Appendix I

Data Quality Objectives for Long-Term Monitoring of Biota—Amchitka, Alaska, Site

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I1.0 Introduction

Responsible management decisions regarding environmental response activities must be based on valid and relevant data and careful interpretation of the data. This process of data analysis and interpretation allows managers to determine if the available actions are likely to result in environmental benefits. This data quality objective (DQO) process will outline the intent of the monitoring, highlight the appropriate conditions for action, and provide information relevant to the decision that is to be made.

These DQOs are being developed to define the continued monitoring (sampling and analytical methods) and data evaluation required to verify that there is no migration of radionuclides from the subsurface nuclear test cavities and that the subsistence food of the Aleut people and the commercial fishing catch are safe. Groundwater modeling has demonstrated that any contaminant migration would occur through groundwater discharging into the ocean, which could result in uptake by the biota and potential introduction into the food chain. Biota monitoring results will guide management decisions on appropriate response actions.

These DQOs define the problem, the limitations of the sampling and analysis program, and the type, quantity, and quality of the data to be collected. As an outcome of the DQO process, a statistical sampling design will be developed. When the Long-Term Surveillance and Maintenance (LTS&M) Plan is accepted, the sampling design will be incorporated in to the Sampling and Analysis Plan (SAP). The draft SAP (Appendix A of the LTS&M Plan) does not currently include the sample design.

The quality assurance/quality control procedures designed to ensure that the data collected are of appropriate quality will follow U.S. Department of Energy (DOE) Office of Legacy Management's Quality Assurance Program Plan (QAPP) (DOE-LM 2008). This plan is flexible; Chapter 5 of the QAPP can accommodate special requirements if necessary for Amchitka sampling.

Previous studies conducted for the Amchitka test sites were focused on evaluating the island's surface and subsurface conditions at each test locale to support remedial action decisions. In 2004, the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) conducted an independent study of the Amchitka test sites and surroundings; CRESP provided valuable data and insight that are included in this plan.

The goal of the LTS&M Plan is to monitor the subsurface test cavities and provide scientific data regarding the safety of subsistence food collected near Amchitka Island. Implementation of this goal is by means of collecting appropriate biota samples, analyzing the samples for pertinent radionuclide concentrations, evaluating the concentration data, and presenting those data in a clear, easily understood format.

Figure I−1 shows the Amchitka conceptual model for contaminant migration and biota uptake of radionuclides remaining from the U.S. Atomic Energy Commission (AEC) testing. Previous studies (summarized in Section 3.5.2.1 of the LTS&M Plan) have concluded that there is no radionuclide leakage from the deep cavities to the island's surface sediments or waters. The conceptual model is based on biota uptake via the Pacific Ocean or Bearing Sea pathways.

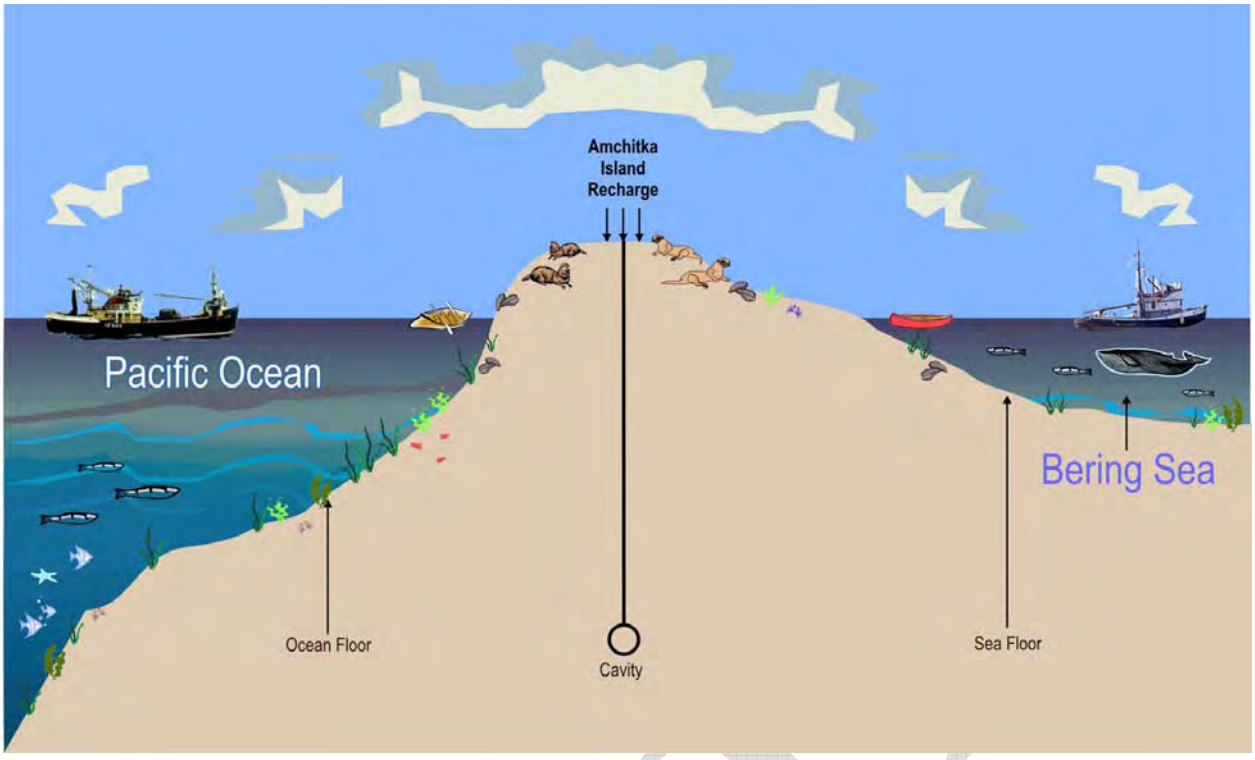

Figure I−1. Idealized Conceptual Model[a]

[a]This figure is not to scale. The potential migration pathway is within the proposed 300-foot sampling zone. The estimated migration distance was the determining factor for the 300 feet.

I2.0 The DQO Process

Development of DQOs will define the continued monitoring, sampling, analytical methods, and data evaluation necessary to assess if radionuclides from AEC testing deep beneath Amchitka Island are present in the subsistence food web at levels that are considered detrimental to the Aleut diet[1].

I2.1 State the Problem

Specify the monitoring strategy (sampling, analysis, analytical methods, and data evaluation) necessary to:

- Measure concentrations of selected radionuclides in subsistence[2] food harvested near Amchitka Island to establish baseline[3] concentrations or for comparison with baseline data.

[1] Several other potential sources of chemical and radiological contamination within the Bearing Sea could and most likely have entered the food chain.
[2] Concern has also been raised regarding exposure to the general populace from distribution of the commercial catch from the Bering Sea area. Upon examination of the current concentrations in the Bering Sea/Pacific Ocean, and the distribution of the catch among the population, monitoring the subsistence Aleut diet where consumption is concentrated is more relevant to this LTS&M specification.
[3] Baseline levels are derived or historical measured concentrations adopted by DOE, ADEC, USWFS, APIA, and stakeholders.

- Determine if the nuclear testing beneath Amchitka Island is a source of detected radionuclide concentrations above baseline.
- Compare detected radionuclide concentrations with levels considered safe for human food intake consistent with the Aleut diet.

I2.2 Identify the Decision

The decision required for the Amchitka test site is what actions need to be taken if radionuclides from subsurface AEC testing are identified and if the radionuclide concentrations are a risk to human health.

The Decision Statement: Radionuclide concentrations that increase above current baselines may require one or more actions in combination:

- Continue monitoring,
- Increase monitoring frequency and/or modify the list of analytes, media sampled, or analytical methods,
- Investigate the source of the increase, or
- Issue warnings, as necessary, if radionuclide levels exceed safe human health levels.

I3.0 Inputs to the Decision

Answers to the questions listed below provide most of the information required to make an informed action decision if radionuclide concentrations are detected above baseline values. The analytical results from sampled Amchitka biota (mainly the Aleut subsistence diet) provide the primary information.

- What radioisotopes in biota are considered detrimental to the Aleut diet?
- What are these levels?
- How should these levels be determined?
- What biological species are present in the Aleut diet that will also aid in detection of migration from the test cavities?
- What are the appropriate locations/areas to be sampled to detect migration from the test cavities?
- What analytical methods and detection limits are appropriate?
- What evaluation methodology will be used?

The analytical components of the LTS&M monitoring program are the radionuclides for analysis, the species or media to sample, the laboratory analytical methods, and the detection limits. Sample locations and logistics are to be addressed in the Amchitka SAP[4]. The initial LTS&M monitoring is scheduled for 2011. The goal here is to select the media appropriate for sampling and radionuclides for analysis. The results from sampling in 2011 may lead to establishment of new baseline levels for future sampling.

[4] The draft SAP will be finalized after acceptance of the LTS&M Plan.

I3.1 Radionuclides

Studies of nuclear inventories at the DOE Nevada Test Site and the French nuclear test sites in the Pacific Ocean (Mururoa and Fangataufa) (IAEA 1998) were used to compile the radionuclide source term listed in Appendix E Table E−1. A summary rationale for each radionuclide in the source term and those recommended for analysis is given in Table E−2. Isotopes of americium, cesium, hydrogen, iodine, neptunium, strontium, plutonium, technetium, and uranium were selected. Additional considerations, including analytical limitations and laboratory technique, are given in Appendix E for the radionuclides recommended for LTS&M monitoring.

I3.2 Media

Considerations regarding species and media to sample are discussed in Appendix E and are listed in Table E−3 with brief comments for each selection. Most of the biotia selections are based on the subsistence Aleut diet. Table I−1, Aleut Dietary Intake, lists the average number of 3-ounce portions of foods in the annual average subsistence diet of the Aluet people.

I3.3 Laboratory Analytical Methodology

Consideration of laboratory analytical methods and detection limits (minimum detection concentration [MDC] for radionuclides) was included in the discussion of selected radionuclides in Appendix E. Specific information regarding reference methods and MDCs was obtained from communications with GEL Laboratories, Charleston, South Carolina, and the U.S. Environmental Protection Agency (EPA) Radiation and Indoor Environments National Laboratory, Las Vegas, Nevada.

I3.4 Sample Species and Radionuclides Selected for Analysis

DOE received comments on the draft LTS&M Plan (July 2006) in January 2007 (ADEC 2007). A review meeting was held in Anchorage and attended by DOE, Alaska Department of Environmental Conservation (ADEC), Aleutian Pribilof Island Association (APIA), U.S. Fish and Wildlife Service (USFWS), and others on February 13 and 14, 2007. At the meeting, DOE agreed to sample the biota listed in Table I−2 for the radionuclides amercium-241, cesium-137, plutonium-239+240, total uranium, and gross alpha, gross beta, and gross gamma, and tritium (in seawater). The species selected for sampling (mainly from the Aluet subsistence diet) are also recommended for sampling in Appendix E (Table E−3).

During the February 2007 meeting, state regulators voiced the preference for not using the U.S. Food and Drug Administration derived intervention levels as the basis for any future comparisons of data collected as indicators of possible adverse conditions.

Columns 3 and 4 in Table I−3 present the estimated radionuclide concentrations in selected species based on the assumption of 18 ounces of seafood consumption per day for 365 days. The assumed 18-ounce daily Aluet diet is based on 10 ounces of fish, 4 ounces of mammal meat, oils, and poultry, and 2 ounces each of seafood belonging to the mollusk and crustacean groups. These intake amounts are consistent with information shown in Table I−1.

Table I−1. Aleut Dietary Intake

Type of Food	Average Yearly Intake of 3-Ounce Portions	
	Portions	Grams[a]
Halibut (includes cooked and dried)	304	25,854.7
Silver salmon (includes cooked, raw, smoked, dried)	256.8	21,840.4
Red salmon (includes cooked, raw, smoked, dried)	232.9	19,813.4
Pink salmon (includes cooked, raw, smoked, dried)	174.2	14,815.4
Geese (includes geese, Aleutian geese, Canadian geese, Black Brandt geese)	84.9	7,720.6
Dolly Varden/trout	82.5	7,016.5
Seal oil (includes seal oil, harbor/hair seal oil, northern fur seal oil)	61.2	5,204.9
Pintail duck	55.8	4,745.7
Cod	48.5	4,068.2
Reindeer meat	35.5	3,019.2
Putschke	30.5	2,594.0
Badarki	23.1	1,964.6
Mussels	23.1	1,964.6
Black duck	22.0	1,871.1
Pitruske	21.8	1,845.1
Teal	19.4	1,649.9
Sea lion meat	17.8	1,513.8
Scoter duck	14.2	1,207.7
Sea lion oil	12.9	1,097.0
King salmon	12.8	1,088.6
Gull eggs	12.6	1,071.6
High bush salmonberries	10.5	893.0
Moose	9.8	833.0
Blueberries	9.1	773.9
Octopus	8.0	680.4
Crowberries (also called blackberries and mossberries)	7.3	620.8
Sea bass	5.8	504.6
Harbor seal meat	4.5	354.3
Sea urchin	4.0	340.2
King crab	2.2	187.1
Northern fur seal meat	1.8	153.1
Low bush salmonberries	1.5	127.5
Shrimp	0.5	42.5
Snow crab	0.1	8.5

Data taken from Hamrick and Smith (2003)
[a]Column added.

Table I−2. Amchitka Monitoring: Sample Species and Radionuclides Selected for Analysis

Species to be Sampled	Cesium-137 (gamma spectroscopy)	Americium-241	Tritium	Plutonium-239+240	Uranium (total)	Gross Alpha	Gross Beta	Gross Gamma
Biota								
Cod	X	X	Not applicable	X	X	X	X	X
Dolly Varden	X	X	Not applicable	X	X	X	X	X
Greenling (kelp or rock)	X	X	Not applicable	X	X	X	X	X
Halibut	X	X	Not applicable	X	X	X	X	X
Rockfish (black or dusky)	X	X	Not applicable	X	X	X	X	X
Sea Urchin	X	X	Not applicable	X	X	X	X	X
Mussels	X	X	Not applicable	X	X	X	X	X
Chitons (gumboots)	X	X	Not applicable	X	X	X	X	X
Gull eggs	X	X	Not applicable	X	X	X	X	X
Kelp *(Alaria f,. Fucus sp)*	X	X	Not applicable	X	X	X	X	X
Environment								
Seawater	Not applicable	Not applicable	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Table I−3. Amchitka Trigger Table

Species to be Sampled	Radionuclide Analysis	Indicator Level Aleut Diet[a] 4 mrem/yr dose (pCi/kg)	Indicator Level Aleut Diet[a] 500 mrem/yr dose (pCi/kg)	CRESP[b] Amchitka Max Detected (pCi/kg ww[c])	CRESP Kiska Max Detected (pCi/kg ww[c])	Biota Detection Limit	Biota Analytical Method
Cod, Dolly Varden, Greenling (kelp or rock), Halibut, Rockfish (dusky or black)	^{137}Cesium (γ spectroscopy)	720	89,000	489	8.519	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	10	1,200	<MDA[d]	0.781	0.00216 pCi /1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	10	1,200	0.468	<MDA[d]	0.0135 pCi/,1000 min	HASL 300 Pu-11-RC mod
	Total uranium	130	17,000	No data	No data	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3
Sea urchin	^{137}Cesium (γ spectroscopy)	4,300	540,000	<MDA[d]	<MDA[d]	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	60	7,500	<MDA[d]	<MDA[d]	0.00216 pCi /1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	60	7,500	Not sampled	Not sampled	0.0135 pCi/1,000 min	HASL 300 Pu-11-RC mod
	Total uranium	800	99,000	Not sampled	Not sampled	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3

[a]Based on a daily Aluet diet of fish/mammals and poultry/crustaceans/mollusks in the proportion of 10 oz/4 oz/2 oz/2 oz, respectively
[b]CRESP data. Results found to be false positives by CRESP are excluded from the table.
[c]ww = wet weight
[d]"<MDA" indicates that all samples were below the minimum detectable activity for the particular radionuclide.
pCi/kg = picocuries per kilogram
mrem/yr = millirem per year

Table I−3 (continued). Amchitka Trigger Table

Species to be Sampled	Radionuclide Analysis	Indicator Level Aleut Diet[a] 4 mrem/yr dose (pCi/kg)	Indicator Level Aleut Diet[a] 500 mrem/yr dose (pCi/kg)	CRESP[b] Amchitka Max Detected (pCi/kg ww[c])	CRESP Kiska Max Detected (pCi/kg ww[c])	Biota Detection Limit	Biota Analytical Method
Mussels	^{137}Cesium (γ spectroscopy)	4,300	540,000	<MDA[d]	<MDA[d]	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	60	7,500	<MDA[d]	0.673	0.00216 pCi /1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	60	7,500	1.3	<MDA[d]	0.0135 pCi/1,000 min	HASL 300 Pu-11-RC mod
	Total uranium	800	99,000	Not sampled	Not sampled	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3
Chitons (gumboots)	^{137}Cesium (γ spectroscopy)	4,300	540,000	<MDA[d]	Not sampled	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	60	7,500	<MDA[d]	Not sampled	0.00216 pCi /1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	60	7,500	Not sampled	Not sampled	0.0135 pCi/1,000 min	HASL 300 Pu-11-RC mod
	Total uranium	800	99,000	Not sampled	Not sampled	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3

[a]Based on a daily Aluet diet of fish/mammals and poultry/crustaceans/mollusks in the proportion of 10 oz/4 oz/2 oz/2 oz, respectively
[b]CRESP data. Results found to be false positives by CRESP are excluded from the table.
[c]ww = wet weight
[d]"<MDA" indicates that all samples were below the minimum detectable activity for the particular radionuclide.
pCi/kg = picocuries per kilogram
mrem/yr = millirem per year

Table I−3 (continued). Amchitka Trigger Table

Species to be Sampled	Radionuclide Analysis	Indicator Level Aleut Diet[a] 4 mrem/yr dose (pCi/kg)	Indicator Level Aleut Diet[a] 500 mrem/yr dose (pCi/kg)	CRESP[b] Amchitka Max Detected (pCi/kg ww[c])	CRESP Kiska Max Detected (pCi/kg ww[c])	Biota Detection Limit	Biota Analytical Method
Gull eggs	^{137}Cesium (γ spectroscopy)	4,300	540,000	<MDA[d]	<MDA[d]	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	60	7,500	<MDA[d]	<MDA[d]	0.00216 pCi/1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	60	7,500	Not sampled	Not sampled	0.0135 pCi/1,000 min	HASL 300 Pu-11-RC mod
	Total uranium	800	99,000	Not sampled	Not sampled	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3
Kelp (*Alaria f., Fucus sp.*)	^{137}Cesium (γ spectroscopy)	720	89000	<MDA[d]	<MDA[d]	30 pCi/kg	HASL 300 4.5.2.3
	^{241}Americium	10	1200	0.935	<MDA[d]	0.00216 pCi/1,000 min	HASL 300 Am-05-RC mod
	$^{239+240}$Plutonium	10	1200	5.59	2.39	0.0135 pCi/1,000 min	HASL 300 Pu-11-RC mod
	Total uranium	130	17000	Not sampled	Not sampled	0.0127 pCi/1,000 min	ASTM D5174
	Gross α	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross β	Not applicable	Not applicable	Not sampled	Not sampled	1,000 pCi/kg	EPA 900.0/9310 mod
	Gross γ	Not applicable	Not applicable	Not sampled	Not sampled	30 pCi/kg	HASL 300 4.5.2.3
Seawater	Tritium	Not applicable	Not applicable	Not reported	Not reported	7 pCi/L	HASL-300: 3H-02-RC (seawater)

[a]Based on a daily Aluet diet of fish/mammals and poultry/crustaceans/mollusks in the proportion of 10 oz/4 oz/2 oz/2 oz, respectively
[b]CRESP data. Results found to be false positives by CRESP are excluded from the table.
[c]ww = wet weight
[d]"<MDA" indicates that all samples were below the minimum detectable activity for the particular radionuclide.
pCi/kg = picocuries per kilogram
mrem/yr = millirem per year

The estimates presented in columns 3 and 4 were derived using an approach that essentially back-calculates what the radionuclide concentration would be in specific biota tissue if the annual doses for a human receptor ingesting the contaminated biota are 4 millirem per year (mrem/yr) or 500 mrem/yr, respectively. Dose conversion factors available for the given species were used in this estimation (DOE 2004).

Each estimated value for a radionuclide presented in columns 3 and 4 for a given species is equivalent to the endpoints used (i.e., 4 or 500 mrem/yr) for the calculations. For example, an annual dose of 4 mrem would be estimated if the 10 ounces of fish consumed every day for 365 days is measured to contain about 720 picocuries per kilogram (pCi/kg) of cesium-137. If multiple radionuclides are present at the levels shown in column 3 for fish, the total estimated dose would be 4 mrem times the number of radionuclides present; the calculation is similar for the other species. The total estimated dose would be the sum. For multiple radionuclides with concentrations that differ from those in column 3 (or 4) for fish, the "sum of the ratios" concept would need to be applied to estimate total dose and is beyond the intent of this example calculation.

If the consumption rate differs from the assumed rate, estimated doses would also differ (in columns 3 and 4). For example, if daily fish consumption is 18 ounces instead of 10 ounces, the estimated cesium-137 concentration equivalent to the 4 mrem annual dose endpoint would be lower than the 720 pCi/kg shown in column 3. Conversely, if the daily amount of fish consumed is less than 10 ounces, then the estimated concentration in column 3 would be higher.

The results presented in columns 3 and 4 could be considered as radionuclide indicator levels in biota tissue.

Not included in the media to be sampled although included in the recommendations (Appendix E, Table E−3) were marine and freshwater sediments, groundwater, the Steller sea lion, and silver salmon. The radionuclides selected for analysis included radionuclides recommended in Appendix E but not strontium-90, other plutonium isotopes, neptunium-237, technetium-99, isotopes of iodine, and uranium isotopes. Gross alpha, gross beta, and gross gamma analyses were not recommended in Table E−2.

Table I−3 shows the species selected for sampling and the radionuclides selected for analysis (columns 1 and 2, respectively).

Maximum detected sample results (CRESP 2005 and 2006) for Amchitka samples are listed in column 5, and results for Kiska samples are listed in column 6 for comparison.

Analytical methods and detection limits based on communications with GEL Laboratories, Charleston, South Carolina, and EPA's Las Vegas Laboratory are listed in the last two columns of Table I−3.

I3.5 Sample Locations

Any migration of radionuclides from the test cavities is expected to be through a fracture in the cavity that allows groundwater to transport the contaminants into the ocean environment. To maintain consistency, DOE will approximate as nearly as possible the transects used by CRESP in the 2005 study. However, due to variations in marine life related to climatic and oceanic

factors, sample locations may need to be adjusted to obtain the designated species. If this occurs, alternate locations will be documented in the sampling report provided to the regulatory agencies.

Trawls will follow the transect and not extend beyond a maximum distance[5] from the island shore. Beyond this distance, mixing and currents will mask detection.

Kelp samples will be taken from the island end of the transects at low tide. Other samples will be taken at 30, 60, 90, and 120 feet from the shore along the transects (CRESP conference call March 24, 2006).

Where possible, sampling locations will be determined with Global Positioning System equipment to allow the location to be noted.

I3.6 Evaluation Methods

Results of the most recent study (CRESP 2006) indicate that current Aleut subsistence seafood and commercial catch are safe for consumption.

DOE will use a graded approach for determining if action needs to be taken based on the analytical results from the sampling.

For the first two sampling rounds, DOE will collect biota and seawater samples for analysis. Gross alpha, gross beta, and gross gamma screening analyses will also be conducted in addition to the radionuclide analytes listed in Table I−2. If after two rounds (2016) the data indicate that the Kiska sample results are at or above the Amchitka levels, ADEC will be consulted about the future sampling plan.

If the sampling data (above detection limits) indicate that the Amchitka levels are higher than the Kiska levels, DOE will perform a two-way analysis of variance test to compare the baseline populations on Kiska to the Amchitka populations. The analysis will determine whether there is a statistically significant increase in the radionuclide concentrations in the selected species at the location being evaluated that is not associated with a similar increase at the baseline location (Kiska). A comparison with indicator levels (e.g., columns 2 or 3 in Table I−3) could be conducted to determine if any follow-up work needs to be considered.

I3.7 Sampling Frequency and Reporting

DOE will sample the species for the radionuclides discussed in Section I3.4. The sampling will occur every 5 years, after the nesting seasons.

Sampling will be conducted off shore along three transects (one associated with each test) and at the Kiska sites used by CRESP. Sampling size will be 1 kg for each species from each location.

Additional monitoring may be necessary in the event of significant volcanic or seismic activity or if sample concentrations of radionuclides increase. A volcano or large earthquake affecting the Amchitka test cavities has little potential to increase the rate at which radionuclides are

[5]To be determined.

transported; however, the possibility does exist. Therefore, if a large earthquake ($M_r > 6.7$) occurs on Amchitka or within the Rat Island Quadrangle, or if a volcano on the island becomes active, DOE will consult with ADEC and USFWS to determine if further action is required. Additional sampling also may be necessary if unexpected, statistically significant increases in the levels of target analytes are observed.

After each sampling event, DOE will perform the required analyses and include the results in the report discussed in the *Post-Closure Monitoring and Inspection Plan for Amchitka Island Mud Pit Release Sites* (DOE 2005). This report will not be finalized until the data have been checked for quality assurance/quality control and determined to be the final data.

Should any of the targeted species become subject to non-catch restrictions or become listed as a threatened or endangered species, DOE will work with ADEC to determine appropriate substitutes.

I4.0 Decision Rule

If the Kiska value for a given species and analyte is greater than the Amchitka test site value for the same species and analyte, *then* no action is required.

If the Kiska value for a given species and analyte is less than the Amchitka test site value for the same species and analyte, *then* the Amchitka value will be compared to an appropriate radionuclide indicator level (e.g., values shown in columns 3 and 4 in Table I−3). *If* the Amchitka value is less than the indicator level, *then* no follow-on action will be taken.

If elevated levels observed at Amchitka can be associated with another source, *then* no action other than continued monitoring will be taken concerning transport of radionuclides from Amchitka. ADEC will be notified.

All values are assumed to be above detection limits.

I4.1 Limits for Decision Errors

The baseline condition for the Amchitka sampling locations is that there is no measurable effect from the radionuclides in the cavities to the food chain of the Aleuts.

DOE will use the 95 percent confidence level as the tolerable decision error, that is, 5 percent of the time the Amchitka values will exceed the Kiska values and still not present a risk.

I5.0 Sampling Design

The results of this DQO process will be incorporated into the sampling design to be included in the Sampling and Analysis Plan (Appendix A of the LTS&M Plan).

The basic sampling design is to sample three transects adjacent to Amchitka for the species and analyze for the parameters summarized in Table I−2.

I5.1 Assumptions

- Kiska and Amchitka will be affected equally by radionuclides introduced into the environment from sources other than the test cavities.
- Current dietary information reflects actual intake values.
- Agreement by parties to this LTS&M Plan for a baseline (e.g., columns 3 or 4, FRMAC, other) of indicator radionuclides.

I6.0 References

ADEC (Alaska Department of Environmental Conservation), 2007. Letter from John Halverson, Environmental Program Manager, to Tracy Plessinger, DOE Office of Legacy Management, comments on LTS&M Plan, with attachments, 2 January.

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