LMS/AMC/S04623

U.S. Department of Energy
Office of Legacy Management

Record of Decision for Amchitka Surface Closure, Alaska

August 2008

U.S. Department of Energy

Office of Legacy Management

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Record of Decision for Amchitka Surface Closure, Alaska

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Preface

This Record of Decision has been prepared to document the remedial actions taken on Amchitka Island to stabilize contaminants associated with drilling mud pits generated as a result of nuclear testing operations conducted on the island. This document has been prepared in accordance with the recommended outline in the Alaska Department of Environmental Conservation guidance on decision documentation under the Site Cleanup Rules (18 AAC 75.325–18 AAC 75.390) (ADEC 1999). It also describes the decision-making process used to establish the remedial action plans and defines the associated human health and ecological risks for the remediation.

THE STATE OF ALASKA, THROUGH THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, AGREES WITH THIS RECORD OF DECISION. THIS DECISION MAY BE REVIEWED AND MODIFIED IN THE FUTURE IF NEW INFORMATION BECOMES AVAILABLE THAT INDICATES THE SITE MAY POSE AN UNACCEPTABLE RISK TO HUMAN HEALTH, SAFETY, AND WELFARE, OR THE ENVIRONMENT.

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Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ARARs	Applicable or Relevant and Appropriate Requirements
APIA	Aleutian Pribilof Islands Association, Inc.
BSAF	biota-sediment accumulation factor
COC	contaminant of concern
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DRO	diesel-range organics
EC20	20 percent effects on population parameters
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
HI	Hazard Index
LOAEL	Lowest Observable Adverse Effects Level
NOAEL	No Observable Adverse Effects Level
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
ROD	Record of Decision
TRV	toxicity reference value
USFWS	U.S. Fish and Wildlife Service

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1.0 Introduction

This Record of Decision (ROD) has been prepared to comply with the requirements of the Alaska Contaminated Sites Remediation Program for the Amchitka, Alaska, Site. The format used follows the recommended outline in the Alaska Department of Environmental Conservation (ADEC) guidance on decision documentation under the Site Cleanup Rules (Title 18 *Alaska Administrative Code* Chapter 75, Sections 325–390 [18 AAC 75.325–390]) (ADEC 1999).

Site name and location: Amchitka, Alaska, Site, Aleutian Island Chain (see Figure 1–1).

Name and mailing address of responsible person:

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Database record key and CS file number: 2512.38.002

Regulatory authorities: Site Cleanup Rules (18 AAC 75.325–390) (ADEC 1999); Underground Storage Tank (18 AAC 78.085–100) (ADEC 2003); *Comprehensive Environmental Response, Compensation, and Liability Act*

Areas for cleanup: A total of 12 drilling mud pits, located at the Long Shot, Milrow, and Cannikin nuclear test sites, Drill Sites D, E, and F, and the Hot Mix Plant at Charlie Runway. An unknown number of monitoring wells were plugged and abandoned from 1970 to 1972. A comprehensive search of all six test and drill areas was conducted during 2000 and 2001, resulting in a total of 16 monitoring wells being plugged and abandoned. The 16 wells were located at Milrow and Long Shot and were plugged and abandoned as part of the 2001 remedial activities. Two groundwater monitoring wells, GZ-1 and GZ-2, remain at Long Shot, and one open, steel-cased well, UAE-7C/UAE-7H, remains at Drill Site E. The disposition of these three wells, as well as all previously abandoned wells on Amchitka Island, will be provided in the Long-Term Surveillance and Maintenance Plan the U.S. Department of Energy (DOE) Office of Legacy Management is preparing.

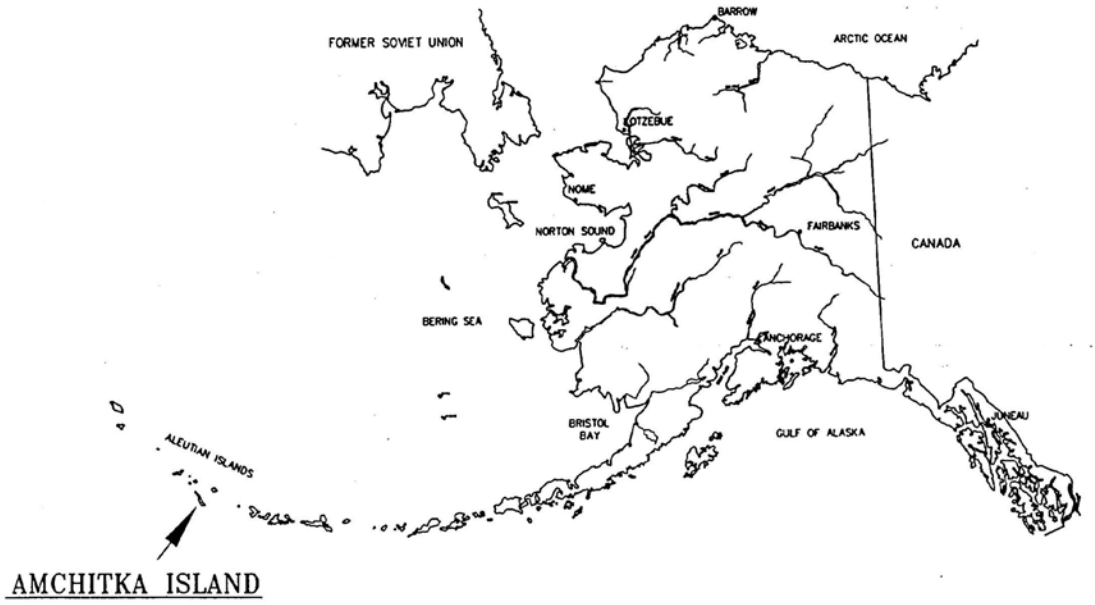

Figure 1–1. Amchitka Island, Aleutian Island Chain

2.0 Site Information

This document has been prepared for the cleanup of surface contaminated sites on Amchitka Island, Alaska, where DOE has environmental restoration responsibility. This document was prepared in accordance with ADEC Regulation 18 AAC 75.325–18 AAC 75.390, Site Cleanup Rules (ADEC 1999). This document addresses those surface sites where impacts from substances found in drilling muds due to spills or releases during testing and facility construction have been identified. These operations occurred between 1965 and 1972 at the six drill sites on Amchitka Island. Remediation of the Hot Mix Asphalt Plant (Hot Mix Plant) on the island is also addressed in this ROD.

Historical Site Use: Amchitka Island is near the far western end of the Aleutian Islands, approximately 1,340 miles west-southwest of Anchorage, Alaska (Figure 1–1). Three underground nuclear tests were conducted on the island between 1965 and 1971. Long Shot (80 kilotons) was detonated on October 29, 1965. Milrow (about 1 megaton) was detonated on October 2, 1969. Cannikin (less than 5 megatons) was detonated on November 6, 1971. In addition to the three sites that were used for underground nuclear testing, drilling occurred at three other sites (D, E, and F) where nuclear testing was considered but not performed. These DOE environmental restoration sites comprise a total of 12 drilling mud pits, eight impacted streams, five impacted lakes and ponds, and the Hot Mix Plant at Charlie Runway that was used for construction of the runway and support roads on the island.

Future Site Use: Amchitka Island is part of the Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge, which is administered by the U.S. Fish and Wildlife Service (USFWS). The island is currently uninhabited. There will be limited activities conducted by USFWS personnel in support of management of the island and the possibility of some minimal part-time subsistence use activities in the future. Additionally, researchers may also visit the island from other agencies, universities, or private organizations as well as the general public.

Physical Characteristics: The island's coastline is very rugged, with sea cliffs, isolated sandy and gravel beaches, and grassy slopes. The lowest elevations are on the eastern third of the island and are characterized by isolated, shallow ponds and heavily vegetated drainages. The central portion of the island has higher elevations, is more prone to wind erosion, and has fewer lakes. The westernmost 3 miles of the island are barren. The area contains a windswept rocky plateau with sparse vegetation, except for those areas protected from the wind. The average surface elevation at the western end of the island is approximately 800 feet (ft) (e.g., stream drainages). The highest elevation on the island is approximately 1,600 ft.

Geology: Amchitka Island apparently formed in the early Tertiary, roughly 50 million years ago, as a result of tectonic uplift and deposition of volcanic flow and marine sediments collectively known as the Amchitka Formation. Most of the island contains only a thin, discontinuous veneer of unconsolidated sediments overlying the volcanic bedrock. Organic soils, including peat, overlie most of the unconsolidated sediments. In the most topographically depressed and wettest parts of the island, the soils are typically peaty, with a thick mat of vegetation and little organic decomposition. In the drier and topographically higher areas, the soils are folists (well-drained organic soil). Limited areas of poorly developed sandy soils exist in dune areas that form a narrow strip along the Bering Sea coastal bluffs.

Hydrology: Amchitka Island is covered with hundreds of small, shallow ponds up to 330 ft wide and 10 ft deep. The smaller ponds are considerably shallower, typically ranging from 12 to 20 inches deep. The highest density of ponds lies on the eastern two-thirds of the island (averaging approximately 26 ponds per square mile), where they have developed above marine terraces and are confined by thick peat vegetation. Sediments in ponds are either floc (suspension of low-density detrital organic material) over gravel, organic silts over gravel, or clean gravel. The bottoms of smaller ponds are usually composed of peat or fine sediment covered with floc.

Watersheds on Amchitka Island are generally limited to 1 to 3 miles in length, since all streams drain perpendicular to the long axis of the island into either the Bering Sea or the Pacific Ocean. Most of the streams on the island flow year-round. During relatively dry periods, stream flows are sustained by base flow from soils and the underlying weathered bedrock; surface runoff and base flow contribute to flows during wet periods.

The groundwater system on Amchitka Island can be divided into three zones: (1) a shallow, water-bearing zone developed entirely within the organic soils and peat; (2) an intermediate groundwater zone developed within the shallow, weathered bedrock where fractures are relatively open; and (3) a deep groundwater zone developed in less-weathered bedrock where fractures are less open. The shallow, water-bearing zone occurs largely in the tundra vegetation, peat, and underlying organic soils and accumulates due to the high porosity and low vertical permeability of these materials. Perched groundwater is likely widespread in the eastern half of the island, as indicated by the large number of ponds in the region. Groundwater in the intermediate zone occurs in open fractures and within the volcanic rock matrix, where weathering processes have increased effective porosity. The intermediate zone may extend over most of the island and have a depth extending several hundred feet below the base of the shallow groundwater zone. Groundwater in the deep zone occurs in less-weathered bedrock at depths greater than several hundred feet and appears isolated from the surface water/shallow perched groundwater. Groundwater discharging into springs is common on Amchitka Island. There are no groundwater production wells on the island, and there are no plans to install any such wells in the future. Springs have provided water supplies during periods of occupation on the island.

3.0 Contaminants of Concern

Drilling muds were used to aid in the drilling of the emplacement and exploratory holes at the three test sites and the three drill sites. The boreholes were drilled using methods that employed large quantities of drilling mud, which is a mixture of bentonite, diesel fuel, and other compounds, including chrome lignosulfonate and chrome lignite, to control viscosity and mitigate loss of drilling mud in the boreholes. The composition of the drilling mud used at Amchitka included 91 to 93 percent water, 6 to 8 percent oil, and other additives, including cement, bentonite, paper, chrome lignosulfonate, chrome lignite, and sodium bicarbonate. The drilling mud was commonly stored near the drill sites in bermed pits, which were excavated to hold large quantities of drilling fluid produced from drilling the boreholes.

DOE conducted site investigations in 1993, 1997, 1998, and 2000. In the 1998 investigation, the chemical analysis of the drilling mud revealed that mud pits contain concentrations of diesel-range organics (DRO), polycyclic aromatic hydrocarbons (PAHs), low levels of polychlorinated biphenyls (PCBs), and chromium, but the only contaminants of concern (COCs) within each mud pit above ADEC cleanup levels was DRO. Mean concentrations of COCs in water overlying the drilling mud were well below applicable ecological criteria in all drilling mud pits.

Sampling of the surface water drainages revealed DROs and PCBs within the sediment. The June 2000 investigation gathered chemical data on the shallow groundwater downgradient of the drilling mud pits. This sampling showed that the drilling mud did not impact the shallow groundwater, and no cleanup of shallow groundwater is necessary (DOE/NV 2000).

Based on potential chemical exposure pathways, the following remedial action objectives have been identified for the DOE environmental restoration sites:

- Prevent or mitigate human and ecological exposure to surface contamination.
- Meet the requirements of Alaska environmental regulations and refuge management goals of the USFWS.
- Address stakeholder concerns and the cultural beliefs and practices of native people.

Anomalous concentrations of tritium were found in the vicinity of Long Shot ground zero 27 days after the test. Tritium activity has been monitored in surface water and shallow groundwater from 1965 to the present, under various programs. The following is a summary of information from Castagnola (1969):

- Initial breakthrough of Long Shot–related tritium occurred between 27 and 32 days after the test.
- The main activity front of test radioactive gases reached the surface roughly 6 months or more after the Long Shot event.
- At least 3.5 years after the Long Shot test, anomalous concentrations of tritium were detected in several surface waters in the vicinity of Long Shot ground zero, reaching a maximum detected concentration of about 5,000 tritium units (approximately 16,000 picocuries per liter [pCi/L]) in September 1966.

The drinking water standard for tritium is 20,000 pCi/L. As noted, the maximum tritium activity detected shortly after the Long Shot test was approximately 16,000 pCi/L in 1966. Tritium levels in some of the groundwater and surface waters samples collected by the U.S. Environmental Protection Agency (EPA) in 1997 (Faller and Farmer 1998) remain above background levels but well below the current safe drinking water levels. As discussed in this EPA report, at locations around surface ground zero, tritium concentrations continue to decrease faster than would be expected from tritium decay alone, indicating that dilution is also an important factor. In Dasher et al. (2000), it was noted that "Observations of tritium at sites within the Long Shot watershed continue to provide evidence of an early escape of radioactive gases to the near-surface shortly after the October 1965 test (Faller and Farmer 1998)." Dasher further noted "These measurements do not appear to reflect long-term movement from the contaminated groundwater to the Long Shot Ground Zero surface environment" (Dasher et al. 2000).

In addition to the fact that tritium concentrations are declining faster than the rate of decay alone, hydrologic measurements at Amchitka indicate a downward flow for recharge water to a freshwater/saline water zone where movement occurs laterally. Hydrological test results do not indicate upward flow paths from the test cavities to the surface environment (Claasen 1978; Fenske 1972; Wheatcraft 1995).

The source of tritium in surface water at Long Shot was believed to be gases that migrated to the top of the Long Shot chimney shortly after the test. It is postulated that, as the chimney filled with water, the gases were pushed upward through stemming material, out into the spall zone, and then dissolved in groundwater (Castagnola 1969). This upward spreading of the gaseous radionuclide source has not been included in the Desert Research Institute model. In addition, as there is a strong component of downward vertical flow, the path length for any particles placed higher in the chimney could be longer than that obtained by starting them in the cavity (Hassan, Pohlmann, and Chapman 2002).

The downward vertical flow of the freshwater flow path has been confirmed for Amchitka through the measurement of hydraulic head, which decreases with increasing depth, and analysis of temperature logs, which indicate downward movement of cooler water (Hassan, Pohlmann, and Chapman 2002). The end result is that the downward flow of the fresh water prevents any contaminants from reaching the surface.

Chapman and Hokett (1991) indicated that tritium above background levels had been detected in the near-surface and surface water systems at Long Shot, and the extent of tritium migration in the shallow groundwater system was unknown. However, based on the discussion above, tritium is not considered a COC for the surface cleanup.

4.0 Contaminant Concentration/Extent of Contamination

Contaminant Concentration: The site investigation sampling reports referenced in Section 3.0 contain detailed data concerning the concentration of the COCs resulting from drilling and testing operations conducted on the island.

Although the only COCs above ADEC cleanup levels are DRO in the mud pits, a number of other contaminants of potential concern (COPCs) were evaluated. While none of these additional COPCs, which include various metals (primarily aluminum and arsenic), organics (PAHs and a few volatile organic compounds), and PCBs (primarily Aroclor 1260) were detected at concentrations above ADEC cleanup levels, they were evaluated and addressed in the Mud Pit Risk Assessment. A detailed breakdown of the COPCs is included in tables of Appendix A to the Mud Pit Risk Assessment. Those tables are included as Appendix A of this ROD. The tables are organized by media and site and identify each COPC, including the detection frequency, maximum, minimum, and mean detected concentration, as well as background and exposure point information. Section 5 of this ROD presents further information about the risk assessment. The remainder of this section concentrates on the 2001 remediation of DRO contaminants in the mud pits.

Extent of Contamination: The drilling mud COCs were found primarily in the mud pits. However, drilling mud spills and failure of mud pit berms occurred during the underground testing program. Drilling mud has been released into the freshwater drainages present at each of the drill sites. Most of the drilling mud has subsequently been flushed from the creeks, but some remains in depositional areas of the creeks and in ponds adjacent to the drill sites.

Remediation of the drilling mud pits has been completed. Ten of the pits were remediated by stabilizing the contaminants, which involved mixing the drilling mud with clean soil from an on-island borrow source and then constructing an impermeable cap over each pit to isolate the contaminants from the environment and to eliminate exposure routes. One of the pits was cleaned up by removing all of the contaminated drilling mud for consolidation into another pit, where it was stabilized and capped. Section 8 provides specific detailed information about the remediation process.

In addition to the 11 mud pits requiring remediation, a twelfth pit (Drill Site E, Northern Mud Pit) was evaluated and was deemed suitable for No Further Action. This decision is based on the fact that no drilling mud was found in this pit during a June 2000 investigation, the contamination is confined to a small area, and the COC concentrations are significantly below ADEC remediation levels. In addition, it is not expected that the condition found at this mud pit will pose an unacceptable human health or ecological risk based on present or future use scenarios.

In addition to cleanup of the mud pits, the remedial action in 2001 also included cleanup of the Hot Mix Plant and evaluation of potential surface water contamination to determine whether remediation was necessary for water bodies in the vicinity of the mud pits. Table 4–1 contains a summary of the remedial action efforts that took place in 2001. For the mud pits, this table includes the size of each pit, estimated quantity of drilling mud, concentration of DRO, and the remedial action method used for each.

Table 4–1. Site Summary Data and Selected Remedial Actions

Site	Mud Pit Dimensions (ft)	Concentration of DRO (parts per million) (based on 1998 data)[a]	Drilling Mud (cubic yards)	Standing Water (ft)	Remedial Action
Long Shot					
West Mud Pit	150 × 150	296–58,800	2,740	1.5	Geosynthetic cap
East Mud Pit	150 × 150	296–58,800	2,740	1.5	Geosynthetic cap
Milrow Rifle Range Road	150 × 200	60–2,620	1,880	0	Geosynthetic cap
Cannikin Northwest Mud Pit (at Surface Ground Zero);	120 × 170,	1,980–14,000	3,000	3	Geosynthetic cap
North Post-shot Drill-Back;	40 × 80	273–7,940	135	1	Geosynthetic cap
South Post-shot Drill-Back	60 × 85	273–7,940	355	1	Clean closure—consolidate into North Post-shot Drill-Back Pit
Drill Site D					
Southern Mud Pit	130 × 500	46–2,400	2,350	3	Geosynthetic cap
Northwest Mud Pit	125 × 300	46–2,400	7,820	3	Geosynthetic cap
Northeast Mud Pit	175 × 300	46–2,400	4,870	6	Geosynthetic cap
Drill Site E					
Northern Mud Pit	20 × 40	214	<4	0	No Further Action
Southern Mud Pit	40 × 80	10,600	415	1	Geosynthetic cap
Drill Site F Remnant of Mud Pit	(1) 25 × 200 (2) 10 × 20	975–12,800	(1) 300 (2) 10	(1) 1 (2) 1	Geosynthetic cap
Hot Mix Plant Waste Tanks	NA	NA	NA	NA	Clean closure with off-island disposal; Cleaned—backfilled with native soil
Surface Water Drainage	NA	NA	NA	NA	No Further Action

[a]The observed concentrations of DRO were those present in drilling mud before stabilization.

The following is a brief description of the Amchitka Island sites that were evaluated and remediated.

Long Shot Test Site: Four side-by-side mud pits are present at the Long Shot test site. These mud pits were excavated into native soil in a low-lying area that is drained by a shallow trench. Surface water drainage from the mud pits released contaminants to streams and ponds in the area. The affected streams are Bridge Creek, Rainbow Creek, and Cloudberry Creek. The affected ponds are Reed Pond and Long Shot Pond.

Milrow Test Site: The Milrow test site contained four mud pits and also used the Rifle Range Road mud pits for drilling mud storage. Several small losses and large spills are reported to have occurred in 1968 and 1969. These spills released contaminants into nearby Clevenger Creek. Heart Lake at the Milrow site is also affected.

Drill Site D: Three large drilling mud pits are located at this site. Besides use for drilling at Drill Site D, mud was also mixed here and piped to other drill sites. During the Milrow test, drilling mud splashed out of the holding ponds, and the pond walls were reported to have cracked and failed during the Cannikin test. Additionally, intentional releases reached the freshwater drainage in the area. Affected water bodies include the unnamed lake at Site D and Falls Creek, which flows from the unnamed lake.

Drill Site E: This site contained one mud pit near the drilling pad and two smaller mud pits to the north and south. The Drill Site E mud pit was constructed on unstable soil, and in 1968, the mud pit berm failed, and drilling mud was released into the nearby Site E Stream.

Drill Site F: This site originally contained four drilling mud pits. Mud from the sumps was reported to have escaped and reached the Limpet Creek drainage.

Cannikin Test Site: This site used four or five mud pits. Releases into White Alice Creek are reported to have occurred from 1968 to 1971. Intentional releases occurred via drainpipes installed in sump walls and from trenches cut through the walls. Drilling mud also entered Cannikin Lake.

Hot Mix Plant: The Hot Mix Plant was adjacent to the Charlie Runway and consisted of two underground storage tanks, which contained approximately 12,000 gallons of a tar-like liquid. No evidence of spills was observed at this site.

Surface Water Drainages: Surface water, sediment, and biological data were collected in 1998. DOE conducted additional sampling to close data gaps in 2000 and 2001. The complete data set was used in the production of the human health and ecological risk assessments described in Section 5.0 of this document.

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5.0 Summary of Risk Assessment

Releases of drilling mud into freshwater drainages at the drill sites occurred during the testing period, and a considerable amount of the material was left on the island in exposed mud pits after testing was completed. The preferred alternative described in this ROD involves stabilizing and capping the drilling mud pits. This work was performed in 2001. Stabilizing and capping the mud pits eliminated all exposure pathways to waste material in the pits as long as the caps remain intact. Several stream, lake, and pond areas containing historical releases of drilling mud have been determined to be No Further Action sites, because these sites do not pose an unacceptable risk to humans or ecological receptors. The decision to designate these sites as No Further Action was made by DOE and ADEC in the Proposed Plan (NNSA/NSO 2005a).

The COCs are DRO, the impacted medium is drilling mud, and the concentration levels range from 214 to 58,000 parts per million, as discussed in Section 4.0 and shown in Table 4–1. Contaminants in impacted media may potentially migrate through surface water and sediment transport, sediment deposition, adsorption/desorption, sediment resuspension, uptake by aquatic plants, bioaccumulation into aquatic organisms, and trophic transfer via the food web. Surface water bodies have the potential to transport contaminants downstream to other areas of the streams and to the marine environment.

A human health and ecological risk assessment was conducted for the surface contamination at Amchitka Island as part of remediation activities. The results are documented in detail in *Human Health And Ecological Risk Assessment for the Mud Pit Release Sites Amchitka Island, Alaska* (NNSA/NSO 2003a). This section provides a summary of the risk assessment findings.

Human health and ecological risks were evaluated for several stream, lake, and pond areas containing historical releases of drilling mud (NNSA/NSO 2003a). These surface water bodies were proposed for No Further Action on the basis of the risk assessment:

- Heart Lake
- Clevenger Creek
- Bridge Creek
- Rainbow Creek
- Cloudberry Creek
- Reed Pond
- Long Shot Pond
- White Alice Creek
- Cannikin Lake
- Unnamed Lake at Site D
- Falls Creek
- Limpet Creek
- Site E Stream

Human Health Risk Assessment Assumptions: The human health risk assessment was conducted to determine the types and magnitudes of exposures to constituents originating from

the drill sites on Amchitka Island and to determine the potential carcinogenic risks and noncarcinogenic health hazards posed by such exposures.

Based on past use and expected future use of the island, the risk assessment considered two potentially exposed human populations: USFWS workers/residents and part-time subsistence users and other visitors to the island. The COPCs for human health exposure were DRO, other organics, metals, and PCBs. The summary of COPCs is included in tables of Appendix A to the Mud Pit Risk Assessment and is attached to this ROD as Appendix A. The source of risk at Rainbow Creek was Aroclor-1260 in sediment, and at Cannikin Lake was Aroclor-1260 in fish tissue. Arsenic in sediment was the source of risk at White Alice Creek, and arsenic in surface water was the source of risk at Clevenger Creek. All historical drinking water use on the island has been from Constantine Spring in the base camp area. The assumed populations and exposure pathways are shown in Table 5–1.

Table 5–1. Potential Human Exposure Pathways

Exposed Population	Exposure Pathways
USFWS workers/residents	• Ingestion of fish • Direct contact with surface water • Direct contact with sediment
Part-time subsistence users and other visitors to the island	• Ingestion of fish • Incidental ingestion of surface water • Direct contact with surface water • Incidental ingestion of sediment • Direct contact with sediment

The carcinogenic risks for the USFWS worker and the part-time subsistence user and other visitors to the island are calculated in Table 5–2.

Table 5–2. Carcinogenic Risks

Site	USFWS Worker	Part-Time Subsistence User and Other Visitors to the Island
Falls Creek	1×10^{-7}	2×10^{-7}
Drill Site D Lake	0	0
Drill Site E Stream	0	0
Bridge Creek	0	0
Reed Pond	0	0
Cloudberry Creek	7×10^{-8}	4×10^{-7}
Rainbow Creek	7×10^{-8}	1×10^{-7}
Clevenger Creek	5×10^{-8}	4×10^{-7}
Heart Lake	0	0
Cannikin Lake: adult/child	4×10^{-7}/NA	$1 \times 10^{-5}/2 \times 10^{-6}$
White Alice Creek	3×10^{-6}	9×10^{-6}

The noncarcinogenic hazards for USFWS workers and part-time subsistence workers and other visitors to the island are calculated in Table 5–3.

Table 5–3. Noncarcinogenic Hazards

Site	USFWS Worker	Part-Time Subsistence User and Other Visitors to the Island
Falls Creek	9.2×10^{2}	4.0×10^{-3}
Drill Site D Lake	4.8×10^{-1}	2.6×10^{-2}
Drill Site E Stream	4.6×10^{-6}	3.5×10^{-7}
Bridge Creek	0	0
Reed Pond	0	0
Cloudberry Creek	1.2×10^{-2}	3.8×10^{-3}
Rainbow Creek	0	0
Clevenger Creek	5×10^{-3}	1.9×10^{-3}
Heart Lake	0	0
Cannikin Lake: adult/child	24×10^{-1}/NA	$3.0 \times 10^{-1}/2.9 \times 10^{-1}$
White Alice Creek	3.0×10^{-1}	4.6×10^{-2}

All of the calculated carcinogenic risks are within or below the EPA recommended risk range of 1×10^{-4} to 1×10^{-6} and the State of Alaska regulatory threshold for cumulative cancer risk of 1×10^{-5} (ADEC 2000). Additionally, all of the calculated noncarcinogenic hazards are less than the ADEC and EPA recommended target hazard index of 1.0. Therefore, site-related constituents, including DRO, do not pose significant risks or hazards to USFWS workers/residents or part-time subsistence users and other visitors to the island.

Ecological Risk Evaluation: An ecological risk assessment was performed on the mud pit release sites to evaluate the potential risks to ecological receptors. Based on the surface water and sediment samples collected at the 13 listed water bodies, several constituents of potential ecological concern were identified. These included metals (aluminum, arsenic, barium, boron, cadmium, chromium, copper, iron, nickel, titanium, and zinc), PAHs, PCBs, and a few volatile organic compounds.

Through the identification of complete exposure pathways, the following receptors representing several trophic levels were chosen as the focus of the ecological risk assessment:

- Benthic macroinvertebrate communities
- Aquatic plants (milfoil and aquatic mosses)
- Freshwater fish (land-locked Dolly Varden)
- Omnivorous birds (green-winged teal)
- Herbivorous birds (Aleutian Canada goose)
- Piscivorous birds (bald eagle)

Assessment endpoints evaluated the potential for significant adverse effects on the following:

- Benthic invertebrate community abundance and diversity
- Plant species abundance, diversity, and primary production
- Freshwater fish abundance
- Waterfowl abundance
- Bald eagle abundance

Benthic invertebrates: The potential for significant adverse effects on benthic invertebrate communities was addressed through the Sediment Quality Triad approach, in which measurements of chemistry, toxicity, and biology are made and a weight of evidence is used to determine whether effects due to chemical contamination are evident. Benthic community analysis and laboratory toxicity testing indicated that, for the most part, biological effects were not manifested to any significant degree above those in reference locations, even in areas where sediment chemical concentrations were elevated. Low-flow depositional areas in several lakes and streams have been affected by drilling muds; however, the site characterizations and risk assessment have shown that ecological effects on populations are minimal.

Aquatic plants: The potential for significant effects to aquatic plant productivity was addressed by comparing surface water concentrations to the lowest chronic levels available in the literature. Only aluminum and copper concentrations exceeded these levels in a few locations. Neither aluminum nor copper is known to be associated with drilling mud. Aluminum is a major component of sediment and is usually found as aluminum silicates, which are not readily bioavailable. Copper was found at concentrations not much higher than background. Thus, these are probably related to background conditions and suspended sediments in the surface water samples, and no significant effects to aquatic plant productivity are expected from the drilling mud pits.

Fish: The potential for significant effects on fish reproduction and populations was addressed by comparing concentrations that are correlated with 20 percent effects on population parameters (EC20) and by comparing tissue concentrations with tissue levels correlated with reproductive effects. As with plants, aluminum and copper were found in a few samples above the EC20 values. These are probably related to background conditions and suspended sediments in the surface water samples, and no significant effects to fish populations are expected. Fish tissue analyses found detectable levels of PCBs in many of the fish sampled. A conservative residue effect threshold of approximately 0.1 milligram per kilogram, based on a 4 percent average lipid content, was found to be associated with reproductive effects in salmonids. Of all the fish sampled, only one fish from Falls Creek had a concentration greater than this benchmark. Thus, effects on fish populations from the drilling mud pit constituents are expected to have no deleterious effect on the population.

Bald eagles and waterfowl: The potential for significant effects on bald eagles and on waterfowl (e.g., Aleutian Canada goose and green-winged teal) were evaluated through the use of food chain models. The potential risk is presented as a hazard index (HI), which is the ratio of the estimated daily dose to the receptor based on the food chain models to conservative estimates of potential toxicity, either chronic No Observable Adverse Effects Level (NOAEL) or chronic Lowest Observable Adverse Effects Level (LOAEL). An HI greater than one indicates that a potential hazard may exist.

Bald eagles: Bald eagles are assumed to forage over a large area and obtain fish and waterfowl for their diet (which also includes rats and upland birds) from any of the lakes and ponds in the mud pit release site area. The NOAEL-based HI for the bald eagle is 0.17. Therefore, no effects are expected to bald eagles on Amchitka Island due to contaminants related to the drilling mud pits. Field observations indicate that bald eagles are abundant on Amchitka Island. The birds have adapted well to the closure of the island's landfill, which had attracted many eagles during the periods of high human occupation in the 1970s, 1980s, and early 1990s. Numerous nests with fledglings were observed during 2001 field activities.

Green-winged teal/Aleutian Canada goose: Green-winged teal are year-round residents at Amchitka Island but only spend the 3-month breeding season in the freshwater areas at the site. They eat both benthic invertebrates and aquatic plants. The Aleutian Canada goose is a migratory bird and spends about 6 months, including the breeding season, at Amchitka Island. They are primarily herbivorous and eat both upland and aquatic plants. Three of the lakes and ponds in the mud pit release site area had NOAEL-based HIs greater than 1.0 for the green-winged teal and the Aleutian Canada goose: Drill Site D Lake, Heart Lake, and Cannikin Lake.

The only COC at Drill Site D Lake for these species is chromium. The HI was based on the modeled concentration of chromium that is bioaccumulated from the sediment in benthic invertebrates upon which they might feed. Sources of uncertainty in the HI values include the limited number of sediment samples collected in the lake and the non-site-specific biota-sediment accumulation factor used to model the benthic invertebrate concentrations. For Aleutian Canada geese, there is uncertainty in this model since the risk was based on assuming that half of their on-site plant consumption is aquatic plants. Site observations suggest that Aleutian Canada geese are almost entirely upland grazers, and this suggests that the assumed aquatic plant consumption rate is a very conservative assumption. Though a potential for effects from chromium exists at Drill Site D Lake, it is not considered to be significant and is limited to this lake.

The only COC at Heart Lake for these species is aluminum. The HI was based on the modeled concentration of chromium that is bioaccumulated from the sediment in benthic invertebrates, upon which they might feed. Aluminum in sediments is usually found in the form of aluminum silicates, which are not readily bioavailable. Aluminum in sediments is not expected to readily bioaccumulate. The toxicity test on which the NOAEL was based tested only one dose and found no effects. Thus, no LOAEL has been established for aluminum. Aluminum is not considered to be related to drilling mud, and no significant effects are expected from exposure to aluminum from sediments.

The only COC present at Cannikin Lake for green-winged teal and Aleutian Canada geese are PAHs. This is based on the modeled concentration of PAHs bioaccumulated from the sediment in benthic invertebrates upon which they might feed. Sources of uncertainty include the small number of samples collected in Cannikin Lake and their location in only one area nearest the mud pits (which probably is not representative of the entire lake); the biota-sediment accumulation factor used for all PAHs, which was based on one PAH (benzo[a]pyrene); and the toxicity reference values (TRVs), which were based on acute studies in which PAHs were injected into eggs, and the eggs were observed for subsequent mortality. The route of exposure may not be appropriate for developing TRVs that will affect reproduction, and safety factors of 20 to 250 were used in extrapolating from acute endpoints to chronic NOAELs. Though a potential for effects is present at Cannikin Lake due to PAHs in sediment, it is expected to be limited to birds that would only feed in the small portion of Cannikin Lake, which is unlikely. No significant effects on green-winged teal or Aleutian Canada goose populations are expected from PAHs.

The conclusion that teal and goose populations are not adversely affected by the COCs in these water bodies is supported by recent field observations. During sampling and remediation activities, green-winged teal were observed to be abundant on Amchitka and were successfully nesting and rearing young on most of the small ponds throughout the eastern lowland portion of

the island. Field observations made during sampling and remediation work indicate that the Aleutian Canada goose population, formerly listed as a threatened species on Amchitka, has recovered well. In the spring of 2001, counts made in the work areas and along Infantry Road found both small and large flocks of geese, some with over 100 birds, throughout the portion of the island containing the drill sites. Observations included numerous mated pairs, several nests with eggs, and adults with goslings. At present, the greatest threat to Aleutian Canada geese on Amchitka is predation by bald eagles. On March 20, 2001, this species was removed from the federal list of threatened and endangered wildlife and plants.

Summary: The mud pit stabilization capping and closure work performed on Amchitka Island by DOE in 2001 removed the sources of drilling mud that have historically entered several of the streams, ponds, and lakes adjacent to the drill sites. Although some of this material remains in ponds and stream depositional areas, the risks posed to ecological receptors are not substantial, and will diminish over time. The birds, fish, and other biota of Amchitka appear to be thriving, and the disturbance and habitat disruption that would result from further remediation is not warranted by the potential reduction of risk levels.

6.0 Cleanup Levels for the Site and How They Were Established

For the following reasons, no alternative cleanup levels were proposed:

- All mud pits with contaminants above ADEC cleanup levels were stabilized and capped or clean-closed.
- The contents of the Hot Mix Plant storage tanks were removed, the tanks were rinsed out, and the contents and rinsates were transported to an off-site waste management facility. The empty tanks were then filled with soil, and the manholes were grouted closed.
- The human and ecological risk assessments showed that the sites do not pose an unacceptable risk to human health and the environment.

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7.0 Alternatives Analysis

Based on a review of existing data and current and future land use plans, the following remedial action alternatives were developed for consideration at Amchitka Island:

- Alternative 1: No Further Action
- Alternative 2: Geosynthetic Cap
- Alternative 3: Institutional Controls with Long-Term Monitoring

Each of the remedial action alternatives was evaluated according to criteria identified in the National Contingency Plan for effectiveness, constructability, cost, and schedule. The National Contingency Plan criteria are as follows:

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility, or Volume through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. Stakeholder/Community Acceptance

Other factors considered were safety of construction workers and potential damage to the surrounding ecological environs (e.g., wetlands and tundra).

Selected Remedial Actions: Table 7–1 summarizes the selected alternatives for each site.

Table 7–1. Selected Remedial Actions

Site	Proposed Remedial Action
Long Shot	Geosynthetic Caps and Institutional Controls
Rifle Range Road (Milrow)	Geosynthetic Cap and Institutional Controls
Drill Site D	Geosynthetic Caps and Institutional Controls
Drill Site E: Northern Pit; Southern Pit	No Further Action; Geosynthetic Cap and Institutional Controls
Drill Site F	Geosynthetic Cap and Institutional Controls
Cannikin Northwest Pit (at surface ground zero) North Post-shot Drill-Back South Post-shot Drill-Back	Geosynthetic Cap and Institutional Controls Geosynthetic Cap and Institutional Controls Clean Closure by Consolidation—Consolidated into North Post-test Drill-Back Pit
Hot Mix Plant	Clean Closure with Off-Island Disposal
Surface Water Drainages	No Further Action

Table 7–2 provides a summary of the evaluation criteria assessed during the analysis of alternatives considered for this remediation.

Table 7–2. Assessment of Remedial Action Alternatives

Assessment Factors	Alternative 1 No Further Action	Alternative 2 Geosynthetic Cap	Alternative 3 Institutional Controls and Long-Term Monitoring
1. Overall Protection of Human Health and the Environment	• Minimal risk in areas where contamination is confined to a small area. • Minimal risk in areas where remedial action would cause extensive damage to sensitive ecological areas. • Does not provide adequate protection in large areas of significant contamination.	Minimal risk because the geosynthetic cap provides a highly impermeable barrier between the contaminants and the environment.	• Minimal risk in areas where contamination is confined to a small area. • Minimal risk in areas where remedial action would cause extensive damage to sensitive ecological areas. • Does not provide adequate protection in large areas of significant contamination.
2. Compliance with Applicable or Relevant and Appropriate Requirements	• Does not comply because contaminants remain above regulatory limits until they naturally attenuate. • Inadvertent intrusion not prevented.	• Contaminant exposure and migration essentially eliminated. • Contaminants remain above regulatory limits until they naturally attenuate. • Inadvertent intrusion prevented.	• Does not comply because contaminants remain above regulatory limits until they naturally attenuate. • Inadvertent intrusion prevented.
3. Long-Term Effectiveness and Permanence	• Effective and permanent after contaminants naturally attenuate below regulatory limit. • Inadvertent intrusion not prevented.	• Effective and permanent after contaminants naturally attenuate below regulatory limit. • Inadvertent intrusion prevented.	• Effective and permanent after contaminants naturally attenuate below regulatory limit. • Inadvertent intrusion prevented.
4. Reduction of Toxicity, Mobility, or Volume through Treatment	• Does not reduce contaminant toxicity or mobility. Contaminants remain toxic until they naturally attenuate. • Inadvertent intrusion not prevented.	• Contaminant migration essentially eliminated. • Contaminants remain toxic until they naturally attenuate. • Inadvertent intrusion prevented.	• Does not reduce contaminant toxicity or mobility. • Contaminants remain toxic until they naturally attenuate. • Inadvertent intrusion prevented.
5. Short-Term Effectiveness	• Not effective until contaminants naturally attenuate to below regulatory limit. • Inadvertent intrusion not prevented.	• Effective by preventing contaminant migration until contaminants naturally attenuate to below regulatory limit. • Inadvertent intrusion prevented.	• Not effective until contaminants naturally attenuate to below regulatory limit. • Inadvertent intrusion prevented.
6. Implementability	Easy to implement and easy to maintain.	• Easy to implement other than logistical challenges. • Implementation requires mobilization of extensive equipment and materials. • Periodic monitoring and maintenance required. • Difficult to maintain due to the isolated location.	• Easy to implement other than logistical challenges. • Periodic monitoring and maintenance of the caps required.
7. Cost	No cost associated with this alternative.	• Significant cost to implement. • Periodic monitoring and maintenance will be performed in conjunction with other on-island activities to minimize costs.	• Cost will be minimal to implement. • Periodic monitoring and maintenance will be performed in conjunction with other on-island activities to minimize costs.
8. Stakeholder/Community Acceptance	Acceptance unlikely.	Acceptance is likely because of moderate implementation cost, with significant benefit.	Acceptance likely after public awareness program is implemented.

8.0 Description of Remedial Actions

Remedial actions are documented in the *Amchitka Island Surface Closure Report* (NNSA/NSO 2003b).

Mud Pit Remediation: The remediation of 10 of the 12 drilling mud pits consisted of constructing geosynthetic caps over each mud pit. The remedial action was completed by performance of several sequential tasks using conventional earth-moving equipment. These tasks included treatment and discharge of standing water in the mud pits, operation of several soil-processing areas to obtain material for drilling mud stabilization and cover construction, stabilization of the drilling mud, installation of the geosynthetic cap, and site restoration. Those tasks are discussed in the this section.

Water Treatment and Discharge: To stabilize the drilling mud, it was necessary to pump all standing water from the mud pits. Several high-output, portable trash pumps were used to pump the water from the pits. Analytical data on the standing water show that, as long as the underlying mud is not disturbed, the water could be discharged without prior treatment. Therefore, the suction hose was attached to a float to prevent the drilling mud from becoming disturbed during pumping operations. The pumps discharged onto the concrete drill pad, into a sediment trap for activities at Drill Site D, or into an energy dissipater constructed of 6-inch-diameter rock. The dissipater prevented erosion downgradient of the pump discharge point. When the standing water was drawn down to approximately 2 ft from the mud surface, or whenever sheen on the water surface was observed, the water was treated before discharge. The water was pumped into a large modular tank constructed on each site and treated in batches.

Each batch was treated by the addition of ferric chloride and alum; the pH of the water was then adjusted with the addition of lime. An anionic polymer was then added to flocculate free product, if present. The water was then passed through a series of bag filters, and finally through activated carbon canisters to remove any organics. Treated water was sampled at the discharge point at the frequency required in ADEC's Wastewater General Permit Number 9640-DB-004.

Soil Processing: During the remedial activities, it was necessary to process soils from several borrow areas. A large borrow area at Mile Marker 8 on Infantry Road was used to supply soil for the Cannikin and Long Shot mud pits. Borrow areas in the vicinity of the Rifle Range Road mud pit and within Drill Sites D, E, and F were used to supply soil for pits at each of those locations. All proposed borrow areas were within previously disturbed areas; no virgin tundra was used for borrow material.

Erosion and sediment control structures were installed before any earth-disturbance activities. Soils excavated from the borrow areas were used for several different applications. The applications and the required gradation of soils are as follows:

- Soil to stabilize the drilling mud; less than 6-inch maximum diameter
- Intermediate cover (1 ft below liner); less than 1-inch maximum diameter
- Protective cover (1 ft above liner); less than 1-inch maximum diameter
- Soil cover; less than 2-inch maximum diameter
- Vegetated layer; less than 3-inch maximum diameter
- Energy dissipaters; 4- to 6-inch diameter

Soils were excavated from the borrow areas and placed into the processor equipped with a series of vibratory screens. Processed material was segregated and stockpiled based on gradation.

Drilling Mud Excavation and Consolidation: The Cannikin site contained three mud pits—one at the surface ground zero drilling pad and two at the post-shot drill-back well. The drilling mud within the southern post-shot drill–back mud pit (approximately 550 cubic yards) was removed and consolidated into the northern mud pit as follows:

- After the standing water on the mud pit had been removed, all of the drilling mud from the southern mud pit was removed and transported approximately 120 yards to the northern mud pit for consolidation.
- After visual inspection determined that all drilling mud had been removed from the southern mud pit, confirmatory sampling was completed on the in situ soils to verify that contaminants concentrations are below the regulatory cleanup levels.

Drilling Mud Stabilization: After the standing water was removed from each of the mud pits, screened solidification soils were hauled from the borrow area and end-dumped into the mud pit. The screened material was mixed with the drilling mud at a ratio of approximately four parts screened material to one part drilling mud, by weight. The solidification soils were mixed into the drilling mud.

The mixing continued until the Quality Control engineer determined that a homogeneous mixture had been obtained. Nuclear density tests were performed on the solidified drilling mud as solidification soils were added. The tests served to monitor the solidification process and to document the final conditions. The solidified drilling mud was then graded to promote runoff from the mud pit and to meet required lines and grades of overlying geomembrane.

Cap Construction: Once the drilling mud was stabilized, a geosynthetic cap, constructed of soil layers and a geomembrane cover, was installed as follows:

- Once the drilling mud mixture was brought to grade, a 1-ft minimum layer of intermediate cover (1-inch maximum particle size) was placed in a 1-ft lift and compacted with a minimum of four passes by a drum roller. The intermediate cover acts as the base for the geosynthetic liner; therefore, the surface was constructed to ensure that it was free of sharp rocks, sticks, and other materials that could potentially damage the liner.
- A perimeter berm or bench was constructed around each mud pit to help contain the drilling mud during solidification and to accommodate the anchor trench. The alignment of the perimeter or bench was over-excavated to remove any organic, peaty soils. Fill material from the borrow area was then placed in 1-ft lifts and compacted to bring the area back to grade. An anchor trench was excavated in the compacted fill around the perimeter of each mud pit to secure the geomembrane. Care was taken to ensure that the wall of the anchor trench did not contain any sharp, protruding rocks that could damage the geomembrane.
- Once the intermediate cover had been placed and the anchor trench installed, a 30-millimeter polyester XR-5 geomembrane manufactured by Seaman Corporation was installed over the intermediate cover. The geomembrane is manufactured in panels up to 40,000 square feet in size, which minimized the number of field welds required. All field seams were hot welded. Care was taken to prevent wrinkles, fishmouths, and other defects.

The geomembrane extends into the base of the anchor trench. After the geomembrane was in place, the anchor trench was backfilled in 1-ft lifts and compacted with a hand compactor.

- After the geomembrane deployment was completed and approved by the Quality Control engineer, a 1-ft layer of protective cover soil was placed over the geomembrane with low-ground-pressure bulldozers and compacted with a drum roller. The protective cover had a maximum particle size of 1 inch to protect the liner from damage during subsequent construction. Care was taken during placement to minimize any wrinkles in the underlying geomembrane.
- After the protective cover layer had been placed, an 18-inch layer of soil cover was placed to provide additional frost protection for the geomembrane cover. The maximum particle size of this material was 2 inches.
- The final 6-inch lift of material was then placed over the area.

Revegetation: The mud pit caps were revegetated with a USFWS-approved seed mixture. Before seeding, an adequate seedbed was prepared on the surface, and the soil was amended with a USFWS-approved fertilizer. After the seed had been placed, an erosion control blanket was installed over the seeded areas.

Site Restoration: All disturbed areas, including borrow areas, were reseeded with the USFWS seed mix and covered with the erosion control blanket to minimize erosion. The soil borrow areas were graded to blend into the surrounding contours, and no slopes steeper than two horizontal to one vertical remain.

Hot Mix Plant Remediation: The Hot Mix Plant was adjacent to Charlie Runway and consisted of two underground storage tanks, which contained approximately 12,000 gallons of a tar-like liquid.

Characterization Sampling and Analysis: A representative sample of the liquid from each tank was taken by lowering a disposable bailer or other device into the tank to obtain the sample. If the liquid had multiple phases, each phase was sampled and analyzed. The liquid was sampled for the following suite of parameters:

- Ignitability
- Corrosivity
- Reactivity
- PCBs
- Toxicity Characteristic Leaching Procedure
  - — Semivolatile organics
  - — Volatile organics
  - — Metals

Tank Content Removal: After the results from the characterization sampling were obtained, the liquid was pumped out of the tanks, placed into appropriate containers, and stored in a waste storage facility pending shipment off site for management. The storage area was bermed and

underlain with a 30-millimeter liner and enclosed with safety fencing. Appropriate signage was posted. Once all of the liquid was pumped out, the tanks were rinsed with a high-pressure steam cleaner to remove as much residual material as practical. The rinsates were containerized and stored, pending disposal.

Tank Closure: Once the residual liquids were removed, the tank was filled with native soils to prevent the possibility of future collapse. Once the tank was filled as much as possible through the manway, the manway was grouted closed with lean concrete.

Final Survey: A final survey of all work areas was completed by a surveyor licensed in the state of Alaska. The survey was used to provide as-built drawings of all mud pit caps and borrow areas.

Institutional Controls: Institutional controls will include prohibiting any intrusion into the mud pit caps without express DOE and ADEC permission. DOE is currently negotiating with USFWS, who has administrative jurisdiction over Amchitka Island. The details of any USFWS responsibility will be described in a Memorandum of Understanding/Land Use Agreement to be developed between DOE and USFWS. The need for an amendment to the Land Withdrawal for Amchitka as an institutional control will also be evaluated.

Post-closure inspection and monitoring will be conducted as described in the *Post-Closure Monitoring and Inspection Plan for Amchitka Island Mud Pit Release Sites* (NNSA/NSO 2005b).

9.0 Applicable or Relevant and Appropriate Requirements

Site-specific ARARs were identified for this remediation. These ARARs represent the standards under which the remediation was conducted. The complete list of ARARs for this project is provided in Table 9–1.

Table 9–1. Amchitka Applicable or Relevant and Appropriate Requirements List

Requirement	Authority	Prerequisite	Description
Action-Specific Requirements			
National Environmental Policy Act and implementing regulations	42 U.S.C. 4321 et seq.; 40 CFR 1500 et seq.	Implementation of a major federal action	Requires various levels of impact analyses relating to the proposed project; discusses alternatives to the proposed project and related impacts.
Occupational Safety and Health Administration and implementing regulations	29 CFR 1910.120	Employment of federal and contractor employees	Regulations pertaining to protection of workers in an occupational setting.
Generator Requirements Potential actions: Mud pit closure, underground storage tank closure	40 CFR 261; 40 CFR 262, Subparts A–C	Generation of a Resource Conservation and Recovery Act hazardous waste	Requires that a hazardous waste determination be made, sets requirements for the on-site accumulation of hazardous waste, including container requirements, inspections, and pre-transport requirements.
Underground Storage Tanks	18 AAC 78.007; 18 AAC 78.015; 18 AAC 78.085; 18 AAC 78.100	Underground storage tank	Permanent closure of an underground storage tank; site characterization and assessment.
Alaska Air Quality Regulations Potential Actions: Use of diesel generators on site, construction of cap to include mixing and/or solidification, use of heavy equipment	18 AAC 50.045(d)	Handling, transporting, or storage of bulk materials	Dust control requirements; reasonable precautions must be taken to prevent emission of particulate matter into ambient air.
Alaska Air Quality Regulations Potential Actions: Use of diesel generators on site, construction of cap to include mixing and/or solidification, use of heavy equipment	18 AAC 50.055(a–c)	Industrial process or fuel-burning equipment	Industrial processes and fuel-burning equipment; addresses opacity, particulate matter emissions, and sulfur-compound emissions.
Recommended Practices for Monitoring Well Design, Installation and Decommissioning (April 1992) Potential Action: Plugging and abandonment of existing monitoring wells	Incorporated by reference in 18 AAC 75.345(j)	Groundwater monitoring wells	Plugging and abandonment requirements for monitoring wells.
Chemical-Specific Requirements			
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.325	Discharge/release of oil or hazardous substance	Site cleanup rules.

Table 9–1 (continued). Amchitka Applicable or Relevant and Appropriate Requirements List

Requirement	Authority	Prerequisite	Description
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.335–341		Site characterization and soil cleanup levels.
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.345		Groundwater and surface water cleanup—requires groundwater and surface water to be cleaned up to certain numerical standards, and establishes point of compliance and monitoring requirements.
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.350–360		Groundwater use, sampling and analysis, cleanup requirements.
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.375–390		Institutional controls, final reporting requirements and site closure, waiver or modification.
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75.990		Definitions
Location-Specific Requirements			
Alaska Coastal Zone Management Program	AS 16.20 15 CFR 930.30–40	Activity within a coastal zone	Requires a project consistency review; results in determination of state and federal permitting requirements.
Coastal Zone Management Act	16 U.S.C. 1541 et seq.		
Endangered Species Act	16 U.S.C. 1531 et seq. 50 CFR 402	Federal action	Requires a federal agency to review proposed actions to determine any effect on endangered/threatened species and/or their habitat; mandates consultation with USFWS if species or habitat may be adversely affected by federal actions.
Fish and Wildlife Coordination Act	16 U.S.C. 661 et seq.	Federal actions resulting in control or modification of a natural stream or water body	Requires federal agencies to assess impacts of water-related projects on fish and wildlife; prevent loss and/or damage to these resources; and provide for the development and improvement of the resources.
National Historic Preservation Act	16 U.S.C. 470 36 CFR 63 36 CFR 800	Federal action	Identification, evaluation, registration, protection, and preservation of historic properties; requires federal agencies to identify and evaluate potential impacts on historic properties; discusses federal consultation with State Historic Preservation Officer.
Requirements to be Considered			
Alaska Solid Waste Regulations	18 AAC 60.430(e)	Permitted drilling waste disposal facility	Closure of a permitted disposal facility to include removal of fluids, capping requirements, and revegetation.
Storm Water Treatment Plan Review Guidance Manual (Municipality of Anchorage)	January 1999	Construction activity in Alaska	Erosion and sediment guidance; best management practices; storm water site plans.
Erosion and Sediment Control and Materials Containment Guidance Manual (Municipality of Anchorage)	January 1998	Construction activity in Alaska	Preparation and implementation of erosion and sediment control plans.

10.0 Public Input

Previous Public Input: Previous public meetings were held before and after the 2001 performance of the DOE Amchitka mud pit cleanup. These included:

December 16, 1996	Public Meeting—Objective and Related Technical Advisory Group Development
May 1, 2001	Aleutian Pribilof Islands Association, Inc. (APIA) Meeting, Anchorage, Alaska
May 2, 2001	Public Meeting—Open House, Anchorage, Alaska, Re: Cleanup Activities at Amchitka Island and Budget Activities (both meetings)
December 4, 2001	Public Meeting—Open House, Anchorage, Alaska
December 5, 2001	APIA Meeting, Anchorage, Alaska, Re: Cleanup Activities at Amchitka Island (both meetings)
December 4, 2002	Public Meeting—Open House, Anchorage, Alaska, Re: Risk Assessment Discussion
May 13, 2003	Public Meeting—Dutch Harbor, Alaska
May 14, 2003	Public Meeting—Anchorage, Alaska, Re: Amchitka Island Risk Screening Assessment (both meetings), Community Involvement and Path Forward

The Proposed Plan for Surface Remediation was subject to public comment. The public comment period was from August 18 to September 18, 2005. No public comments were received (NNSA/NSO 2005a).

Public Information: The site documents for the Amchitka Island remediation are archived and are available to the public at the following location:

Aleutian Pribilof Island Association
1131 E International Airport Road
Anchorage, AK 99518-1408
(907) 276-2700

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11.0 Review of Remedial Action After Site Closure

The effectiveness and durability of the remedial action will be achieved through institutional controls and long-term monitoring. Periodic monitoring and maintenance of the geosynthetic caps constructed over the mud pits will be performed in conjunction with other on-island activities to minimize costs. Each geosynthetic cap will be inspected for signs of erosion, animal burrowing, or other signs of degradation that may affect the integrity of the closure system. This inspection will be conducted at a minimum of every 5 years for 30 years and may be performed following significant seismic events or volcanic eruption on the island as part of the long-term monitoring on the island. Details of the planned inspections and monitoring are described in the *Post-Closure Monitoring and Inspection Plan for Corrective Action Unit 1020, Amchitka Island Mud Pit Release Sites* (NNSA/NSO 2005b) and will be described in subsequent updates to the Long-Term Surveillance and Maintenance Plan developed for Amchitka.

Under Section 18 AAC 75.380(d)(1) of the site cleanup rules, ADEC may require additional action if new information is discovered that leads ADEC to make a determination that the cleanup is not protective of human health, safety, and welfare, or the environment. The remediated mud pit sites may be reopened for further evaluation and cleanup even after site closure, should the cleanup be determined to not be protective of human health, safety, and welfare or the environment. This determination would be based on results of the post-closure inspection and monitoring.

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12.0 References

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Appendix A

Human Health Screening Tables for Contaminants of Potential Concern

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TABLE A-1
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SURFACE WATER IN FALLS CREEK (DRILL SITE D)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (ug/L)	Minimum Detected Conc. (ug/L)	Mean Detected Conc. (ug/L)	95% UCL Conc. (ug/L)	Upland Stream Background Conc. (ug/L)	Human Health Screening Value (ug/L)	Exposure Point Conc. (ug/L)	
Metals :									
Chromium +3	20% (1 of 5)	12	ND(1.0)	2.8	316.63	3.49 b	11 e	10.29	b
Chromium +6								1.71	b

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

e - One-tenth USEPA Region III risk-based concentrations for tap water (online, 2001).

TABLE A-2
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN FALLS CREEK (DRILL SITE D)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)	
Petroleum Hydrocarbons:										
Diesel Range Organics	20%	(1 of 5)	176	ND(4.0)	39.97	31,236	--	20 c	176	
Polycyclic Aromatic Hydrocarbons :										
Benzo(ghi)perylene	20%	(1 of 5)	0.0143	ND(0.0033)	0.0068	0.04	--	NA	0.0143	
Phenanthrene	20%	(1 of 5)	0.125	ND(0.0033)	0.02894	14.15	--	NA	0.125	
Polychlorinated Biphenyls:										
Aroclor 1260	67%	(2 of 3)	0.82	ND(0.033)	0.292166667	4.71E+16		1	0.82	
Metals :										
Cerium	100%	(5 of 5)	14.6	3.71	8.91	19.71		NA	14.6	
Chromium +3	100%	(5 of 5)	226	20.6	67.42	698.92	18.9	50.7 c	193.71	b
Chromium +6									32.29	b
Uranium	20%	(1 of 5)	2.49	ND(0.5)	1.095	6.76		1.6	2.49	

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-3
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN FALLS CREEK (DRILL SITE D)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)	
Polychlorinated Biphenyls :									
Aroclor 1260	100% (2 of 2)	0.183	0.0325	0.10775	NA	--	0.00016	0.183	
Metals :									
Chromium +3	100% (2 of 2)							0.65	b
Chromium +6		0.758	0.312	0.535	NA	0.684	0.41	0.11	b

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

TABLE A-4
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SURFACE WATER IN DRILL SITE D LAKE (DRILL SITE D)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (ug/L)	Minimum Detected Conc. (ug/L)	Mean Detected Conc. (ug/L)	95% UCL Conc. (ug/L)	Upland Stream Background Conc. (ug/L)	Human Health Screening Value (ug/L)	Exposure Point Conc. (ug/L)	
Metals:									
Chromium +3	100% (3 of 3)	11.5	10.5	10.83	12.00	3.49 b	11 e	9.86	c
Chromium +6								1.64	c

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

e - One-tenth USEPA Region III risk-based concentrations for tap water (online, 2001).

TABLE A-5
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN DRILL SITE D LAKE (DRILL SITE D)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)	
Petroleum Hydrocarbons:										
Diesel Range Organics	100%	(5 of 5)	146	66.2	112.9	167.63	--	20 c	146	
Polycyclic Aromatic Hydrocarbons :										
Phenanthrene	80%	(4 of 5)	0.207	0.00588	0.060646	13.10	--	NA	0.207	
Metals :										
Cerium	100%	(5 of 5)	61.4	9.45	36.17	162.47	13	NA	61.4	
Chromium +3	100%	(5 of 5)	695	16.1	420.42	274635.43	18.9	50.7 c	595.71	b
Chromium +6									99.29	b
Thorium	100%	(5 of 5)	16.8	0.91	7.758	221.68	ND	NA	16.8	

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-6
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN DRILL SITE E STREAM (DRILL SITE E)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Petroleum Hydrocarbons:									
Diesel Range Organics	20%	(1 of 5)	22.1	ND(4.0)	7.541	53.54	--	20 c	22.1
Polycyclic Aromatic Hydrocarbons :									
Phenanthrene	20%	(1 of 5)	0.0702	ND(0.0033)	0.017525	2.79	--	NA	0.0702
Metals:									
Cerium	100%	(5 of 5)	19.7	8.03	11.87	18.23	13	NA	18.23

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-7
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN DRILL SITE E STREAM (DRILL SITE E)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals:								
Cesium	100% (3 of 3)	0.036	0.026	0.0317	0.05	ND	NA	0.036

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

TABLE A-8
SUMMARY OF CONSTITUENT OF POTENTIAL CONCERN FOR FISH TISSUE IN LIMPET CREEK (DRILL SITE F)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Upland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Polychlorinated Biphenyls :								
Aroclor 1260	67% (2 of 3)	0.0204	ND(0.01)	0.0118	1.20	--	0.00016	0.0204

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

TABLE A-9
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN BRIDGE CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals :								
Aluminum	100% (5 of 5)	63,900	11,200	33,080	104,823	45,400	7,800 d	63,900

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

d - One-tenth USEPA Region III risk-based concentration for residential soil (on-line, 2001).

TABLE A-10
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN BRIDGE CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals :								
Arsenic (total)	100% (2 of 2)	0.257	0.0508	0.1539	NA	0.127	0.00021	0.257
Arsenic (inorganic)	100% (2 of 2)	0.154	0.0109	0.08245	NA	0.0208	0.00021	0.154
Cerium	50% (1 of 2)	0.088	ND(0.025)	0.05025	NA	0.0280 b	NA	0.088
Cesium	50% (1 of 2)	0.0305	ND(0.025)	0.0215	NA	0.0258 b	NA	0.0305
Thallium	50% (1 of 2)	0.0503	ND(0.025)	0.0314	NA	0.0283 b	0.0095	0.0503
Thorium	50% (1 of 2)	4.06	ND(2.5)	2.655	NA	3.43 b	NA	4.06
Vanadium	100% (2 of 2)	2.6	0.389	1.4945	NA	1.05	0.95	2.6

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

TABLE A-11
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN REED POND (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Petroleum Hydrocarbons:									
Diesel Range Organics	50%	(1 of 2)	42.6	ND(27.4)	28.15	NA	--	20 c	42.6
Metals:									
Cesium	50%	(1 of 2)	5.72	ND(3.42)	3.715	NA	ND	NA	5.72

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-12
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN CLOUDBERRY CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals :									
Beryllium	17%	(1 of 6)	2.9	ND(1.51)	2.11	4.67	ND	0.19 c	2.90
Cesium	17%	(1 of 6)	3.51	ND(1.51)	2.21	5.13	ND	NA	3.51
Thallium	17%	(1 of 6)	4.08	ND(1.51)	2.31	5.59	1 b	0.55 d	4.08

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

d - One-tenth USEPA Region III risk-based concentration for residential soil (on-line, 2001).

TABLE A-13
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN CLOUDBERRY CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals :								
Cerium	33% (1 of 3)	0.031	ND(0.025)	0.019	0.238	0.0280 b	NA	0.031
Thorium	33% (1 of 3)	4.17	ND(2.5)	2.223	211.09	3.43 b	NA	4.17

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

TABLE A-14
SUMMARY OF CONSTITUTENTS OF POTENTIAL CONCERN FOR SEDIMENT IN RAINBOW CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Petroleum Hydrocarbons:									
Diesel Range Organics	80%	(4 of 5)	2110	ND(19.9)	682.87	95,454,212	--	20 c	2110
Polychlorinated Biphenyls :									
Aroclor 1260	50%	(1 of 2)	0.46	ND(0.056)	0.244	NA	--	1 c	0.46

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-15
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN RAINBOW CREEK (LONGSHOT SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Polychlorinated Biphenyls									
Aroclor 1260	100%	(1 of 1)	0.0161	0.0161	0.0161	NA	--	0.00016	0.0161
Metals									
Arsenic (inorganic)	100%	(2 of 2)	0.0236	0.00521	0.01441	NA	0.0208	0.00021	0.0236
Thorium	50%	(1 of 2)	5.4	ND(2.5)	3.325	NA	3.43 b	NA	5.4

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

TABLE A-16
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SURFACE WATER IN CLEVENGER CREEK (MILROW SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (ug/L)	Minimum Detected Conc. (ug/L)	Mean Detected Conc. (ug/L)	95% UCL Conc. (ug/L)	Lowland Stream Background Conc. (ug/L)	Human Health Screening Value (ug/L)	Exposure Point Conc. (ug/L)	
Metals:									
Arsenic	60% (3 of 5)	1.85	ND(1.0)	1.16	3.70	ND(1)	0.0018 c	1.85	c

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth National Recommended Water Quality Criteria for Toxic Pollutants based on ingestion of water and organisms (USEPA, 1999).

TABLE A-17
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN CLEVENGER CREEK (MILROW SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc.	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Petroleum Hydrocarbons:									
Diesel Range Organics	67%	(4 of 6)	542	ND(8.5)	129.89	36,240	--	20 c	542
Metals:									
Aluminum	100%	(6 of 6)	90,600	16,000	33,583	83,564	45,400	7,800 d	83,564
Cerium	100%	(6 of 6)	30.9	7.58	13.39	25.16	14.2	NA	25.26
Cesium	33%	(2 of 6)	4.26	1.8	2.09	3.62	ND	NA	3.62

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

d - One-tenth USEPA Region III risk-based concentration for residential soil (on-line, 2001).

TABLE A-18
SUMMARY OF CONSITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN CLEVENGER CREEK (MILROW SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc.	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Polychlorinated Biphenyls :									
Aroclor 1260	67%	(2 of 3)	0.0094	0.0065	0.0070	0.0187	--	0.00016	0.0094
Metals :									
Arsenic (total)	100%	(3 of 3)	0.225	0.0533	0.1301	16.9956	0.127	0.00021	0.225
Arsenic (inorganic)	100%	(3 of 3)	0.0551	0.0138	0.0319	2.8306	0.0208	0.00021	0.0551
Cesium	67%	(2 of 3)	0.0285	ND(0.025)	0.0224	0.1535	0.0258 b	NA	0.0285

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

TABLE A-19
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN HEART LAKE (MILROW SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Metals :									
Aluminum	100%	(5 of 5)	77,500	29,500	47,020	76,128	45,400	7,800 d	76,128
Cerium	100%	(5 of 5)	16.3	8.29	11.094	15.02	14.2	NA	15.02
Thorium	20%	(1 of 5)	2.045	ND(3.06)	1.655	2.68	0.5	NA	2.045

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

d - One-tenth USEPA Region III risk-based concentration for residential soil (on-line, 2001).

TABLE A-20
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SURFACE WATER IN CANNIKIN LAKE (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (ug/L)	Minimum Detected Conc. (ug/L)	Mean Detected Conc. (ug/L)	95% UCL Conc. (ug/L)	Lowland Stream Background Conc. (ug/L)	Human Health Screening Value (ug/L)	Exposure Point Conc. (ug/L)
Metals:								
Arsenic	100% (3 of 3)	7.53	6.81	7.20	7.95	ND(1)	0.0018 c	7.53
Boron	100% (3 of 3)	468	429	445	486	ND(50)	330 e	468

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth National Recommended Water Quality Criteria for Toxic Pollutants based on ingestion of water and organisms (USEPA, 1999).

e - One-tenth USEPA Region III risk-based concentrations for tap water (online, 2001).

TABLE A-21
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN CANNIKIN LAKE (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)	
Petroleum Hydrocarbons :										
Gasoline Range Organics	33%	(1 of 3)	25.9	ND(5.0)	12.05	4.82E+06	--	10 c	25.9	
Diesel Range Organics	100%	(3 of 3)	4,710	110	2,353	5.92E+19	--	20 c	4710	
Volatile Organic Compounds :										
p-Isopropyltoluene	67%	(2 of 3)	0.304	0.282	0.28	3.44E-01	--	NA	0.304	
Polycyclic Aromatic Hydrocarbons :										
Phenanthrene	67%	(2 of 3)	12.1	ND(0.00798)	5.48	2.06E+80	--	NA	12.1	
Polychlorinated Biphenyls:										
Aroclor 1248	33%	(1 of 3)	0.185	0.0816	0.09	1.13E+03	--	1 c	0.185	
Aroclor 1260	67%	(2 of 3)	0.107	0.104	0.09	2.47E-01	--	1 c	0.107	
Metals:										
Aluminum	100%	(3 of 3)	55,900	29,300	44,200	1.33E+05	45,400	7,800	55,900	
Cerium	100%	(3 of 3)	21.10	4.73	14.18	6.18E+03	14.2	NA	21.10	
Cesium	33%	(1 of 3)	1.11	ND(0.5)	0.40	5.05E+15	ND	NA	1.11	
Chromium +3	100%	(3 of 3)	257	13.8	174.60	8.97E+13	11.8	50.7 c	220.29	b
Chromium +6									36.71	b
Thorium	67%	(2 of 3)	2.81	ND(1.21)	1.76	6.71E+19	0.5 b	NA	2.81	

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Total Chromium concentration partitioned as six parts Trivalent Chromium (Chromium +3) and one part Hexavalent Chromium (Chromium +6)

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

TABLE A-22
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN CANNIKIN LAKE (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Polychlorinated Biphenyls :									
Aroclor 1260	100%	(2 of 2)	0.0248	0.019	0.0219	NA	--	0.00016	0.0248
Metals:									
Thallium	50%	(1 of 2)	0.05	ND(0.05)	0.0375	NA	0.0283 b	0.0095	0.05

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

b - Maximum detected concentration in background samples due to insufficient detection frequency to calculate UTL .

TABLE A-23
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SURFACE WATER IN WHITE ALICE CREEK (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (ug/L)	Minimum Detected Conc. (ug/L)	Mean Detected Conc. (ug/L)	95% UCL Conc. (ug/L)	Lowland Stream Background Conc. (ug/L)	Human Health Screening Value (ug/L)	Exposure Point Conc. (ug/L)
Metals:								
Arsenic	40% (2 of 5)	6.42	ND(1.0)	2.54	203.15	ND(1)	0.0018 c	6.42 c

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth National Recommended Water Quality Criteria for Toxic Pollutants based on ingestion of water and organisms (USEPA, 1999).

TABLE A-24
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR SEDIMENT IN WHITE ALICE CREEK (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency		Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Petroleum Hydrocarbons :									
Diesel Range Organics	100%	(5 of 5)	116	32.6	54.44	117.90	--	20 c	116
Metals:									
Aluminum	100%	(5 of 5)	68,300	6,480	44,856	545,414	45,400	7,800 d	68,300
Arsenic	80%	(4 of 5)	109	ND(5.86)	46.686	9097.59	100	0.55 c	109

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

c - One-tenth State of Alaska soil clean-up level, Discharge Reporting, Cleanup, and Disposal of Oil and other Hazardous Substances (18 AAC 75, Articles 3 and 9)

d - One-tenth USEPA Region III risk-based concentration for residential soil (on-line, 2001).

TABLE A-25
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN FOR FISH TISSUE IN WHITE ALICE CREEK (CANNIKIN SITE)
Amchitka Island, Alaska

Constituent of Potential Concern	Detection Frequency	Maximum Detected Conc. (mg/kg)	Minimum Detected Conc. (mg/kg)	Mean Detected Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Lowland Stream Background Conc. (mg/kg)	Human Health Screening Value (mg/kg)	Exposure Point Conc. (mg/kg)
Polychlorinated Biphenyls :								
Aroclor 1260	100% (5 of 5)	0.0394	0.0115	0.02036	0.0443	--	0.00016	0.0394
Metals:								
Arsenic (total)	80% (4 of 5)	0.135	0.0415	0.06726	0.6037	0.127	0.00021	0.135
Arsenic (inorganic)	80% (4 of 5)	0.0457	0.0033	0.0143438	72424.2935	0.0208	0.00021	0.0457
Boron	100% (5 of 5)	37.2	9.08	16.376	39.9822	28.6	12	37.2

ND - Not detected (detection limit), NA - Not available, -- Not analyzed

TABLE A-26
SURFACE WATER IN FALLS CREEK (DRILL SITE D)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals :												
Chromium +3	3.59E-07	1.68E-05	1.24E-06	2.90E-06	2.83E-07	6.61E-07	NA	5.59E-04	NA	1.93E-06	NA	2.20E-05
Chromium +6	5.98E-08	2.79E-06	2.07E-07	4.83E-07	4.72E-08	1.10E-07	NA	4.66E-02	NA	1.56E-04	NA	1.84E-03
TOTAL :							**0.00E+00**	**4.71E-02**	**0.00E+00**	**1.58E-04**	**0.00E+00**	**1.86E-03**
TOTAL CUMULATIVE CANCER RISK :							**0.00E+00**		**0.00E+00**			
TOTAL CUMULATIVE HAZARD INDEX :							**4.71E-02**		**2.02E-03**			

NA - Not Applicable

TABLE A-27
SEDIMENT IN FALLS CREEK (DRILL SITE D)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	9.83E-06	4.59E-04	5.31E-06	1.24E-05	9.69E-06	2.26E-05	NA	1.15E-02	NA	3.10E-04	NA	5.65E-04
Polycyclic Aromatic Hydrocarbons :												
Benzo(ghi)perylene	7.98E-10	3.73E-08	4.32E-10	1.01E-09	7.88E-10	1.84E-09	NA	NA	NA	NA	NA	NA
Phenanthrene	6.98E-09	3.26E-07	3.77E-09	8.81E-09	6.88E-09	1.61E-08	NA	8.15E-06	NA	2.20E-07	NA	4.02E-07
Polychlorinated Biphenyls:												
Aroclor 1260	6.41E-08	2.99E-06	2.48E-08	5.78E-08	6.32E-08	1.48E-07	1.28E-07	NA	4.95E-08	NA	1.26E-07	NA
Metals :												
Cerium	8.15E-08	3.81E-06	4.41E-07	1.03E-06	8.04E-08	1.88E-07	NA	NA	NA	NA	NA	NA
Chromium +3	1.08E-06	5.05E-05	5.85E-06	1.36E-05	1.07E-06	2.49E-06	NA	1.68E-03	NA	9.10E-06	NA	8.30E-05
Chromium +6	1.80E-07	8.42E-06	9.75E-07	2.27E-06	1.78E-07	4.15E-07	NA	1.40E-01	NA	7.34E-04	NA	6.91E-03
Uranium	1.39E-08	6.49E-07	7.52E-08	1.75E-07	1.37E-08	3.20E-08	NA	NA	NA	NA	NA	NA
TOTAL[a] :							**1.28E-07**	**1.42E-01**	**4.95E-08**	**7.43E-04**	**1.26E-07**	**7.00E-03**
TOTAL CUMULATIVE CANCER RISK :							**1.28E-07**		**1.76E-07**			
TOTAL CUMULATIVE HAZARD INDEX :							**1.42E-01**		**7.74E-03**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

TABLE A-28
SURFACE WATER IN DRILL SITE D LAKE (DRILL SITE D)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals:												
Chromium +3	3.44E-07	1.61E-05	1.19E-06	2.78E-06	2.71E-07	6.33E-07	NA	5.36E-04	NA	1.85E-06	NA	2.11E-05
Chromium +6	5.73E-08	2.68E-06	1.98E-07	4.63E-07	4.52E-08	1.06E-07	NA	4.46E-02	NA	1.49E-04	NA	1.76E-03
					TOTAL :		**0.00E+00**	**4.52E-02**	**0.00E+00**	**1.51E-04**	**0.00E+00**	**1.78E-03**
			TOTAL CUMULATIVE CANCER RISK :				**0.00E+00**		**0.00E+00**			
			TOTAL CUMULATIVE HAZARD INDEX :				**4.52E-02**		**1.93E-03**			

NA - Not Applicable

TABLE A-29
SEDIMENT IN DRILL SITE D LAKE (DRILL SITE D)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent Of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	8.15E-06	3.81E-04	4.41E-06	1.03E-05	8.04E-06	1.88E-05	NA	9.52E-03	NA	2.57E-04	NA	4.69E-04
Polycyclic Aromatic Hydrocarbons :												
Phenanthrene	1.16E-08	5.40E-07	6.25E-09	1.46E-08	1.14E-08	2.66E-08	NA	1.35E-05	NA	3.65E-07	NA	6.65E-07
Metals :												
Cerium	3.43E-07	1.60E-05	1.85E-06	4.33E-06	3.38E-07	7.89E-07	NA	NA	NA	NA	NA	NA
Chromium +3	3.33E-06	1.55E-04	1.80E-05	4.20E-05	3.28E-06	7.65E-06	NA	5.18E-03	NA	2.80E-05	NA	2.55E-04
Chromium +6	5.54E-07	2.59E-05	3.00E-06	6.99E-06	5.47E-07	1.28E-06	NA	4.32E-01	NA	2.26E-03	NA	2.13E-02
Thorium	9.38E-08	4.38E-06	5.07E-07	1.18E-06	9.25E-08	2.16E-07	NA	NA	NA	NA	NA	NA
					TOTAL [a]:		**0.00E+00**	**4.37E-01**	**0.00E+00**	**2.28E-03**	**0.00E+00**	**2.15E-02**
					TOTAL CUMULATIVE CANCER RISK :		**0.00E+00**		**0.00E+00**			
					TOTAL CUMULATIVE HAZARD INDEX :		**4.37E-01**		**2.38E-02**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

TABLE A-30
SEDIMENT IN DRILL SITE E STREAM (DRILL SITE E)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	1.23E-06	5.76E-05	6.67E-07	1.56E-06	1.22E-06	2.84E-06	NA	1.44E-03	NA	3.89E-05	NA	7.10E-05
Polycyclic Aromatic Hydrocarbons :												
Phenanthrene	3.92E-09	1.83E-07	2.12E-09	4.95E-09	3.87E-09	9.02E-09	NA	4.58E-06	NA	1.24E-07	NA	2.26E-07
Metals:												
Cerium	1.02E-07	4.75E-06	5.50E-07	1.28E-06	1.00E-07	2.34E-07	NA	NA	NA	NA	NA	NA
					TOTAL [a]:		**0.00E+00**	**4.58E-06**	**0.00E+00**	**1.24E-07**	**0.00E+00**	**2.26E-07**
					TOTAL CUMULATIVE CANCER RISK :		**0.00E+00**		**0.00E+00**			
					TOTAL CUMULATIVE HAZARD INDEX :		**4.58E-06**		**3.49E-07**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

TABLE A-31
SEDIMENT IN BRIDGE CREEK (LONGSHOT SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals :												
Aluminum	3.57E-04	1.67E-02	1.93E-03	4.50E-03	3.52E-04	8.21E-04	NA	NA	NA	NA	NA	NA
TOTAL :							**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
TOTAL CUMULATIVE CANCER RISK :							**0.00E+00**		**0.00E+00**			
TOTAL CUMULATIVE HAZARD INDEX :							**0.00E+00**		**0.00E+00**			

NA - Not Applicable

TABLE A-32
SEDIMENT IN REED POND, LONGSHOT SITE
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	2.38E-06	1.11E-04	1.29E-06	3.00E-06	2.35E-06	5.47E-06	NA	2.78E-03	NA	7.50E-05	NA	1.37E-04
Metals:												
Cesium	3.19E-08	1.49E-06	1.73E-07	4.03E-07	3.15E-08	7.35E-08	NA	NA	NA	NA	NA	NA
TOTAL[a] :							**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
TOTAL CUMULATIVE CANCER RISK :							**0.00E+00**		**0.00E+00**			
TOTAL CUMULATIVE HAZARD INDEX :							**0.00E+00**		**0.00E+00**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

TABLE A-33
SEDIMENT IN CLOUDBERRY CREEK (LONGSHOT SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals :												
Beryllium	1.62E-08	7.56E-07	8.76E-08	2.04E-07	1.60E-08	3.73E-08	6.96E-08	NA	3.77E-07	NA	6.87E-08	NA
Cesium	1.96E-08	9.15E-07	1.06E-07	2.47E-07	1.93E-08	4.51E-08	NA	NA	NA	NA	NA	NA
Thallium	2.28E-08	1.06E-06	1.23E-07	2.87E-07	2.25E-08	5.24E-08	NA	1.18E-02	NA	3.19E-03	NA	5.83E-04
					TOTAL :		**6.96E-08**	**1.18E-02**	**3.77E-07**	**3.19E-03**	**6.87E-08**	**5.83E-04**
			TOTAL CUMULATIVE CANCER RISK :				**6.96E-08**		**4.45E-07**			
			TOTAL CUMULATIVE HAZARD INDEX :				**1.18E-02**		**3.78E-03**			

NA - Not Applicable

TABLE A-34
SEDIMENT IN RAINBOW CREEK (LONGSHOT SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	1.18E-04	5.50E-03	6.37E-05	1.49E-04	1.16E-04	2.71E-04	NA	1.38E-01	NA	3.72E-03	NA	6.78E-03
Polychlorinated Biphenyls :												
Aroclor 1260	3.60E-08	1.68E-06	1.39E-08	3.24E-08	3.55E-08	8.28E-08	7.19E-08	NA	2.78E-08	NA	7.09E-08	NA
TOTAL[a]:							**7.19E-08**	**0.00E+00**	**2.78E-08**	**0.00E+00**	**7.09E-08**	**0.00E+00**
TOTAL CUMULATIVE CANCER RISK :							**7.19E-08**		**9.87E-08**			
TOTAL CUMULATIVE HAZARD INDEX :							**0.00E+00**		**0.00E+00**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission
NA - Not Applicable

TABLE A-35
SURFACE WATER IN CLEVENGER CREEK (MILROW SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals:												
Arsenic	3.23E-08	1.51E-06	2.23E-07	5.21E-07	2.55E-08	5.94E-08	4.84E-08	5.03E-03	3.35E-07	1.74E-03	3.82E-08	1.98E-04
					TOTAL :		**4.84E-08**	**5.03E-03**	**3.35E-07**	**1.74E-03**	**3.82E-08**	**1.98E-04**
			TOTAL CUMULATIVE CANCER RISK :				**4.84E-08**		**3.73E-07**			
			TOTAL CUMULATIVE HAZARD INDEX :				**5.03E-03**		**1.94E-03**			

NA - Not Applicable

TABLE A-36
SEDIMENT IN CLEVENGER CREEK (MILROW SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons:												
Diesel Range Organics	3.03E-05	1.41E-03	1.64E-05	3.82E-05	2.98E-05	6.96E-05	NA	3.53E-02	NA	9.55E-04	NA	1.74E-03
Metals:												
Aluminum	4.67E-04	2.18E-02	2.52E-03	5.89E-03	4.60E-04	1.07E-03	NA	NA	NA	NA	NA	NA
Cerium	1.41E-07	6.59E-06	7.63E-07	1.78E-06	1.39E-07	3.25E-07	NA	NA	NA	NA	NA	NA
Cesium	2.02E-08	9.44E-07	1.09E-07	2.55E-07	1.99E-08	4.65E-08	NA	NA	NA	NA	NA	NA
					TOTAL[a] :		**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
					TOTAL CUMULATIVE CANCER RISK :		**0.00E+00**		**0.00E+00**			
					TOTAL CUMULATIVE HAZARD INDEX :		**0.00E+00**		**0.00E+00**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission
NA - Not Applicable

TABLE A-37
SEDIMENT IN HEART LAKE (MILROW SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals :												
Aluminum	4.25E-04	1.99E-02	2.30E-03	5.36E-03	4.19E-04	9.78E-04	NA	NA	NA	NA	NA	NA
Cerium	8.39E-08	3.92E-06	4.53E-07	1.06E-06	8.27E-08	1.93E-07	NA	NA	NA	NA	NA	NA
Thorium	1.14E-08	5.33E-07	6.17E-08	1.44E-07	1.13E-08	2.63E-08	NA	NA	NA	NA	NA	NA
					TOTAL:		**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
			TOTAL CUMULATIVE CANCER RISK :				**0.00E+00**		**0.00E+00**			
			TOTAL CUMULATIVE HAZARD INDEX :				**0.00E+00**		**0.00E+00**			

NA - Not Applicable

TABLE A-38
SURFACE WATER IN CANNIKIN LAKE (CANNIKIN SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals:												
Arsenic	1.31E-07	6.14E-06	9.09E-07	2.12E-06	1.04E-07	2.42E-07	1.97E-07	2.05E-02	1.36E-06	7.07E-03	1.56E-07	8.06E-04
Boron	8.17E-06	3.81E-04	5.65E-05	1.32E-04	6.44E-06	1.50E-05	NA	4.24E-03	NA	1.47E-03	NA	1.67E-04
					TOTAL :		**1.97E-07**	**2.47E-02**	**1.36E-06**	**8.54E-03**	**1.56E-07**	**9.73E-04**
			TOTAL CUMULATIVE CANCER RISK :				**1.97E-07**		**1.52E-06**			
			TOTAL CUMULATIVE HAZARD INDEX :				**2.47E-02**		**9.51E-03**			

NA - Not Applicable

TABLE A-39
SEDIMENT IN CANNIKIN LAKE (CANNIKIN SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons :												
Gasoline Range Organics	1.45E-06	6.75E-05	7.82E-07	1.82E-06	1.43E-06	3.33E-06	NA	3.38E-04	NA	9.12E-06	NA	1.66E-05
Diesel Range Organics	2.63E-04	1.23E-02	1.42E-04	3.32E-04	2.59E-04	6.05E-04	NA	3.07E-01	NA	8.30E-03	NA	1.51E-02
Volatile Organic Compounds :												
p-Isopropyltoluene	1.70E-08	7.93E-07	9.18E-09	2.14E-08	1.67E-08	3.91E-08	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons :												
Phenanthrene	6.76E-07	3.16E-05	3.65E-07	8.52E-07	6.66E-07	1.55E-06	NA	7.89E-04	NA	2.13E-05	NA	3.89E-05
Polychlorinated Biphenyls:												
Aroclor 1248	1.45E-08	6.75E-07	5.59E-09	1.30E-08	1.43E-08	3.33E-08	2.89E-08	NA	1.12E-08	NA	2.85E-08	NA
Aroclor 1260	8.36E-09	3.91E-07	3.23E-09	7.54E-09	8.25E-09	1.92E-08	1.67E-08	NA	6.46E-09	NA	1.65E-08	NA
Metals:												
Aluminum	3.12E-04	1.46E-02	1.69E-03	3.94E-03	3.08E-04	7.18E-04	NA	NA	NA	NA	NA	NA
Cerium	1.18E-07	5.50E-06	6.37E-07	1.49E-06	1.16E-07	2.71E-07	NA	NA	NA	NA	NA	NA
Cesium	6.20E-09	2.89E-07	3.35E-08	7.82E-08	6.11E-09	1.43E-08	NA	NA	NA	NA	NA	NA
Chromium +3	1.23E-06	5.75E-05	6.65E-06	1.55E-05	1.21E-06	2.83E-06	NA	1.92E-03	NA	1.03E-05	NA	9.44E-05
Chromium +6	2.05E-07	9.58E-06	1.11E-06	2.59E-06	2.02E-07	4.72E-07	NA	1.60E-01	NA	8.34E-04	NA	7.86E-03
Thorium	1.57E-08	7.33E-07	8.48E-08	1.98E-07	1.55E-08	3.61E-08	NA	NA	NA	NA	NA	NA
					TOTAL[a] :		**4.57E-08**	**1.62E-01**	**1.76E-08**	**8.66E-04**	**4.50E-08**	**8.00E-03**
					TOTAL CUMULATIVE CANCER RISK :		**4.57E-08**		**6.27E-08**			
					TOTAL CUMULATIVE HAZARD INDEX :		**1.62E-01**		**8.86E-03**			

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

TABLE A-40
FISH TISSUE IN CANNIKIN LAKE (CANNIKIN SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

Constituent of Potential Concern	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Adult Ingestion (mg/kg/day)	Non-Cancer CDI From Adult Ingestion (mg/kg/day)	Carcinogenic CDI From Child Ingestion (mg/kg/day)	Non-Cancer CDI From Child Ingestion (mg/kg/day)	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Adult Ingestion	Non-Cancer Hazard From Adult Ingestion	Carcinogenic Risk From Child Ingestion	Non-Cancer Hazard From Child Ingestion
Polychlorinated Biphenyls :												
Aroclor 1260	5.16E-08	2.41E-06	5.47E-06	1.28E-05	1.09E-06	1.27E-05	1.03E-07	NA	1.09E-05	NA	2.18E-06	NA
Metals:												
Thallium	1.04E-07	4.86E-06	1.10E-05	2.57E-05	2.20E-06	2.57E-05	NA	5.40E-02	NA	2.86E-01	NA	2.85E-01
					TOTAL :		**1.03E-07**	**5.40E-02**	**1.09E-05**	**2.86E-01**	**2.18E-06**	**2.85E-01**
			TOTAL CUMULATIVE CANCER RISK :				**1.03E-07**		**1.31E-05**			
			TOTAL CUMULATIVE HAZARD INDEX :				**5.40E-02**		**5.71E-01**			

NA - Not Applicable

TABLE A-41
SURFACE WATER IN WHITE ALICE CREEK (CANNIKIN SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Metals:												
Arsenic	1.12E-07	5.23E-06	7.75E-07	1.81E-06	8.84E-08	2.06E-07	1.68E-07	1.74E-02	1.16E-06	6.03E-03	1.33E-07	6.87E-04
					TOTAL :		**1.68E-07**	**1.74E-02**	**1.16E-06**	**6.03E-03**	**1.33E-07**	**6.87E-04**
			TOTAL CUMULATIVE CANCER RISK :				**1.68E-07**		**1.30E-06**			
			TOTAL CUMULATIVE HAZARD INDEX :				**1.74E-02**		**6.72E-03**			

NA - Not Available

TABLE A-42
SEDIMENT IN WHITE ALICE CREEK (CANNIKIN SITE)
EXPOSURES, RISKS, AND HEALTH HAZARDS
Amchitka Island, Alaska

	EXPOSURE						RISK/HAZARD					
	USFWS Worker		Part-time Subsistence User				USFWS Worker		Part-time Subsistence User			
Constituent of Potential Concern	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic CDI From Ingestion (mg/kg/day)	Non-Cancer CDI From Ingestion (mg/kg/day)	Carcinogenic CDI From Dermal (mg/kg/day)	Non-Cancer CDI From Dermal (mg/kg/day)	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal	Carcinogenic Risk From Ingestion	Non-Cancer Hazard From Ingestion	Carcinogenic Risk From Dermal	Non-Cancer Hazard From Dermal
Petroleum Hydrocarbons :												
Diesel Range Organics	6.48E-06	3.03E-04	3.50E-06	8.17E-06	6.39E-06	1.49E-05	NA	7.56E-03	NA	2.04E-04	NA	3.73E-04
Metals:												
Aluminum	3.81E-04	1.78E-02	2.06E-03	4.81E-03	3.76E-04	8.78E-04	NA	NA	NA	NA	NA	NA
Arsenic	1.83E-06	8.53E-05	3.29E-06	7.68E-06	1.80E-06	4.20E-06	2.74E-06	2.84E-01	4.94E-06	2.56E-02	2.70E-06	1.40E-02
TOTAL[a] :							**2.74E-06**	**2.84E-01**	**4.94E-06**	**2.56E-02**	**2.70E-06**	**1.40E-02**
TOTAL CUMULATIVE CANCER RISK :							**2.74E-06**		**7.64E-06**			
TOTAL CUMULATIVE HAZARD INDEX :								**2.84E-01**		**3.96E-02**		

[a] Petroleum Hydrocarbons are not included in the Cummulation Risk/Hazard totals as per Alaska Department of Environmental Commission

NA - Not Applicable

Appendix B

Nevada Environmental Restoration Project
Document Review Sheet

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1. Document Title/Number *Record of Decision for Amchitka Surface Closure, Alaska*			2. Document Date December, 2004	
3. Revision Number ____			4. Originator/Organization Jeff Brownlee	
5. Responsible NNSA/NSO ERP Subproject Mgr. John B. Jones, Pete Sanders			6. Date Comments Due _____	
7. Review Criteria _____				
8. Reviewer/Organization/Phone No. _____			9. Reviewer's Signature _____	
10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
1.		The test sites are located in the Alaska Maritime Wildlife Refuge, which is managed by the US Fish and Wildlife Service (USFW). Due to the nature of the sites and need for institutional controls and long term monitoring and management, DEC must ensure that DOE and USFW are in agreement on these issues. Thus, we need written concurrence from the USFW on the surface closure especially with respect to future institutional controls.	DOE will submit the final ROD to the USFSW for concurrence.	
2.		The signature page needs to include a clause above the DEC signature block stating, " The State of Alaska, through the Department of Environmental conservation, agrees with this Record of Decision. This decision may be reviewed and modified in the future if new information becomes available that indicates the site may pose an unacceptable risk to human health, safety, and welfare, or the environment.	Will incorporate.	
3. Section 1		Section 1.0 states that a comprehensive survey of the test sites was conducted in 2000- 2001 and resulted in sixteen monitoring wells being plugged and abandoned and concludes, "There are no other known monitoring wells open or active on Amchitka Island." The Amchitka Island Surface Closure Report (2003) notes the sixteen wells there were closed were all shallow PVC monitoring wells. DEC staff present during portions of the fieldwork recall deeper, steel cased wells that were not plugged and abandoned. A table is attached listing bore holes and wells, their locations, depths, whether they had been sealed and additional notes. Please verify the status of these boreholes and wells to ensure the accuracy of the statement that no monitoring wells remain on the island. If any wells or bore holes remain they should be closed or properly secured. It would help to include Figures showing the locations of each shot cavity, unused emplacement holes, observation holes, wells, etc. The table notes numerous holes, including unused emplacement holes, and wells were backfilled with drilling muds, which contain diesel fuel. This information should be verified, compiled, and provided to USFW to document what remains in the ground.	This comment is being addressed in the Subsurface Completion Report.	

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3. Revision Number ____			4. Originator/Organization Jeff Brownlee	
5. Responsible NNSA/NSO ERP Subproject Mgr. John B. Jones, Pete Sanders			6. Date Comments Due _____	
7. Review Criteria _____				
8. Reviewer/Organization/Phone No. _____			9. Reviewer's Signature _____	
10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
4. Section 3		Section 3.0 describes tritium as a potential contaminant of concern that is was found in surface water and shallow groundwater shortly after the Long Shot test, concentrations have been decreasing and are below drinking water standards. The document should include additional details on the low potential for radionuclide transport to the surface or shallow subsurface (depth of shots, groundwater flow regime, lack of a transport mechanism).	Tritium is not a potential contaminant of concern, as that term has a specific risk meaning. The text has been changed to delete the heading “Tritium as a Potential Contaminant of Concern”. The following text has been added to the third full paragraph on page 6, ending in Wheatcraft, 1995). The source of tritium in surface water at Longshot was believed to be gases that migrated to the top of the Long Shot chimney shortly after the shot. As the chimney filled with water, it is postulated that the gases were pushed upward through stemming material, out into the spall zone, and then dissolved in groundwater (Castagnola, 1969). This upward spreading of the gaseous radionuclide source has not been included in the DRI model. In addition, as there is a strong component of downward vertical flow, the path length for any particles placed higher in the chimney could be longer than that obtained by starting them in the cavity (Hassan, Pohlmann and Chapman, 2002). The downward vertical flow of the freshwater flow path has been confirmed for Amchitka through the measurement of hydraulic head, which decreases with increasing depth and analysis of temperature logs, which indicate downward movement of cooler water (Hassan, Pohlmann and Chapman, 2002). The end result is that the downward flow of the freshwater prevents any contaminants from reaching the surface. Added to ROD Citations: Hassan, Pohlmann and Chapman, 2002, Modeling Groundwater Flow and Transport of Radionuclides at Amchitka Island’s Underground Nuclear Tests: Milrow, Long Shot, and Cannikin, October 2002	

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7. Review Criteria _____				
8. Reviewer/Organization/Phone No. _____			9. Reviewer's Signature _____	
10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
5. Sections 4 and 5		Sections 4 and 5 should be expanded, both the text and Table 1, to address all of the contaminants of potential concern (COPCs) and environmental media that were evaluated in the risk assessment. The current version is focused on diesel range organics (DRO) Page eleven notes, " DRO, other organics, metals, and PCBs" were evaluated in the risk assessment, but there is no clear description of the specific COPCs or the range of concentrations they were found in various media.	Incorporated, the following language has been added to section 4, at the end of the first paragraph: While the only COC above ADEC clean up levels is DRO in the mud pits, a number of other Contaminants of Potential Concern (COPC) were evaluated. While none of these additional COPC's, which include various other metals (primarily aluminum, arsenic and), organics (PAHs and a few VOCs), and PCB's (primarily Aroclor 1260) were found to be above ADEC clean up levels, they were evaluated and addressed in the Mud Pit Risk Assessment. A detailed break down of these COPC's are included in the Summary of Constituents of Potential Concern in Tables of Appendix A to the Mud Pit Risk Assessment, and are included in this ROD as Attachment A. This table is organized by media and site then identifies each of the COPC's including the detection frequency, maximum, minimum, and mean detected concentration, as well as background and exposure point information. Further information about the Risk Assessment is presented in Section 5 of this document. The remainder of this section concentrates on the remediation of the DRO contaminants in the mud pits that occurred in 2001. The following text has been added to Section 5 Page 11 2nd paragraph change to read: "Based on past use and expected future use of the island, the risk assessment considered two potentially exposed human populations: USFWS workers/residents and part-time subsistence users. The COPC's for human health exposure were DRO, other organics, metals, and PCB's. The Summary of Constituents of Potential Concern is included in Tables of Appendix A to the Mud Pit Risk Assessment, and are attached to this ROD as Attachment A. The source of risk at Rainbow Creek was aroclor-1260 in sediment, and at Cannikin Lake was Aroclor -1260 in fish tissue. Arsenic in sediment was the source of Risk at White Alice Creek and Arsenic in surface water was the source of risk at Clevenger Creek. All historic drinking water use on the island has been from Constantine Spring in the base camp area. The assumed populations and exposure pathways are shown in Table 2."	

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8. Reviewer/Organization/Phone No. _____			9. Reviewer's Signature _____	
10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
6. Section 11		Section 11 describes inspection, monitoring and maintenance plans for the drilling mud pits that were closed in place. It states inspections will be conducted every five years. DEC recommends this be revised to include inspections at least every five years and after any major seismic events for the next thirty years. Then, based on the stability of the cells, DEC and DOE may agree to decrease or suspend future inspections or monitoring.	Section 11 Page 27 1st paragraph replace “every five years” with “at a minimum of every 5 years for 30 years and may be performed following significant seismic events and/or volcanic eruption on the island” .	