natural conditions. The addition of approximately 115 seismic monitoring stations to the Aleutian Islands and Becharof Wilderness areas would have a cumulative impact on the less tangible Wilderness values.

The monitoring network is not intended to be permanent, however, and Wilderness impacts would be "short term" and reversible. The seismic housings and all equipment would be removed at the end of the project, a projected time frame of approximately 25 years. A time frame of this duration is short in comparison to the permanence of the Wilderness

designation. The area will be preserved as Wilderness in perpetuity and should not experience any long term impacts from implementing the proposed project.

Wildlife Impacts. Impacts to wildlife would be minimal. Most of the seismic monitoring equipment would be installed at elevations that receive little use by wildlife. The proposed project should have no significant effects on the eider, whale, or sea otter populations or on any land mammal populations living on the islands.

Large numbers of eiders molt and winter on the Alaska Peninsula/eastern Aleutians, but few would be in the area during the proposed installation time frame of July or August. Individual whales, sea otters, or land mammals may be temporarily disturbed by helicopter noise overhead, but any disturbance would be minor and temporary.

There is, however, the potential for visual and noise disturbance to some colonial wildlife populations, resulting from the use of a helicopter to access the proposed sites. Possible impacts and mitigation measures that could reduce or eliminate impacts, are discussed for each species, or species group, below.

Seabirds. Adverse impacts to seabirds could result if helicopter overflights disturb nesting adults. Nesting is energetically costly to adult seabirds, especially during times when prey species are scarce or out of range. Adults that over-expend energy reserves can suffer mortality or abandon nests. Therefore, it is important to minimize human disturbance during the nesting season.

Most species of seabirds would have unfledged chicks in the nests if seismic stations were installed in July/August (Stephensen, pers. comm.). The noise and sight of an overflying helicopter could cause adults to temporarily vacate their nests, dislodging eggs or young from cliff ledges, or exposing eggs/chicks to inclement weather, and increasing the risk of depredation. Egg losses resulting from colony disruption are typically greater among ledge nesting species than among burrow or crevice nesters.

Impacts to seabirds could be minimized or eliminated by restricting flights in proximity to seabird colonies. Permit stipulations would require the helicopter crew to avoid flying within ½ mile of active seabird colonies whether en route to a seismic station or during an approach or departure from the site. These ‘no-fly-zones’ would not

apply if installation occurs before or after the peak breeding season which spans from mid-May to mid-September. The permit stipulations would require the AVO to provide the Service with the intended installation time frame and the proposed locations of all seismic stations prior to initiating any work. The Service could then advise the AVO of the locations of noise sensitive areas to avoid in the project area.

Aleutian Canada goose. Both Yunaska and Amukta islands have historically active volcanoes, as well as breeding populations of Aleutian Canada geese. Adverse impacts on nesting geese could result if helicopter overflights or landings flush brooding adults off their eggs for protracted time periods. Weather conditions in the western Aleutians can be severe enough to addle eggs even during the summer months.

By late July, juvenile Canada geese are beginning to test their wings in preparation for fledging. Helicopter overflights during this period could panic juveniles from seaside bluffs into the ocean before their flight capabilities are sufficiently developed. It is unlikely that juveniles with limited flight capabilities could regain sufficient lift to take flight from the ocean's surface.

Impacts to Aleutian Canada geese could be minimized or eliminated by prohibiting helicopter overflights from May through August on those islands with nesting populations.

Steller sea lion. As with birds, the potential impacts to Steller sea lions that could result from implementation of the proposed project include a possible increase in noise disturbance from helicopter overflights. There are 30 major sea lion rookeries in the Aleutian Islands and the Alaska Peninsula. A total of eight major rookeries are located on islands with historically active volcanos. There are at least 68 haulouts that are located on or near (within 50 miles of) islands that would be included in the AVO seismic network. Flying a helicopter low over rookeries or haulouts could cause widespread fright reactions and would constitute harassment under the provisions of the Endangered Species Act.

Adverse impacts on sea lions could be minimized or avoided through establishment of protective restrictions on flight routes. Permit stipulations would prohibit flying over, or within ½ mile, of known haul out or rookery areas. In addition, seismic stations would be

located at least ½ mile from rookeries and haulouts.

Northern fur seal. The only fur seal rookery in the Aleutians is on tiny Bogoslof Island, the emergent summit of a large submarine volcano. The fur seals use two cobble-boulder beaches that fringe the island's north and southeast shores and a sand beach that extends along the eastern margin. During the period from June 1 to October 15, no person except those authorized by a representative of NMFS or accompanied by an authorized employee of NMFS may visit the island without a special permit issued by the Assistant Administrator.

Bogoslof Island is a very low priority for the AVO. However, they would like to eventually install one or two seismic stations on the volcano if permitted to do so by NMFS and the Service. Because of the small size of the island (approximately 1.25 miles long by 0.4 mile wide), it would be difficult to approach the island by helicopter without some noise disturbance of at least one rookery area.

Impacts to fur seals could be minimized by accessing the island by boat. Impacts would be eliminated by restricting all installation and maintenance work to the non-breeding season from November through May.

Vegetation Impacts. Minimal impacts on the vegetative cover should result from the proposed project. The footprint for the equipment housing is small (approximately 4 ft. by 4 ft.), and the proposed installation sites for the seismic equipment would generally be located on the slopes of volcanoes where vegetation is thin and interspersed with bare rock and gravel.

Potential impacts to the Aleutian shield fern under the proposed alternative are very unlikely. The species is believed to be confined to a small area on Mt. Reed, Adak Island. No work will occur on Mt. Reed, and no plants are known to exist in areas where the seismic equipment will be installed.

Several species of rare plants occur at elevations where they could be encountered by the AVO scientists. Permit stipulations would restrict work in those areas where populations of rare plants are known to occur. However, it is possible that the AVO may encounter rare plant species in locations where they have not been previously identified.

Solid Waste Generation. There is the potential for solid wastes, such as used air cell batteries, to be left at the site. A stipulation of the permit would require the proper handling and disposal of all solid wastes in order to

mitigate impacts to the refuge and Wilderness environment. Removal of all equipment from the refuge would be required at the completion of the project.

Human life-safety. The installed network would provide advance warning of potentially hazardous eruptions throughout the Aleutian Islands and the Alaska Peninsula. The early warning would enable aircraft in the North Pacific air route to avoid dangerous ash clouds originating from these volcanoes, and would facilitate timely evacuation of local residents, if necessary.

4.2 Effects of Alternative B: No Action; Denial of Right-of-Way Permit Application.

Wilderness values. There would be no impact on Wilderness values.

Wildlife Impacts. There would be no impact on wildlife.

Vegetation Impacts. There would be no impact on vegetation.

Solid Waste Generation. No solid wastes would be generated.

Human life-safety. The potential hazard to aircraft posed by volcanic eruptions would not be alleviated. No early warning system would be in place to help air carriers avoid ash clouds and other debris originating from unmonitored volcanoes in the Aleutian arc. Human populations living near the volcanoes would not receive advance warning of potential eruptions.

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Appendix

Mitigative stipulations to be incorporated into the right-of-way permit include:

1. At least 3 months prior to initiating field work each year, the AVO must provide the Division of Realty with proposed locations of seismic stations. The Division of Realty may require additional consultation with the Ecological Services Office or the National Marine Fisheries Service if endangered species occur within the project area. Additional consultation with the State Historic Preservation Officer would be required if the proposed work could potentially affect cultural resources.
2. The AVO shall notify in advance the appropriate Refuge Manager regarding flight plans and time frames for completion of work at each seismic station.
3. Prior to beginning any activities allowed by this permit, the permittee shall provide the Refuge Manager with (1) the name and method of contact for the field party chief/supervisor; (2) the identification information for aircraft and other vehicle types to be used; and (3) any changes to the scope of work that was detailed in the permit application.
4. All work proposed in designated Wilderness areas must be scheduled so as to minimize impacts on other Wilderness users in the area. The AVO must consult with the Refuge Manager to schedule work during acceptable time periods.
5. All aircraft being used in a commercial operation must have 12" identification numbers in contrasting colors which are readily visible.
6. The operation of aircraft at altitudes and in flight paths resulting in the herding, harassment, hazing, or driving of wildlife is prohibited. It is recommended that all aircraft flying over refuge land maintain a minimum altitude of 2000 feet above ground level (AGL), except for take off and landing, as detailed in the Federal Aviation Administration (FAA) Advisory Circular 91-36C, "Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas".
7. In general, the AVO pilots are prohibited from flying over, or within ½ mile of documented seabird colonies between May 15 and September 15 (Figures 4-14 and Appendix Figures 15-24 in the Environmental Assessment). However, in some cases (e.g. colonies comprised solely of burrow nesting species), the Refuge Manager may authorize flights within this ½ mile radius. In other cases, the Refuge Manager may require a broader 'no-fly-radius' of one mile or more, in order to adequately protect especially sensitive colonies. Within 45 days of receiving the proposed seismic station locations from the AVO, the Division of Realty, in

consultation with the Refuge Manager, will notify the AVO of any additional restrictions or stipulations that apply on a case-by-case basis. The right-of-way permit would be amended to reflect any necessary changes.

8. The AVO pilots are prohibited from flying over, or within ½ mile of documented Steller sea lion rookeries identified in 50 CFR 223.202 (Table 1) and haulouts identified in 50 CFR 226 (Table 2). Locations of these sites are illustrated in Figures 15-24. The AVO scientists are prohibited from approaching on land within ½ mile, or within sight, of a documented rookery or haulout.

9. Current season/area restrictions are summarized in the table below:

Site	Location	Restrictions	Effective Dates
Seabird colonies	See Figures 9-24 of EA	½ mile “no-fly-zone” around colonies	May 15 - Sept. 15
Aleutian Canada Goose Nesting Areas	Buldir Chagulak Nizki-Alaid Agattu Little Kiska Amchitka Amukta* Yunaska* *Sites of active volcanoes	No helicopter overflights. Depending on population status, Refuge Manager may prohibit on-the-ground work during the nesting season.	May 15-August 30
Fur Seal Rookery	Bogoslof	No access (including installation, maintenance or emergency repairs) without NMFS permit, unless accompanied by NMFS or a NMFS permit holder (USFWS). Boat access only.	June 1 - October 15

Site	Location	Restrictions	Effective Dates
Steller Sea Lion Rookery/Haulout	See Figures 9-24 of EA	½ mile “no-fly-zone” around site. No land approach within ½ mile (or within sight). No boat approach within 3 nautical miles.	Year-round
Wilderness/Refuge Lands	See Figures 4-24 of EA	Herding, harassment, hazing, or driving of wildlife is prohibited. A minimum flight altitude of 2000 feet above ground level (AGL) is recommended. Work in Wilderness Areas shall be scheduled so as to minimize impacts on other Wilderness users. Coordination with the Refuge Manager is required.	Year-round

10. The AVO and authorized agents shall restrict their activities to the installation sites.
11. All structures (fiberglass huts, steel boxes, etc) shall be painted to blend in with the environment as much as possible.
12. Fuel caches on refuge lands are not authorized.
13. Construction of cabins or other permanent structures on refuge lands is prohibited.
14. Construction of tent platforms on refuge lands is prohibited.

15. The construction or clearing of landing strips or pads is prohibited. Incidental hand removal of rocks and other minor obstructions may be permitted.
16. Any action by a permittee or the permittee's employees which unduly interferes with or harasses other refuge visitors or impedes access to any site is strictly prohibited. Examples of prohibited acts include, but are not limited to, low flights over camps or persons at less than 500 feet (unless landing) and parking aircraft or placing other objects (rocks, tents, etc.) on any suitable landing area so as to restrict use by other aircraft or persons.
17. All solid wastes, including batteries and building materials, shall be removed from the site during each maintenance visit and not allowed to accumulate. Used batteries shall be disposed of at a licensed disposal site for used batteries, off of the refuge.
18. All equipment and housings, including cement anchors, guy wires, etc. shall be removed by helicopter within 1 year of monitoring cessation, and the area restored to its original condition. If individual seismic stations are decommissioned prior to the end of the project, all equipment must be removed from those sites, and the area restored to its previous condition, within one year of monitoring cessation at those sites, even if monitoring is continuing elsewhere.
19. Scheduling of unanticipated emergency maintenance visits to seismic sites on refuge lands must be coordinated with the appropriate Refuge Manager.
20. In accordance with the Archaeological Resources Protection Act (16 USC 470aa), the disturbance of archaeological or historical sites and the removal of artifacts from Federal land is prohibited. Permittee agrees to cease work on Federal land immediately upon discovery of any cultural resources or when ordered to do so by the Refuge Manager.
21. The AVO is responsible for ensuring that all personnel conducting activities under this permit are familiar with and adhere to the conditions of this permit.
22. The use of Native or State lands that have been conveyed (patented) is not authorized by this permit.
23. Any problems with wildlife and/or animal taken in defense of life or property must be reported immediately to the Refuge Manager and the Alaska Department of Fish and Game and be salvaged in accordance with State regulations.
24. "Strain meter-borehole seismometers" proposed for installation on Akutan Island are not authorized on refuge land (including selected land). Authorization

may be granted if and when additional information is supplied that allows a thorough assessment of refuge impacts and compatibility.

25. All or part of this permit may be terminated by the Service, for failure to comply with any or all of the terms or conditions of the grant, violation of any refuge related provision in Titles 43 (Part 36) or 50 (sub-chapters B and C) Code of Federal Regulations; or violation of any pertinent state regulation (e.g., fish or game violation). A rebuttable presumption of abandonment is raised by deliberate failure of the Permittee to use for any continuous 2-year period the permit for the purpose for which it was granted or renewed. In the event of noncompliance or abandonment, the Service will notify the Permittee in writing of his or her intention to suspend or terminate the grant 60 days from the date of the notice, stating the reasons therefore, unless before that time the Permittee completes such corrective actions as are specified in the notice. The Service may grant an extension of time within which to complete corrective actions when, in its judgement, extenuating circumstances not within the Permittee's control such as adverse weather conditions, disturbances to wildlife during breeding periods or periods of peak concentration, or other compelling reasons warrant. Failure to take corrective action within the 60-day period will result in suspension or termination of the permit. Appeals of decisions relative to rights-of-way permits are handled in accordance with Title 50 Code of Federal Regulations Part 29.22.

Appendix Figures

Locations of Unmonitored Volcanoes in Relation to Sensitive Wildlife Populations and Rare Plant Communities