
**Pacific Northwest
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**Soil Sampling to Demonstrate
Compliance with Department of
Energy Radiological Clearance
Requirements for the McGee Ranch-
Riverlands and North Slope Units of
the Hanford Reach National**

B. G. Fritz
R. L. Dirkes
B. A. Napier

September 2007

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830



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**Soil Sampling to Demonstrate Compliance
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Richland, Washington 99352

Summary

The Hanford Reach National Monument (HRNM) was created by presidential proclamation in 2000. It is located along the Columbia River in south central Washington and consists of five distinct units. The McGee Ranch-Riverlands and the North Slope units are addressed in this report. North Slope refers to two of the HRNM units: the Saddle Mountain Unit and the Wahluke Slope Unit. The Saddle Mountain and Wahluke Slope Units are located north of the Columbia River, while the McGee Ranch-Riverlands Unit is located south of the Columbia River and north and west of Washington State Highway 24. To fulfill internal U.S. Department of Energy (DOE) requirements prior to any radiological clearance of land, the DOE must evaluate the potential for residual radioactive contamination on this land and determine compliance with the requirements of DOE Order 5400.5. Authorized limits for residual radioactive contamination were developed based on the DOE annual exposure limit to the public (100 mrem) using future potential land-use scenarios. The DOE Office of Environmental Management approved these authorized limits on March 1, 2004. Historical soil monitoring conducted on and around the HRNM indicated soil concentrations of radionuclides were well below the authorized limits (Fritz et al. 2003). However, the historical sampling was done at a limited number of sampling locations. Therefore, additional soil sampling was conducted to determine if the concentrations of radionuclides in soil on the McGee Ranch-Riverlands and North Slope units were below the authorized limits.

Sixty-seven soil samples were collected from the McGee Ranch-Riverlands and North Slope units. A software package (Visual Sample Plan) was used to plan the collection to assure an adequate number of samples were collected. The number of samples necessary to decide with a high level of confidence (99%) that the soil concentrations of radionuclides on the North Slope and McGee Ranch-Riverlands units did not exceed the authorized limits was determined to be 27. Additional soil samples were collected from areas suspected to have a potential for accumulation of radionuclides. This included samples collected from the riparian zone along the Columbia River, Savage Island, and other locations across the North Slope and McGee Ranch-Riverlands units.

The 67 soil samples collected from the McGee Ranch-Riverlands and North Slope units all had concentrations of radionuclides far below the authorized limits established by the DOE. Statistical analysis of the results concluded that the Authorized Limits were not exceeded when total uncertainty was considered. The calculated upper confidence limit for each radionuclide measured in this study (which represents the value at which 99% of the measurements reside below with a 99% confidence level) was lower than the Authorized Limit for each radionuclide. The maximum observed soil concentrations for the radionuclides included in the authorized limits would result in a potential annual dose of 0.23 mrem assuming the most probable use scenario, a recreational visitor. This potential dose is well below the DOE 100-mrem/year dose limit for members of the public.

Furthermore, the results of the biota dose assessment screen, which used the RESRAD biota code, indicated that the sum of fractions is less than one. This assumed soil concentrations equal to the maximum concentrations of radionuclides measured on the McGee Ranch-Riverlands and North Slope units' in this study. Since the sum of fractions was less than 1, dose to terrestrial biota will not exceed the recommended biota dose limit for the soil concentrations measured in this study.

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1.0 Introduction

The Hanford Reach National Monument (HRNM) was created by presidential proclamation in June 2000 (65 FR 37253). It is located along the Columbia River in south central Washington and consists of five distinct units (Figure 1). The McGee Ranch-Riverlands Unit and the North Slope units are addressed in this report. The McGee Ranch-Riverlands Unit is located south of the Columbia River and north and west of Washington State Highway 24. The North Slope refers to two of the HRNM units: the Saddle Mountain Unit and the Wahluke Slope Unit. The Saddle Mountain and Wahluke slope Units are located north of the Columbia River. To fulfill internal U.S. Department of Energy (DOE) requirements prior to any radiological clearance of land, the DOE must evaluate the potential for residual radioactive contamination on this land and determine compliance with the requirements of DOE Order 5400.5. Authorized limits for residual radioactive contamination were developed (based on the DOE annual exposure limit of 100 mrem to the public) using future potential land-use scenarios. The DOE Office of Environmental Management approved these authorized limits on March 1, 2004. Historical soil monitoring conducted on and around the HRNM indicated soil concentrations of radionuclides were well below the authorized limits (Fritz et al. 2003). The historical sampling was completed at a limited number of sampling locations; therefore, additional soil sampling was conducted to determine if the concentrations of radionuclides in soil on the McGee Ranch-Riverlands and North Slope units were below the authorized limits.

2.0 Methods

A computer program called Visual Sample Plan (VSP) was used to determine the appropriate number and location of environmental samples needed for this monitoring project (Gilbert et al. 2001; Hassig et al. 2002). This program was developed as a tool for selecting the appropriate number and location of environmental samples. The input was configured to determine the number of samples necessary to decide with 99% confidence that the average soil concentration was less than the authorized limits. The sampling and analysis plan prepared prior to conducting this sampling provides additional detail about the methodology used to plan and conduct this soil sampling (Fritz and Dirkes 2004).

2.1 Sample Collection

Soil samples were collected between April 2005 and January 2006 in accordance with current environmental monitoring soil sampling procedures (Hanf et al. 2007) and with the protocol outlined in the sampling and analysis plan developed prior to sampling (Fritz and Dirkes 2004). The collection of samples consisted of five 10-cm-diameter, 2.5-cm-deep “cookie cutter” samples from each location. These five discreet portions were then combined to make one sample at each location. Prior to analysis, each sample was split with a riffle splitter, and half the sample was kept for potential future analysis.

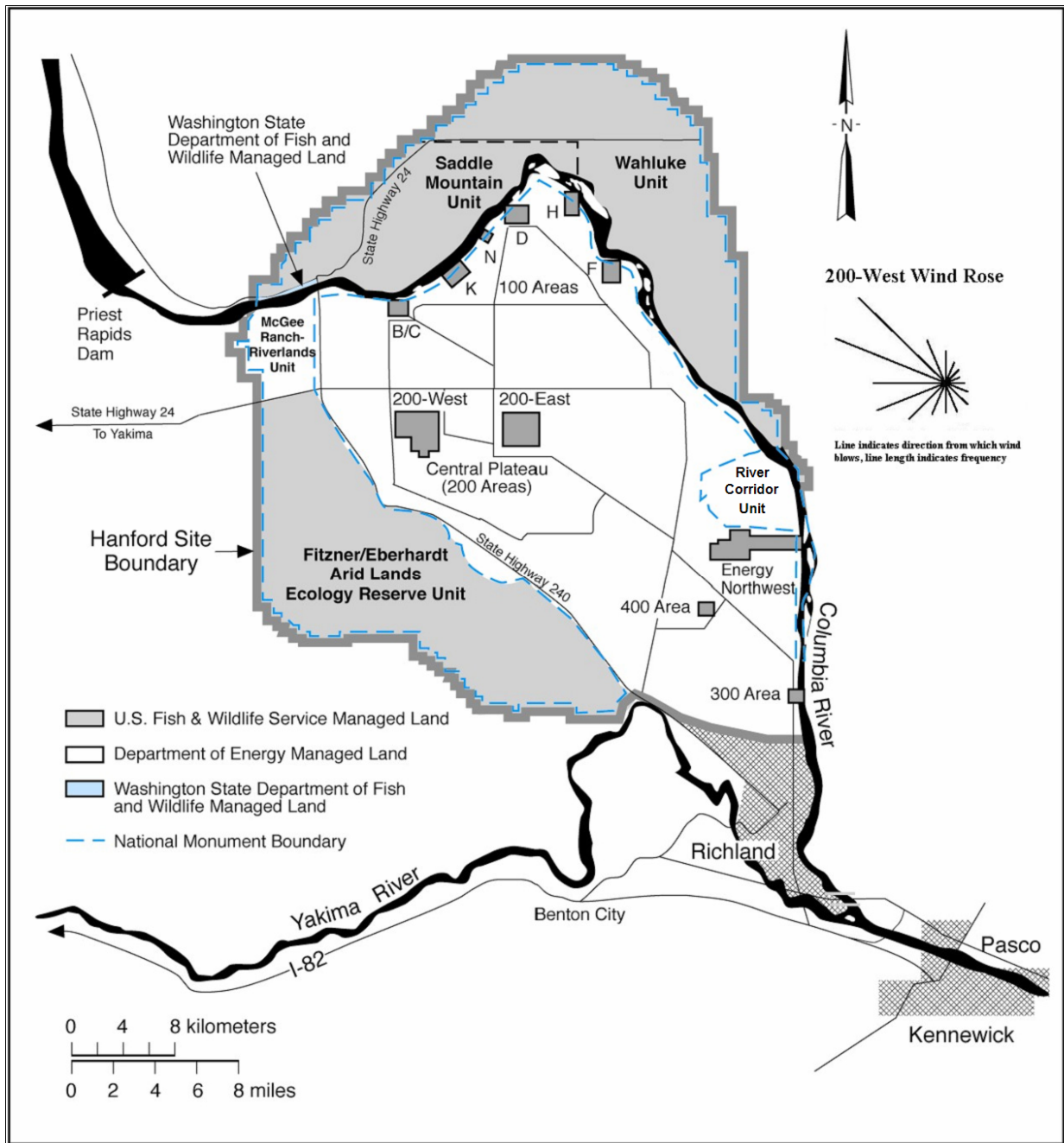


Figure 1. Location of the Hanford Reach National Monument Units, including the McGee Ranch-Riverlands and Saddle Mountain and Wahluke (North Slope) Units

2.2 Sampling Locations

Results from the VSP program indicated that 27 soil samples collected across the McGee Ranch-Riverlands and North Slope units would provide a 99% degree of confidence that the units comply with the authorized limits; or a 1% chance of incorrectly concluding that the soil concentrations were below the authorized limits (Fritz and Dirkes 2004). In addition to the 27 soil samples necessary to satisfy the statistical requirements, extra soil samples were collected from locations with potential for accumulation of radionuclides (Fritz and Dirkes 2004). A total of 67 soil samples were collected (Table 1).

Based on the historical site assessment for the HRNM (Fritz et al. 2003), Savage Island was considered the most likely location for accumulation of radionuclides on the North Slope units. Six additional soil samples were collected from Savage Island. Since the North Slope units border the Columbia River, the riparian area along the Columbia River was considered a potential location for the accumulation of radionuclides that had been discharged to the river during Hanford operations. Twelve soil samples were collected from the riparian zone along the northern and eastern edge of the Columbia River shoreline at evenly spaced intervals beginning at the upstream edge of the HRNM and extending to the downstream edge. Another location considered to have a high potential for accumulation of radionuclides was the Riverlands Classification Yard. The classification yard was used to decontaminate railcars leaving the Hanford Site between 1943 and 1965 (Fritz et al. 2003). Although this location had been previously cleaned up (Fritz and Dirkes 2004), samples were collected from within the boundary of the old rail classification yard to verify that soil concentrations did not exceed the authorized limits.

The VSP program provided coordinates for 27 randomly selected target sample locations (Figure 2). Due to the lack of roads, rugged terrain, safety considerations, and desire to minimize impacts to sensitive ecological resources, samples were not always collected exactly at the 27 target locations. All but two of the samples were collected within 1.6 km (1 mi) of the pre-determined target locations. Based on the Historical Site Assessment (Fritz et al 2007), the source (atmospheric deposition) and site observations, spatial variations at the 1.6 km scale were not anticipated, and would not bias the results. The actual sampling locations were recorded with a global positioning device, and the elevation of each sample was determined by mapping the sample locations on global information system elevation layers. Additional information about each sampling location is included in Appendix A.

Table 1. Number of Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units of the Hanford Reach National Monument

Area	Number of Samples
North Slope random start grid	20
North Slope selected locations	10
North Slope near Columbia River	18
McGee Ranch-Riverlands random start grid	7
McGee Ranch-Riverlands selected locations	5
Riverlands Classification Yard	7
Total Soil Samples	67

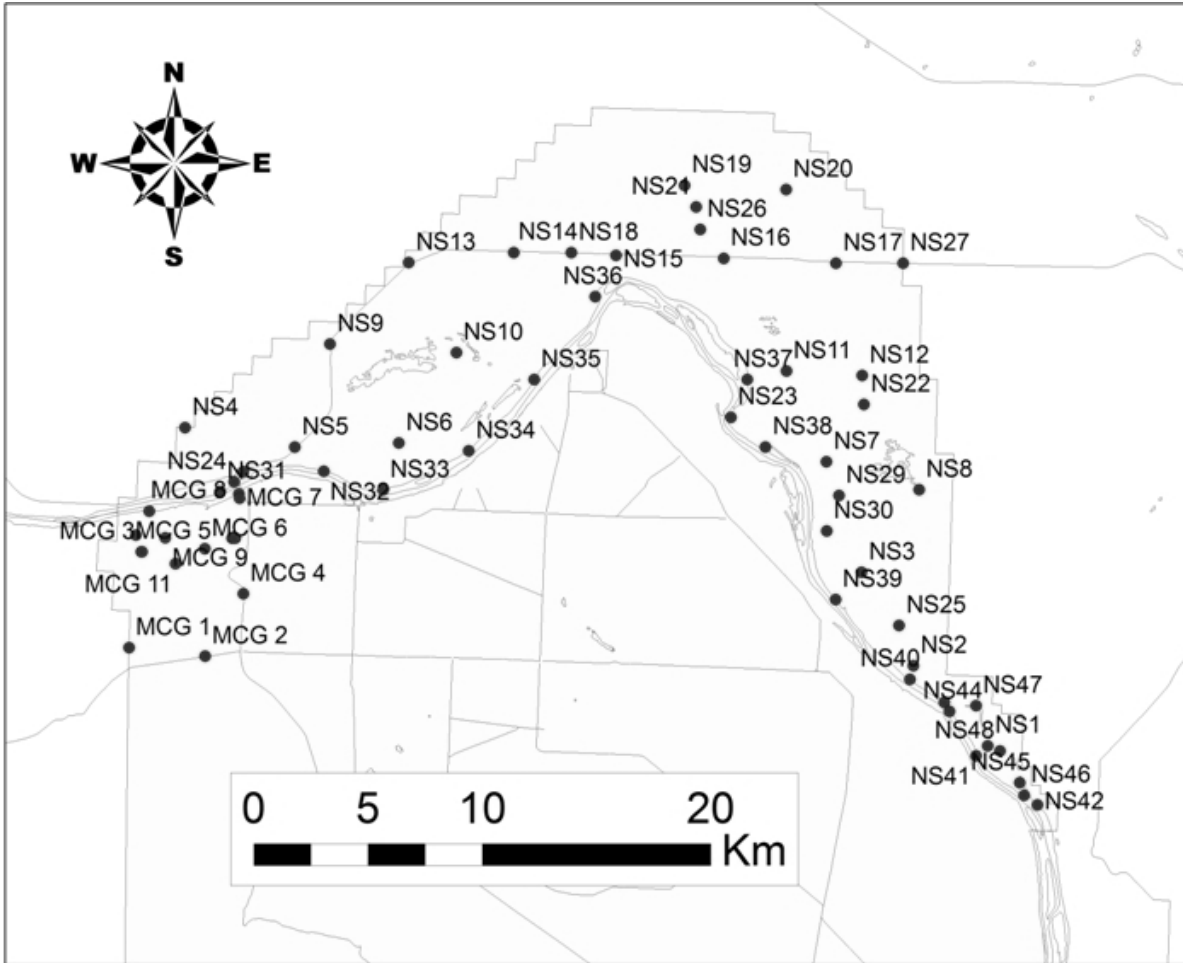


Figure 2. Locations of Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units

2.3 Sample Analysis

Sample analyses were conducted by a sub-contracted analytical laboratory. Sample preparation included sieving (2 mm screen size), drying and ball milling to achieve a particle size of 300 micrometers or less. Further chemical processes were conducted as part of the analytical procedure on an isotope specific basis. The suite of radionuclides selected for analysis was determined from historical data and the derivation of the authorized limits (Fritz et al. 2003; Napier et al. 2004). The analytical methods were adequate to detect concentrations well below the authorized limits (Table 2). In some cases, concentrations of additional radionuclides were determined as a result of the analytical procedure. The gamma scan provided results for 23 radioisotopes, an isotopic plutonium analysis provided results for plutonium-238 in addition to plutonium-239/240. Americium-241 was not analyzed for in samples collected for this study because it was not expected to be present in detectable amounts. The inclusion of americium-241 in the authorized limits was based on the historical site assessment where it was identified as having been used in research on the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE) Unit of the HRNM (Fritz et al. 2003). All results are permanently stored, and available upon request, in the Hanford Environmental Information System (HEIS).

Table 2. Approved Authorized Limits and the Contractual Analytical Detection Limits

Radionuclides of Concern	Contractual Analytical Detection Limit (pCi/g) ^(a)	Authorized Limit (pCi/g)
Cobalt-60	0.03	11
Cesium-134	0.03	20
Cesium-137	0.03	46
Europium-152	0.03	24
Strontium-90	0.05	88
Uranium-234	0.02	2,400
Uranium-235	0.02	190
Uranium-238	0.02	770
Plutonium-239/240	0.0004	480
Americium-241 ^(b)	0.015	420
(a) The contractual detection limit is the detection limit required in the sub-contract. The actual detection limit is usually lower than the contractual detection limit.		
(b) Samples collected on the McGee Ranch-Riverlands and North Slope units were not analyzed for americium-241.		

3.0 Results and Discussion

In this section, sampling results are compared to the authorized limits (Napier and Glines 2004), other soil concentration data (Poston et al. 2005), and background concentrations (DOE 1996). Results are also analyzed for any trends, patterns, or discrepancies that might indicate elevated radionuclide concentrations.

3.1 Radiological Results

The results from all 67 soil samples collected on the McGee Ranch-Riverlands and North Slope units had low concentrations of radionuclides. Overall, only 44% of the sample results for the radionuclides of concern had detectable concentrations¹ (Table 3). All of the measured concentrations were well below the authorized limits. The raw data for the sampling results are included in Appendix B.

3.1.1 Soil Sample Results and Comparison to Authorized Limits

Gamma spectroscopy analyzed for 23 different gamma-emitting radioisotopes, of which 4 were radionuclides of concern as identified by the authorized limits. Of these four gamma emitters included in the authorized limits, only cesium-137 was reported as having detectable concentrations in any of the soil samples (Appendix B). Cesium-137 had detectable concentrations in 56 of the 67 samples collected on the McGee Ranch-Riverlands and North Slope units. The authorized limit for cesium-137 is 46 pCi/g. The maximum cesium-137 concentration observed on the McGee Ranch-Riverlands and North Slope

¹ If a reported concentration is less than the minimum detectable activity, or if the two-sigma total analytical error is greater than the reported concentration, then the result is considered to be undetected.

units was 0.66 pCi/g, 1.4% of the authorized limit. The median concentration of cesium-137 measured in the samples collected on the McGee Ranch-Riverlands and North Slope units during this sampling effort was 0.11 pCi/g (Table 3).

Table 3. Summary Statistics for Radionuclides of Concern Measured in Soil Samples on the McGee Ranch-Riverlands and North Slope Units of the HRNM

Radionuclides of Concern	Number of Samples Analyzed	Number of Samples with Detectable Concentrations ^(a)	Nominal Analytical Detection Limit ^(a) (pCi/g)	Authorized Limit (pCi/g)
Cobalt-60	67	0	0.02	11
Cesium-134	67	0	0.03	20
Cesium-137	67	56	0.02	46
Europium-152	67	0	0.05	24
Strontium-90	67	12	0.04	88
Uranium-234	67	66	0.008	2,400
Uranium-235	67	28	0.006	190
Uranium-238	67	59	0.008	770
Plutonium-239/240	67	44	0.001	480
Radionuclides of Concern	Median Concentration (pCi/g)	Average Concentration (pCi/g)	Maximum Concentration (pCi/g)	Standard Deviation (pCi/g)
Cobalt-60	0.00079	0.00077	0.026	0.0082
Cesium-134	0.052	0.055	0.17	0.024
Cesium-137	0.11	0.15	0.66	0.15
Europium-152	-0.0088	-0.0067	0.16	0.027
Strontium-90	0.0056	0.014	0.19	0.038
Uranium-234	0.17	0.30	3.5	0.49
Uranium-235	0.0058	0.011	0.098	0.015
Uranium-238	0.17	0.28	2.9	0.40
Plutonium-239/240	0.0037	0.0050	0.025	0.0053
(a) A detectable result is larger than the analytical detection limit and larger than the total analytical uncertainty. Detection limits for individual samples were typically at least 50 times lower than contractual required detection limits (see Table 2). Non-detected concentrations are included in the determination of both median and average concentrations.				

Other than cesium-137, there were no detectable levels of radionuclides of concern measured by gamma spectroscopy in any of the samples collected on the McGee Ranch-Riverlands and North Slope units. Cobalt-60, cesium-134, and europium-152 all had concentrations below the analytical detection limit, and, consequently, well below the respective authorized limits (Table 3).

In addition to the four gamma-emitting radionuclides of concern, the gamma scan analyzed for 19 other radionuclides. Some of the other radionuclides were detected at low concentrations by the gamma scan, and are presented in Appendix B; the others were all undetectable results, and can be found

in HEIS. Potassium-40 was the only radionuclide consistently detected in the gamma scan from samples collected on the McGee Ranch-Riverlands and North Slope. Potassium-40 is a naturally occurring radionuclide and is generally found at detectable concentrations in soil.

Strontium-90 was measured above the detection limit in 12 of the 67 soil samples collected on the McGee Ranch-Riverlands and North Slope units. The median and maximum strontium-90 concentrations observed were 0.0056 and 0.19 pCi/g, respectively. The maximum observed strontium-90 concentration was 0.22% of the authorized limit (88 pCi/g) (see Table 3).

Soil samples collected on the McGee Ranch-Riverlands and North Slope units were analyzed for three uranium isotopes: uranium-234, uranium-235, and uranium-238. As expected, uranium-234 and uranium-238 had concentrations above the detection limit for most of the samples, and 28 of the 67 samples had uranium-235 concentrations above the detection limit (Table 3). This is consistent with historical soil monitoring data, which consistently detects uranium-235 less often than uranium-234 and uranium-238. The maximum measured concentrations of uranium-234, uranium-235, and uranium-238 were well below the authorized limits for the McGee Ranch-Riverlands and North Slope units (Table 3). The maximum observed uranium-238 concentration (2.9 pCi/g) was 0.38% of the authorized limit (770 pCi/g).

Plutonium-239/240 had detectable concentrations in 44 of the 67 soil samples collected on the McGee Ranch-Riverlands and North Slope units (Table 3). The maximum measured soil concentration of plutonium-239/240 (0.025 pCi/g) was only 0.005% of the authorized limit. While plutonium-238 is not a contaminant of concern identified in the authorized limits, it was analyzed at the same time as plutonium-239/240. Only 25 of 67 samples had detectable concentrations of plutonium-238. In general, the plutonium-238 concentrations were about ten times lower than the plutonium-239/240 concentrations.

The results of soil samples collected on the McGee Ranch-Riverlands and North Slope units indicate that the concentrations of the radionuclides of concern are well below the authorized limits (Figure 3). Cesium-137 was the radionuclide with a measured maximum closest to the applicable authorized limit. The maximum cesium-137 concentration was 1.4% of the authorized limit.

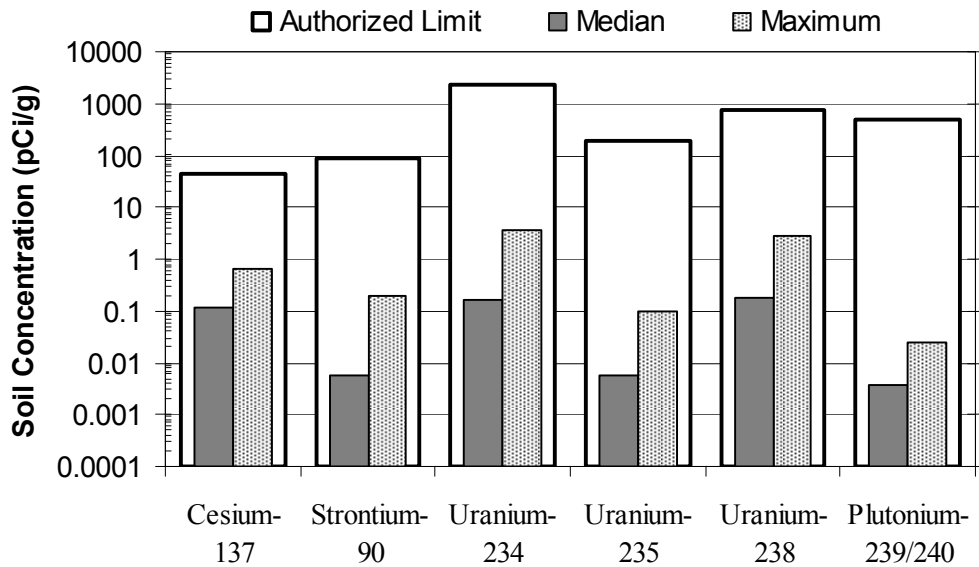


Figure 3. Comparison of Median and Maximum Results to Authorized Limits for Radionuclides with Detectable Concentrations in Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units. (Note the vertical axis is a logarithmic scale).

3.1.2 Statistical Analysis

A statistical analysis of the results was conducted to confirm assumptions made in the sampling design were met and to determine if the potential existed for concentrations of radionuclides to exceed the Authorized Limits when uncertainty was considered. This analysis confirmed that all the assumptions were valid for the North Slope units, and that the number of samples and location of sampling sites were appropriate. For the McGee Ranch-Riverlands Unit, the assumption of normally distributed data was not met. Since this assumption was not met, the number of samples necessary to determine with a high statistical confidence that the McGee-Ranch-Riverlands Unit did not exceed the Authorized Limits was recalculated assuming non-parametric distribution. Under this scenario, the 19 total samples collected from the McGee Ranch-Riverlands Unit were an acceptable amount. In other words, the additional 12 samples collected from the Riverlands Classification Yard and from selected locations on the unit (see Table 1) were sufficient to meet the statistical requirements for determining if the not-normally distributed soil concentrations of radionuclides on the McGee Ranch-Riverlands were less than the Authorized Limits.

The statistical analysis of results for samples collected on the North Slope and the McGee Ranch-Riverlands units concluded that the Authorized Limits were not exceeded when total uncertainty was considered. Confidence limits (as opposed to tolerance limits) were used to statistically determine if concentrations measured on the HRNM units were greater than the authorized limits since the results on the McGee Ranch-Riverlands were not normally distributed. The calculated non-parametric upper confidence limit for each radionuclide for the North Slope and McGee Ranch Riverlands units (which represents the value at which 99% of the measurements reside below with a 99% confidence level) was lower than the Authorized Limit for each radionuclide.

3.1.3 Comparison to Other Data

While the concentrations of radionuclides collected on the McGee Ranch-Riverlands and North Slope units were less than the authorized limits, a comparison to other relevant data was conducted to further evaluate radionuclide concentrations. Environmental surveillance of radionuclide concentrations has been conducted on and around the Hanford Site since the 1940s. For comparison to the results obtained by this sampling effort, recent environmental monitoring data was used. Based on the historical site assessment (Fritz et al. 2003), soil monitoring data since 1990 were deemed the most appropriate to use for comparison. Soil samples collected from two locations on the North Slope and from the upwind soil samples collected at Sunnyside, Washington, provided two sets of comparison data. Hanford background soil concentrations, estimated based on the distribution of results from environmental samples on and around the Hanford Site (DOE 1996), provided a third set of comparison data. The median concentrations measured by this sampling effort were generally lower than available comparison data (Table 4).

Table 4. Comparison of Results to Other Relevant Data

Radionuclides of Concern	Median Concentration Observed in this Study (pCi/g)	Median North Slope Concentration Observed Since 1990 ^(a)	Median Upwind Concentration Observed Since 1990 ^(a)	Hanford Site Background Average Concentration ^(b)
Cobalt-60 ^(c)	0.00079	-0.001	-0.004	0.0013
Cesium-134 ^(c)	0.052	NA	NA	NA
Cesium-137	0.11	0.36	0.4	0.42
Europium-152 ^(c)	-0.0088	NA	NA	NA
Strontium-90	0.0056	0.070	0.084	0.081
Uranium-234	0.17	0.41	0.35	0.79
Uranium-235	0.0058	0.02	0.014	0.052
Uranium-238	0.17	0.58	0.60	0.76
Plutonium-239/240	0.0037	0.011	0.011	0.0094
NA = Data not available. (a) Data from HRNM historical site assessment (Fritz et al. 2003); see Appendix C, Table C.1. (b) Data from Hanford Site soil background report (DOE 1996). (c) No detectable concentrations measured in this study for this isotope.				

The maximum measured concentrations in this study were also similar to the estimated Hanford Site background maximum soil concentrations. The concentrations of radionuclides measured in soil on the McGee Ranch-Riverlands and North Slope units were consistent with the concentrations expected in Hanford Site soil (Table 4, Figure 4). All results indicate that there is no difference in the radionuclide concentrations on the McGee Ranch-Riverlands and North Slope units relative to the estimated Hanford Site background soil concentrations.

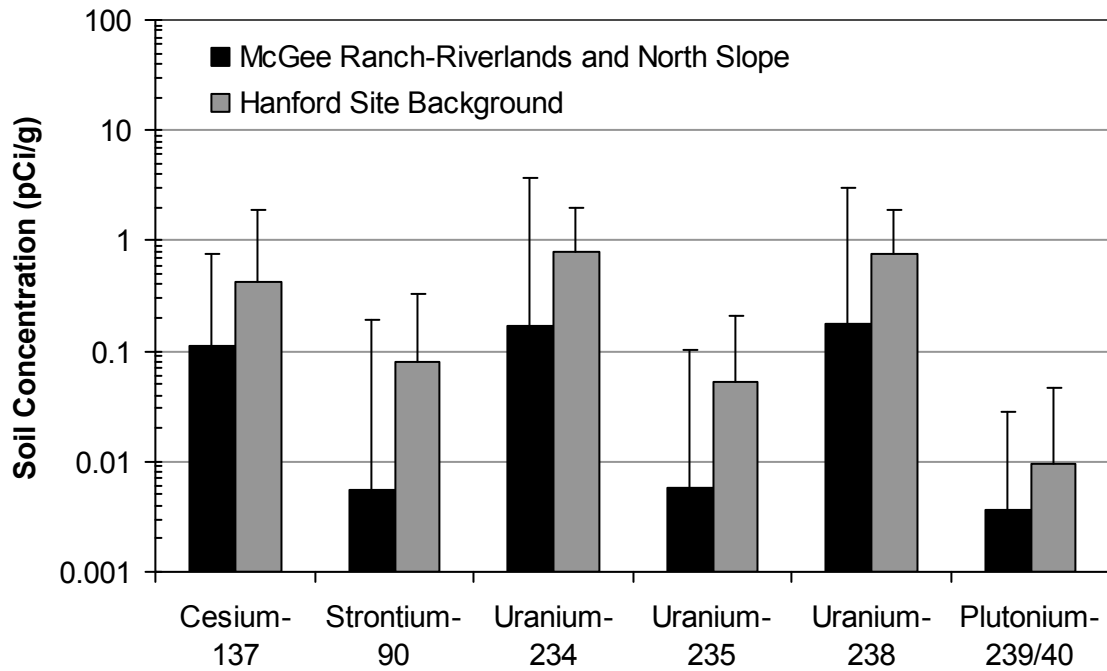


Figure 4. Soil Concentrations Measured on the McGee Ranch-Riverlands and North Slope Units Compared to Estimated Hanford Site Background Soil Concentrations (DOE 1996) for Radionuclides with Detectable Concentrations in Soil (Solid bars represent median concentrations; lines represent maximum concentrations. Background maximum concentrations are the 95th percentile [DOE 1996].)

3.1.4 Spatial Analysis

The two areas identified in the historical site assessment and the sample and analysis plan as being the most likely to have residual Hanford origin contamination present were the Riverlands Classification Yard and Savage Island (Fritz et al. 2003; Fritz and Dirkes 2004). Analysis of these data indicated that these locations did have slightly elevated concentrations relative to surrounding soil concentrations. However, these concentrations were within the range of background concentrations, and were well below the Authorized Limits.

It appeared that the soil concentrations of strontium-90, cesium-137, and plutonium-239/240 were slightly higher in the Riverlands Classification Yard relative to other soil samples collected on the McGee Ranch-Riverlands Unit (Table 5). The concentrations on the Riverlands Classification Yard were highest on the northern edge of what appeared to be the area cleaned up by previous efforts (Figure 5). However, the concentrations measured at the Riverlands Classification Yard were below the respective Authorized Limits.

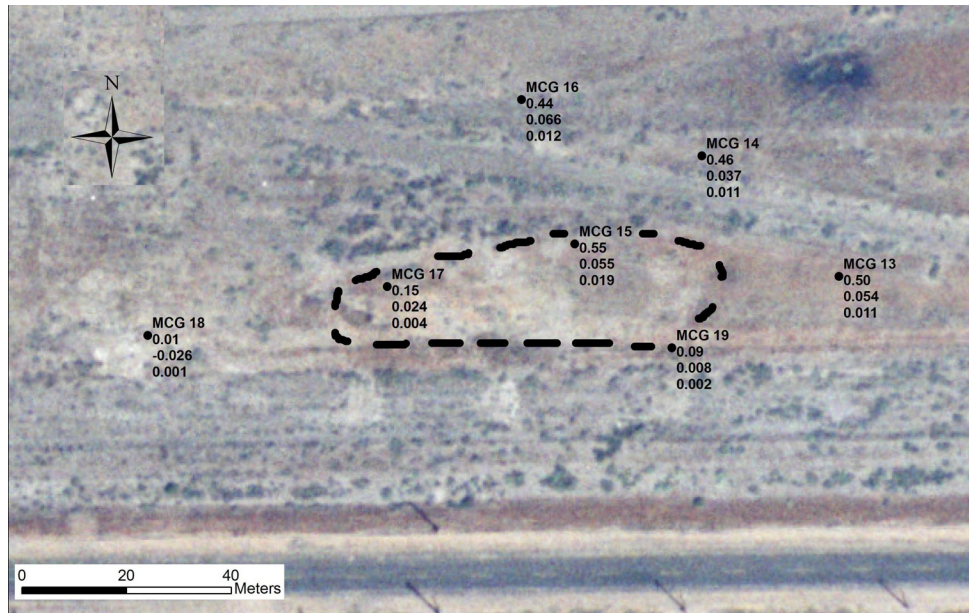


Figure 5. Concentrations of Cesium-137, Strontium-90, and Plutonium-239/240 in Soil Collected at the Former Riverlands Classification Yard (Dashed line indicates the area of apparent soil removal.)

Table 5. Soil Concentrations Measured in the Seven Samples Collected at Riverlands Classification Yard and Seven McGee Ranch-Riverlands Locations Closest to the Classification Yard

Radionuclides of Concern	Average Concentration on Riverlands Classification Yard ^(a) (pCi/g)	Average Concentration on McGee Ranch-Riverlands ^(b) (pCi/g)
Cobalt-60 ^(c)	-0.0039	0.0024
Cesium-134 ^(c)	0.049	0.046
Cesium-137	0.31	0.16
Europium-152 ^(c)	-0.015	-0.014
Strontium-90	0.031	0.024
Uranium-234	0.10	0.16
Uranium-235	0.0057	0.0052
Uranium-238	0.098	0.15
Plutonium-239/240	0.0085	0.0060

(a) Seven samples collected on and around Riverlands Classification Yard.
 (b) Seven samples collected from McGee Ranch-Riverlands Unit closest to the Riverlands Classification Yard.
 (c) All results below detection limit for this isotope.

Nine soil samples were collected on and around Savage Island to evaluate contaminant concentrations. With the exception of uranium, the soil concentrations measured indicated that concentrations of radionuclides on Savage Island were typical of those measured across the McGee Ranch-Riverlands and North Slope units of the HRNM (Table 6). It is assumed that the uranium concentrations measured on and around Savage Island are a result of agricultural practices in Franklin County. Uranium is found in

chemical fertilizers, which are used in the irrigated fields found throughout Franklin County (Fritz et al. 2003). The irrigation water used in Franklin County originates from the Columbia River in the northern half of Eastern Washington, an area with extensive historical mining operations; the irrigation water used in Franklin County may have higher concentrations of heavy metals as a result. There were also farm fields on and adjacent to Savage Island prior to the establishment of the Hanford Site (Figure 6). Multiple irrigation waste water canals drain back into the Columbia River around Savage Island, providing a pathway for uranium transport to Savage Island slough areas. The highest uranium concentrations measured on or around Savage Island were at the upstream end and middle of the island near the shore (Figure 7).

Table 6. Concentrations of Cesium-137, Plutonium-239/240, Uranium-234, and Uranium-238 for the Nine Soil Samples Collected on and Around Savage Island

Location	Cesium-137 (pCi/g)	Plutonium-239/240 (pCi/g)	Uranium-234 (pCi/g)	Uranium-238 (pCi/g)
NS-1	0.19	0.0047	0.14	0.17
NS-41	0.14	<i>0.0015</i>	0.66	0.58
NS-42	0.023	<i>0.00045</i>	0.29	0.29
NS-43	0.059	<i>0.00060</i>	0.37	0.33
NS-44	0.10	<i>0.0018</i>	0.50	0.48
NS-45	<i>0.0052</i>	0.00037	0.22	0.24
NS-46	0.034	<i>0.00028</i>	0.25	0.20
NS-47	<i>-0.011</i>	<i>0.00019</i>	0.46	0.42
NS-48	0.66	0.0068	0.76	0.66

Shaded *Italics* indicate samples with results less than the detection limit.



Figure 6. Aerial Photograph (circa 1943) of the Upper End of Savage Island. Farming on Savage Island is visible, as well as on the shore north of Savage Island.

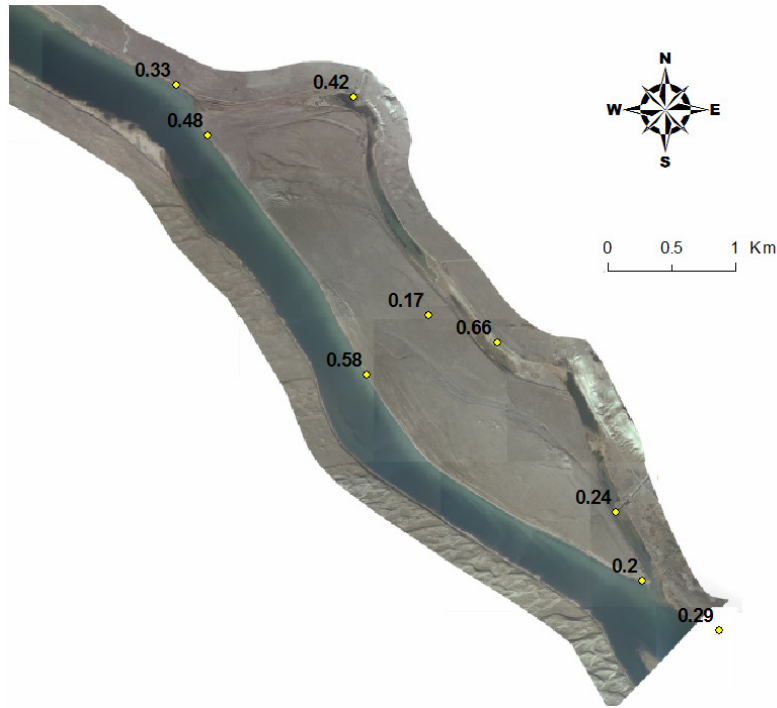


Figure 7. Uranium-238 Concentrations (pCi/g) Measured on and Around Savage Island

3.1.5 Riparian Sampling

Samples were collected from the riparian zone along the Columbia River on the North Slope of the HRNM. Figure 8 shows uranium-238 concentrations (pCi/g) in soil samples collected from the riparian zone. Uranium isotopes were the only radionuclides with detectable concentrations higher than the average concentrations measured across the McGee Ranch-Riverlands and North Slope units (Table 7). Similar to Savage Island, uranium was assumed to have originated from either natural abundance, agricultural practices adjacent to the Hanford Site, upstream mining operations, or Hanford activities. The two highest uranium-238 concentrations measured in the riparian zone in this study were collected downstream of the reactors and upstream of Vernita Bridge. The higher concentrations appeared to generally be adjacent to locations near irrigation water returns or near areas where farming had occurred prior to establishment of the Hanford Site. All uranium concentrations measured in samples collected by this study were below the respective Authorized Limits.

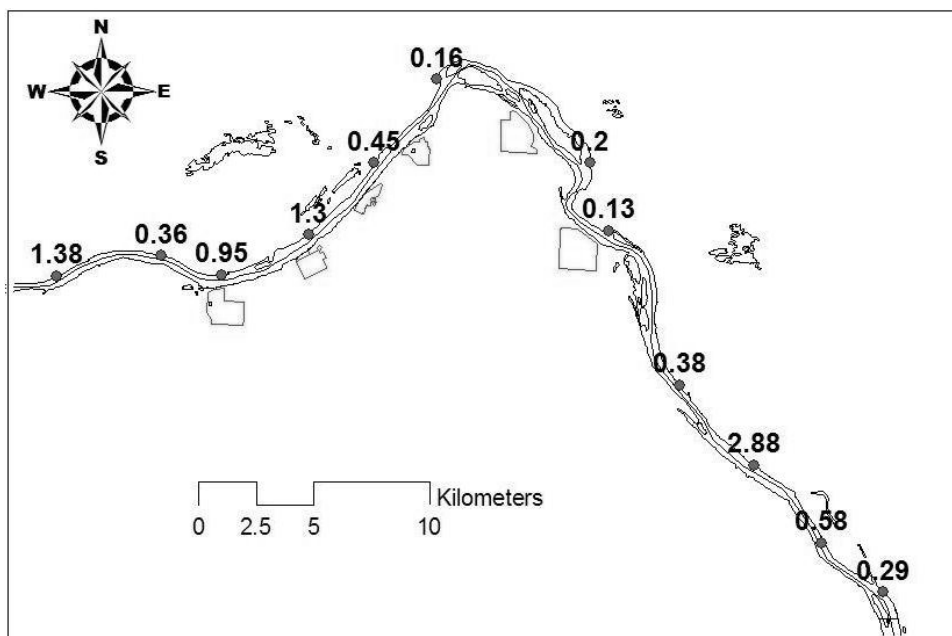


Figure 8. Uranium-238 Concentrations (pCi/g) in Soil Samples Collected from the Riparian Zone Along the Columbia River

Table 7. Average Concentrations of Radionuclides in Soil Samples Collected from the Riparian Zone of the Columbia River Compared to the Average Concentrations Measured in this Study

Radionuclide	Concentration Measured in Riparian Zone Soil Samples (pCi/g)	Average Concentration Measured in this Study ^(a) (pCi/g)
Cobalt-60 ^(b)	0.0025	0.00077
Cesium-134 ^(b)	0.075	0.055
Cesium-137	0.084	0.15
Europium-152 ^(b)	-0.0091	-0.0067
Strontium-90	-0.012	0.014
Uranium-234	0.86	0.30
Uranium-235	0.030	0.011
Uranium-238	0.76	0.28
Plutonium-239/240	0.0048	0.0051

(a) From Table 3 of this report.
(b) All results below detection limit for this isotope.

3.1.6 Department of Health Co-Sampling

As part of this sampling effort, four samples were split and given to the Washington State Department of Health for analysis. These samples were collected at the former Riverlands Classification Yard site since it was suspected to be the most likely location to have above average soil concentrations of radionuclides. A Department of Health employee accompanied the PNNL sample collection staff

members during sample collection, and helped determine sampling locations at the site. The samples were then returned to PNNL, where they were split with a riffle splitter. One half of the sample was turned over to the Department of Health, while the other half was submitted for analysis. The four samples that were split were MCG- 13, -14, -15 and -17. In February 2007 the Department of Health released a report summarizing the comparison of results for the split samples (DOH 2007). Results indicated good agreement for all radionuclides, with the exception of uranium isotopes. The observed difference between uranium concentrations reported by DOH and PNNL for these four samples was consistent with historical differences observed in Hanford Site soil and sediment samples; the DOH concentrations were consistently higher (DOH 2007). The discrepancy between reported DOH and PNNL uranium isotope concentrations is attributed to a difference in analytical methodology; DOH dissolves the sample completely, while the PNNL analysis leaches uranium from the soil (DOH 2007). The uranium concentrations reported by the DOH in the four soil samples collected from the Riverlands Classification Yard on the McGee Ranch-Riverlands were below the respective Authorized Limits.

3.2 Potential Dose Estimates

The soil concentrations measured on the McGee Ranch-Riverlands and North Slope units were well below the authorized limits. As discussed, these limits were developed based on a 100-mrem/year maximum allowable dose rate to members of the public. In order to estimate the doses from the measured soil concentrations, the maximum measured concentration of each radionuclide analyzed in this study was used as input to the DOE-approved computer model RESRAD. Several different scenarios were considered here, and results of this study could be used to evaluate other scenarios. The modeled doses account for all the radionuclides included in the authorized limits (if they were at detectable concentrations or not), with no subtraction of background.

3.2.1 Recreational Visitor Scenario

The recreational visitor scenario is the scenario that most closely approximates the anticipated usage of the McGee Ranch-Riverlands and North Slope units. This scenario assumes a visitor spends 280 hours/year on the HRNM, and eats game harvested on the HRNM (Napier et al. 2004). For the recreational visitor scenario, the dose estimated from the maximum soil concentrations measured on McGee Ranch-Riverlands and North Slope units is 0.23 mrem/year, or less than 1% of the 100-mrem annual dose limit used to establish the authorized limits. Cesium-137 is the largest contributor to the estimated doses, with cesium-134 the next highest contributor (Table 8). This estimated annual dose is 0.1 mrem higher than the dose estimated for the ALE Unit of the HRNM (Fritz et al. 2007). This difference is primarily attributable to the difference in the maximum reported cesium-134, europium-152, uranium-234, and uranium-238 concentrations. Since the maximum cesium-134 and europium-152 concentrations were not measured at concentrations above the detection limit, the most likely difference in the dose estimates to a recreational visitor on the McGee Ranch-Riverlands or North Slope units of the HRNM (relative to the ALE Unit) stem from the difference in uranium concentrations in soil.

3.2.2 Agricultural Resident Scenario

The agricultural resident scenario assumes the resident lives year-round on the McGee Ranch-Riverlands or North Slope units of the HRNM and produces or harvests most of his or her food on the HRNM. While this is an unlikely event under current and planned future use scenarios, it represents a

conceivable maximum future dose scenario. Using RESRAD, the agricultural resident scenario results in an estimated annual dose of 4.0 mrem (Table 8), or 4% of the 100-mrem annual dose limit used to establish the authorized limits. Similar to the recreational visitor scenario, cesium-137 is the primary contributor to combined total dose to the hypothetical agricultural resident.

3.2.3 Resident Child Scenario

To assess an additional potential use scenario, a scenario similar to those used to develop the authorized limits was evaluated. In the recreational visitor and agricultural resident scenarios, the exposed individual was assumed to be an adult. Conversely, in this scenario, the exposed individual is modeled as a child (6 to 18 months) who resides on either the McGee Ranch-Riverlands or North Slope units of the HRNM. This scenario was developed based on a theoretical Native American family (Appendix D). Because the RESRAD computer code cannot be used without modification to estimate doses to non-adults, the original code outputs for the agricultural resident have been used as a starting point, and the pathways and exposures have been adapted to the scenario of a child residing for 1 year on the McGee Ranch-Riverlands and/or North Slope units (Napier et al. 2004). The child is assumed to ingest 73 grams of soil per year. The resulting maximum estimated annual dose to a child is 4.2 mrem/year (Table 8), or 4% of the 100-mrem annual dose limit used to establish the authorized limits (Appendix D).

Table 8. Total Combined Annual Dose (mrem) and the Contribution from Each of the Isotopes Included in the Authorized Limits for Each of the Three Dose Assessment Scenarios

Radionuclide	Recreational Visitor	Agricultural Resident	Resident Child
Cobalt-60	0.011	0.23	0.23
Cesium-134	0.047	0.88	0.88
Cesium-137	0.084	1.4	1.45
Europium-152	0.031	0.65	0.65
Strontium-90	0.020	0.22	0.24
Uranium-234	0.014	0.14	0.24
Uranium-235	0.0027	0.051	0.054
Uranium-238	0.024	0.37	0.44
Plutonium-239/240	0.00078	0.0051	0.00077
Americium-241 ^(a)	0.00012	0.00086	0.00021
Total dose (mrem)	0.23	4.0	4.2
(a) Americium-241 not measured in soil samples collected on McGee Ranch-Riverlands or North Slope units of the HRNM. Maximum measured americium-241 concentration from the Fitzner/Eberhardt Arid Lands Ecology Reserve Unit (Fritz et al. 2006) used for dose estimate.			

3.3 Biota Dose Screening Assessment

To evaluate the soil concentrations observed on the McGee Ranch-Riverlands and North Slope units in terms of potential dose to biota, the maximum measured soil concentrations for each radionuclide were

used to conduct a biota dose screening assessment using the RESRAD biota computer code. This code compares the ratio of the radionuclide concentration in soil that would result in a 0.1 rad/day dose to terrestrial biota to maximum measured concentrations, then uses the sum of fractions determine if the dose would exceed the recommended dose limit. The assessment was done for the McGee Ranch-Riverlands and North Slope units separately (Appendix E). The total sum of fractions for dose to terrestrial biota from the maximum soil concentrations observed on the McGee Ranch-Riverlands and North Slope units is 0.058. Since the McGee Ranch-Riverlands and North Slope units are bounded by the Columbia River, a level 1 screen was conducted assuming that the maximum measured soil concentrations were also maximum sediment concentrations in the river. The total sum of fractions from the sediment for a riparian animal was 0.026. Since the sum of fractions for each assessment is less than one, the soil evaluated passes the level 1 screen. Passing the level 1 screen indicates that soil concentrations on the McGee Ranch-Riverlands and North Slope units should not contribute a dose to terrestrial or riparian biota receptor that exceeds the recommended dose limit of 0.1 rad per day.

4.0 Conclusions

All 67 soil samples collected from the McGee Ranch-Riverlands and North Slope units of the HRNM had concentrations of radionuclides far below the authorized limits. The maximum measured concentrations in soil were less than 2% of the respective authorized limits. A statistical analysis of the results confirmed the Authorized Limits were not exceeded when total uncertainty was considered. The calculated upper confidence limit for each radionuclide measured in this study (which represents the value at which 99% of the measurements reside below with a 99% confidence level) was lower than the Authorized Limit for each radionuclide. The measured concentrations were similar to previous environmental monitoring on and around the McGee Ranch-Riverlands and North Slope units and to estimated Hanford Site background soil concentrations. Furthermore, the maximum observed soil concentrations of radionuclides included in the authorized limits would only result in an annual dose of 0.23 mrem, assuming a recreational visitor scenario. The modeled dose for the agricultural resident scenario based on the maximum measured concentrations was 4.0 mrem/year. Similarly, the modeled dose to a resident child on the McGee Ranch-Riverlands or North Slope units from the maximum measured concentrations of radionuclides was 4.2 mrem/year. These doses are all well below the DOE established 100-mrem/year dose limit for members of the public.

Spatial analysis of the results indicated no major differences in radionuclide concentrations across the McGee Ranch-Riverlands and North Slope units. There were slightly elevated cesium-137, strontium-90, and plutonium-239/240 concentrations measured around the former Riverlands Classification Yard. Uranium concentrations measured in some samples collected from the Hanford Reach riparian zone and Savage Island were also slightly elevated relative to other sampling locations. However, these results were within in the range of reported Hanford background soil concentrations and historical monitoring results. Finally, the results of the biota dose assessment screen indicate that the levels of radionuclides in soil on the McGee Ranch-Riverlands and North Slope units should result in doses to biota below the recommended limit of 0.1 rad per day.

5.0 References

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Appendix A

Individual Sampling Location Information

Appendix A

Individual Sampling Location Information

Table A.1. Sampling Location Coordinates for Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units of the HRNM

Location Name	Geographic Coordinates (NAD83)			State Plane (WA South – meters)	
	Elevation (m)	Longitude	Latitude	Northing	Easting
MCG 1	302	119.79163	46.57726	138506	554294
MCG 2	249	119.74810	46.57493	138278	557633
MCG 3	334	119.78645	46.61506	142711	554653
MCG 4	242	119.72757	46.59996	141075	559179
MCG 5	332	119.78612	46.61511	142717	554678
MCG 6	143	119.75046	46.61713	142967	557407
MCG 7	135	119.73164	46.63743	145237	558827
MCG 8	123	119.78278	46.63115	144502	554918
MCG 9	142	119.77320	46.62090	143369	555662
MCG 10	133	119.78990	46.62159	143434	554382
MCG 11	347	119.76693	46.61077	142248	556152
MCG 12	131	119.73206	46.63913	145425	558793
MCG 13	140	119.73333	46.62174	143492	558714
MCG 14	141	119.73367	46.62195	143515	558688
MCG 15	140	119.73399	46.62180	143498	558664
MCG 16	141	119.73412	46.62205	143525	558653
MCG 17	140	119.73446	46.62173	143490	558628
MCG 18	140	119.73506	46.62165	143480	558582
MCG 19	140	119.73375	46.62162	143478	558682
NS1	121	119.30052	46.54957	135884	591980
NS2	121	119.34431	46.58018	139236	588573
NS3	280	119.37543	46.61625	143210	586130
NS4	238	119.76411	46.66436	148206	556313
NS5	171	119.70110	46.65828	147577	561141
NS6	150	119.64180	46.66131	147962	565676
NS7	214	119.39741	46.65922	147962	584380
NS8	234	119.34402	46.64933	146921	588482
NS9	195	119.68308	46.69923	152143	562473
NS10	146	119.61065	46.69751	152012	568014
NS11	210	119.42182	46.69441	151847	582459
NS12	265	119.37835	46.69359	151803	585785
NS13	198	119.63952	46.73231	155855	565764
NS14	201	119.57975	46.7376	156495	570325
NS15	201	119.52118	46.73782	156573	574800
NS16	208	119.45966	46.73796	156649	579501
NS17	219	119.39532	46.73733	156646	584419
NS18	201	119.54679	46.73828	156600	572843
NS19	294	119.48325	46.76616	159760	577658
NS20	291	119.42517	46.76572	159770	582095

Table A.1. (contd)

Location Name	Geographic Coordinates (NAD83)			State Plane (WA South –meters)	
	Elevation (m)	Longitude	Latitude	Northing	Easting
NS21	256	119.47625	46.75775	158832	578205
NS22	231	119.37703	46.68218	150536	585904
NS23	119	119.45270	46.67560	149725	580125
NS24	124	119.73500	46.64381	145943	558562
NS25	291	119.35306	46.59580	140962	587877
NS26	230	119.47366	46.74895	157857	578416
NS27	220	119.34477	46.73817	156795	588280
NS28	129	119.72994	46.64790	146402	558945
NS29	235	119.38968	46.64614	146517	584992
NS30	267	119.39597	46.63206	144945	584533
NS31	122	119.742872	46.63983	145495	557964
NS32	122	119.68402	46.64913	146574	562459
NS33	122	119.64987	46.64252	145867	565081
NS34	117	119.60173	46.65914	147755	568745
NS35	117	119.56575	46.68789	150982	571460
NS36	118	119.53239	46.72127	154723	573966
NS37	116	119.44403	46.69060	151401	580766
NS38	117	119.43242	46.66436	148497	581694
NS39	114	119.3898	46.60522	141969	585047
NS40	112	119.34599	46.57481	138637	588453
NS41	112	119.30700	46.54544	135417	591490
NS42	111	119.27130	46.52694	133403	594260
NS43	111	119.32607	46.56619	137701	589993
NS44	112	119.32291	46.56256	137302	590242
NS45	111	119.28168	46.53540	134331	593449
NS46	112	119.27906	46.53056	133796	593658
NS47	111	119.30788	46.56515	137607	591390
NS48	111	119.29356	46.54761	135674	592517

Table A.2. Sample Collection Field Notes

Location Name	Collection Notes
<i>McGee Ranch–Riverlands</i>	
MCG 1	Edge of site next to vineyard
MCG 2	Edge of highway across road from Othello/Richland Jct. sign
MCG 3	At top of steep road at fork S side
MCG 4	Just off Highway 24 near fence line
MCG 5	On ridge under big power lines several hundred feet above river
MCG 6	~0.16 mi away
MCG 7	Just S of Vernita Bridge rest area, inside of rest area fence
MCG 8	Near high water mark
MCG 9	About 0.25 mi N from "T" in road
MCG 10	Near substation, base of ridge ~0.5 mi N of MCG 5
MCG 11	Top of ridge between MCG 3,4,5,6 locations (1,153 ft amsl)
MCG 12	North end of Vernita Bridge rest area
MCG 13	Might be from backfill at cleanup site
MCG 14	Probably not fill dirt – old road or railroad track
MCG 15	Edge of pit – mostly natural soil in river rock
MCG 16	10' S of an old road- probably fill around an old building
MCG 17	Right on top of WIDS site coordinate
MCG 18	W edge of pit, near clay pipe fragments
MCG 19	5-10' N of RR tracks in bottom of trench
<i>North Slope</i>	
NS7	Taken about 300 ft from access road
NS9	Just before bend, between mile marker 48 and 49
NS18	Road closed, sampled just off road near mi 58
NS19	Walked approx 0.5 mi W along canal from Wahluke Wildlife Area
NS20	Taken from N side of canal approx 0.5 mi W of primitive road
NS21	Taken from W side of Wahluke Wildlife Area Rd Approx 1.3 mi
NS22	Intersection of 2 dirt roads, near power lines
NS23	Parking lot of white bluffs boat launch
NS24	Vernita Bridge boat launch parking lot
NS25	Along bluff edge overlooking Hanford Townsite
NS26	Taken from W side of Wahluke Wildlife Area Rd Approx 0.7 mi up
NS27	Berg Ranch Historic sampling location
NS28	N End Vernita Bridge Historic Sampling location
NS29	1 mile south of NS7
NS30	North side of parking lot near bluff edge
NS42	~760 m upstream of given point
NS44	~50 meters upstream of TLD station
NS45	Savage Island slew irrigation return
NS47	Savage Island slew
NS48	Savage Island slew
<p>Locations with no field notes were collected from areas typical of surroundings with no distinguishing features or other noteworthy characteristics. amsl = Above mean sea level. TLD = Thermoluminescent dosimeter. WIDS = Waste Information Data System.</p>	

Appendix B

Soil Concentration Results

Appendix B

Soil Concentration Results

Table B.1. Summary of Results for Radionuclides Included in the Authorized Limits

SAMP_SITE_NAME	Co-60	Cs-134	Cs-137	Eu-152	Sr-90	U-234	U-235	U-238	Pu-239/240
HRNM MCG-1	0.001	0.054	0.036	-0.028	0.011	0.15	0.0039	0.14	0.0009
HRNM MCG-2	0.000	0.078	0.044	-0.025	-0.002	0.42	0.0258	0.36	0.0020
HRNM MCG-3	-0.001	0.058	0.055	-0.010	0.018	0.17	0.0048	0.18	0.0006
HRNM MCG-4	0.007	0.048	0.122	-0.022	-0.008	0.20	0.0050	0.20	0.0037
HRNM MCG-5	0.001	0.039	0.025	-0.039	-0.033	0.11	0.0047	0.11	0.0005
HRNM MCG-6	-0.005	0.067	0.216	-0.012	0.050	0.15	-0.0001	0.13	0.0067
HRNM MCG-7	-0.003	0.041	0.254	-0.007	0.081	0.19	0.0059	0.19	0.0121
HRNM MCG-8	-0.002	0.033	0.093	-0.003	-0.014	0.22	0.0036	0.21	0.0082
HRNM MCG-9	0.003	0.051	0.126	-0.019	0.007	0.20	0.0031	0.17	0.0056
HRNM MCG-10	-0.002	0.040	0.183	-0.032	0.028	0.12	0.0033	0.13	0.0065
HRNM MCG-11	0.004	0.032	0.135	0.006	0.047	0.12	0.0053	0.12	0.0036
HRNM MCG-12	0.019	0.055	0.179	0.006	-0.012	0.23	0.0139	0.21	0.0068
HRNM MCG-13	-0.028	0.054	0.499	0.001	0.054	0.13	0.0056	0.13	0.0106
HRNM MCG-14	0.026	0.025	0.461	-0.009	0.037	0.13	0.0030	0.14	0.0108
HRNM MCG-15	-0.010	0.068	0.550	-0.023	0.055	0.14	0.0053	0.14	0.0185
HRNM MCG-16	0.000	0.045	0.443	0.006	0.066	0.09	0.0025	0.07	0.0117
HRNM MCG-17	-0.010	0.062	0.150	-0.002	0.024	0.08	0.0168	0.07	0.0040
HRNM MCG-18	-0.018	0.046	0.014	0.028	-0.026	0.07	0.0031	0.05	0.0012
HRNM MCG-19	-0.011	0.042	0.088	-0.008	0.008	0.09	0.0033	0.08	0.0025
HRNM NS-1	-0.004	0.056	0.186	0.009	0.028	0.14	0.0015	0.17	0.0047
HRNM NS-2	0.000	0.030	0.038	-0.015	0.000	0.18	0.0040	0.21	0.0013
HRNM NS-3	0.004	0.053	0.119	-0.012	0.031	0.17	0.0026	0.15	0.0041
HRNM NS-4	0.003	0.051	0.067	-0.021	-0.003	0.18	0.0086	0.16	0.0021
HRNM NS-5	0.002	0.031	0.018	0.004	-0.024	0.17	0.0089	0.18	0.0004
HRNM NS-6	-0.012	0.052	0.220	-0.013	0.068	0.08	0.0022	0.08	0.0082
HRNM NS-7	0.002	0.040	0.199	-0.020	0.015	0.18	0.0069	0.20	0.0049
HRNM NS-8	0.002	0.028	0.004	-0.018	-0.021	0.15	0.0042	0.17	-0.0008
HRNM NS-9	0.005	0.050	0.093	-0.039	0.016	0.14	0.0035	0.12	0.0040
HRNM NS-10	0.002	0.047	0.122	-0.026	0.016	0.19	0.0085	0.19	0.0034
HRNM NS-11	0.007	0.049	0.039	-0.005	-0.017	0.22	0.0058	0.21	0.0005
HRNM NS-12	-0.002	0.041	0.096	0.016	0.006	0.13	0.0052	0.15	0.0020
HRNM NS-13	0.012	0.055	0.166	0.013	0.017	0.18	0.0067	0.19	0.0048
HRNM NS-14	0.006	0.050	0.019	-0.019	-0.017	0.18	0.0069	0.20	0.0020
HRNM NS-15	-0.005	0.034	0.220	-0.005	0.062	0.10	0.0022	0.14	0.0065
HRNM NS-16	-0.008	0.051	0.347	-0.006	0.038	0.08	0.0030	0.08	0.0102
HRNM NS-17	0.000	0.031	0.067	-0.013	0.001	0.06	0.0023	0.06	0.0031
HRNM NS-18	-0.007	0.044	0.292	-0.007	0.069	0.11	0.0037	0.11	0.0069
HRNM NS-19	0.001	0.066	0.387	0.005	0.083	0.09	0.0021	0.10	0.0144
HRNM NS-20	0.002	0.058	0.294	0.006	0.055	0.10	0.0085	0.14	0.0128
HRNM NS-21	0.002	0.051	0.271	0.006	0.189	0.12	0.0040	0.12	0.0083
HRNM NS-22	0.006	0.059	0.139	-0.012	0.036	0.17	0.0045	0.16	0.0068

Table B.1. (contd)

SAMP_SITE_NAME	Co-60	Cs-134	Cs-137	Eu-152	Sr-90	U-234	U-235	U-238	Pu-239/240
HRNM NS-23	<i>0.008</i>	<i>0.061</i>	0.112	<i>0.003</i>	<i>0.020</i>	0.19	0.0078	0.19	0.0039
HRNM NS-24	<i>0.003</i>	<i>0.055</i>	<i>0.005</i>	<i>0.007</i>	<i>-0.009</i>	0.18	<i>0.0063</i>	0.17	<i>0.0015</i>
HRNM NS-25	<i>0.006</i>	<i>0.032</i>	0.369	<i>-0.010</i>	0.072	0.17	0.0078	0.16	0.0139
HRNM NS-26	<i>0.001</i>	<i>0.061</i>	0.112	<i>-0.021</i>	<i>-0.013</i>	0.22	0.0106	0.22	<i>0.0026</i>
HRNM NS-27	<i>0.005</i>	<i>0.037</i>	0.283	<i>-0.009</i>	<i>0.040</i>	0.09	<i>0.0041</i>	<i>0.09</i>	0.0117
HRNM NS-28	<i>-0.002</i>	<i>0.049</i>	0.027	<i>-0.011</i>	<i>-0.020</i>	0.09	<i>0.0028</i>	0.10	<i>0.0002</i>
HRNM NS-29	<i>-0.005</i>	<i>0.058</i>	0.230	<i>-0.003</i>	<i>0.042</i>	0.15	0.0085	0.18	0.0082
HRNM NS-30	<i>0.003</i>	<i>0.054</i>	0.180	<i>-0.018</i>	<i>0.039</i>	0.15	<i>0.0048</i>	0.18	0.0048
HRNM NS-31	<i>-0.001</i>	<i>0.052</i>	0.188	<i>0.000</i>	<i>-0.030</i>	1.57	0.0566	1.38	0.0040
HRNM NS-32	<i>0.001</i>	<i>0.079</i>	0.073	<i>-0.005</i>	<i>-0.021</i>	0.35	0.0190	0.36	<i>0.0015</i>
HRNM NS-33	<i>0.006</i>	<i>0.066</i>	0.340	<i>-0.015</i>	<i>0.025</i>	1.13	0.0346	0.95	0.0202
HRNM NS-34	<i>0.007</i>	<i>0.156</i>	0.101	<i>-0.058</i>	<i>-0.015</i>	1.52	0.0520	1.30	0.0028
HRNM NS-35	<i>-0.006</i>	<i>0.066</i>	0.107	<i>0.012</i>	<i>-0.012</i>	0.52	0.0132	0.45	<i>0.0023</i>
HRNM NS-36	<i>0.015</i>	<i>0.019</i>	0.022	<i>0.000</i>	<i>-0.019</i>	0.14	<i>0.0041</i>	0.16	0.0245
HRNM NS-37	<i>-0.001</i>	<i>0.055</i>	<i>0.000</i>	<i>-0.057</i>	<i>-0.026</i>	0.24	0.0103	0.20	<i>-0.0007</i>
HRNM NS-38	<i>0.006</i>	<i>0.049</i>	<i>0.002</i>	<i>0.001</i>	<i>-0.018</i>	0.13	0.0085	0.13	<i>-0.0002</i>
HRNM NS-39	<i>0.004</i>	<i>0.082</i>	<i>0.020</i>	<i>-0.008</i>	<i>-0.005</i>	0.33	0.0306	0.38	<i>0.0006</i>
HRNM NS-40	<i>-0.003</i>	<i>0.173</i>	<i>-0.013</i>	<i>-0.017</i>	<i>0.004</i>	3.50	0.0975	2.88	<i>0.0002</i>
HRNM NS-41	<i>0.010</i>	<i>0.058</i>	0.144	<i>0.047</i>	<i>-0.003</i>	0.66	0.0274	0.58	<i>0.0015</i>
HRNM NS-42	<i>-0.008</i>	<i>0.047</i>	0.023	<i>-0.011</i>	<i>-0.022</i>	0.29	0.0102	0.29	<i>0.0004</i>
HRNM NS-43	<i>-0.004</i>	<i>0.058</i>	0.059	<i>-0.002</i>	<i>-0.009</i>	0.37	0.0133	0.33	<i>0.0006</i>
HRNM NS-44	<i>-0.007</i>	<i>0.087</i>	0.100	<i>-0.019</i>	<i>-0.017</i>	0.50	0.0152	0.48	<i>0.0018</i>
HRNM NS-45	<i>0.016</i>	<i>0.071</i>	<i>0.005</i>	<i>-0.029</i>	<i>-0.044</i>	0.22	0.0085	0.24	0.0004
HRNM NS-46	<i>-0.007</i>	<i>0.066</i>	0.034	<i>-0.015</i>	<i>-0.028</i>	0.25	0.0098	0.20	<i>0.0003</i>
HRNM NS-47	<i>0.010</i>	<i>0.063</i>	<i>-0.011</i>	<i>-0.004</i>	<i>-0.004</i>	0.46	0.0198	0.42	<i>0.0002</i>
HRNM NS-48	<i>0.007</i>	<i>0.094</i>	0.658	<i>0.160</i>	<i>-0.012</i>	0.76	0.0296	0.66	0.0068

Shaded cells with *italic* text denote samples with reported concentrations lower than minimum detectable concentration, i.e., undetected.

Table B.2. Raw Results from HEIS for Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units of the HRNM for Radionuclides Included in the Authorized Limits

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0M5	HRNM MCG-1	4/22/05	Co-60	0.000789	0.0088	0.0154	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Cs-134	0.0541	0.018	0.0232	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Cs-137	0.0363	0.015	0.0152	
B1D0M5	HRNM MCG-1	4/22/05	Eu-152	-0.0284	0.022	0.0361	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Pu-239/240	0.000941	0.0022	0.00163	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Sr-90	0.0109	0.05	0.0448	Undetected
B1D0M5	HRNM MCG-1	4/22/05	U-234	0.148	0.075	0.00198	
B1D0M5	HRNM MCG-1	4/22/05	U-235	0.00388	0.0068	0.00198	Undetected
B1D0M5	HRNM MCG-1	4/22/05	U-238	0.14	0.099	0.00198	
B1D0M6	HRNM MCG-2	4/22/05	Co-60	0.000341	0.011	0.0183	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Cs-134	0.0779	0.023	0.0269	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Cs-137	0.0442	0.014	0.0172	
B1D0M6	HRNM MCG-2	4/22/05	Eu-152	-0.0252	0.026	0.042	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Pu-239/240	0.00198	0.0025	0.00194	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Sr-90	-0.00171	0.046	0.0342	Undetected
B1D0M6	HRNM MCG-2	4/22/05	U-234	0.418	0.099	0.0112	
B1D0M6	HRNM MCG-2	4/22/05	U-235	0.0258	0.011	0.00522	
B1D0M6	HRNM MCG-2	4/22/05	U-238	0.364	0.11	0.00851	
B1D0M7	HRNM MCG-3	4/22/05	Co-60	-0.00079	0.0095	0.0165	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Cs-134	0.0584	0.023	0.0236	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Cs-137	0.0545	0.018	0.0167	
B1D0M7	HRNM MCG-3	4/22/05	Eu-152	-0.00977	0.023	0.0392	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Pu-239/240	0.000611	0.0021	0.00185	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Sr-90	0.0182	0.053	0.0615	Undetected
B1D0M7	HRNM MCG-3	4/22/05	U-234	0.165	0.064	0.00837	
B1D0M7	HRNM MCG-3	4/22/05	U-235	0.00475	0.0059	0.00173	Undetected
B1D0M7	HRNM MCG-3	4/22/05	U-238	0.176	0.084	0.00767	
B1D0M8	HRNM MCG-4	4/22/05	Co-60	0.00659	0.0094	0.0171	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Cs-134	0.0481	0.018	0.0222	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Cs-137	0.122	0.023	0.0149	
B1D0M8	HRNM MCG-4	4/22/05	Eu-152	-0.0222	0.022	0.0365	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Pu-239/240	0.00372	0.0029	0.000795	
B1D0M8	HRNM MCG-4	4/22/05	Sr-90	-0.00834	0.047	0.0386	Undetected
B1D0M8	HRNM MCG-4	4/22/05	U-234	0.198	0.078	0.0104	
B1D0M8	HRNM MCG-4	4/22/05	U-235	0.00501	0.0085	0.0098	Undetected
B1D0M8	HRNM MCG-4	4/22/05	U-238	0.196	0.1	0.00911	
B1D0M9	HRNM MCG-5	4/22/05	Co-60	0.000636	0.01	0.0171	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Cs-134	0.0385	0.017	0.0215	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Cs-137	0.0254	0.012	0.0151	
B1D0M9	HRNM MCG-5	4/22/05	Eu-152	-0.0392	0.022	0.0335	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Pu-239/240	0.000509	0.002	0.000605	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Sr-90	-0.0326	0.045	0.0346	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0M9	HRNM MCG-5	4/22/05	U-234	0.109	0.061	0.00832	
B1D0M9	HRNM MCG-5	4/22/05	U-235	0.00472	0.0062	0.00487	Undetected
B1D0M9	HRNM MCG-5	4/22/05	U-238	0.108	0.083	0.0063	
B1D0N0	HRNM MCG-6	4/22/05	Co-60	-0.00476	0.01	0.0168	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Cs-134	0.067	0.021	0.0239	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Cs-137	0.216	0.032	0.0161	
B1D0N0	HRNM MCG-6	4/22/05	Eu-152	-0.012	0.024	0.0397	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Pu-239/240	0.00668	0.0038	0.00248	
B1D0N0	HRNM MCG-6	4/22/05	Sr-90	0.0495	0.049	0.0307	
B1D0N0	HRNM MCG-6	4/22/05	U-234	0.149	0.075	0.00793	
B1D0N0	HRNM MCG-6	4/22/05	U-235	-0.000137	0.0065	0.00793	Undetected
B1D0N0	HRNM MCG-6	4/22/05	U-238	0.126	0.098	0.00793	
B1D0N1	HRNM MCG-7	4/22/05	Co-60	-0.00315	0.0095	0.0161	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Cs-134	0.0413	0.019	0.0223	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Cs-137	0.254	0.038	0.016	
B1D0N1	HRNM MCG-7	4/22/05	Eu-152	-0.00688	0.023	0.0387	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Pu-239/240	0.0121	0.0039	0.000492	
B1D0N1	HRNM MCG-7	4/22/05	Sr-90	0.0814	0.049	0.0268	
B1D0N1	HRNM MCG-7	4/22/05	U-234	0.186	0.064	0.00489	
B1D0N1	HRNM MCG-7	4/22/05	U-235	0.00587	0.0058	0.00143	
B1D0N1	HRNM MCG-7	4/22/05	U-238	0.192	0.082	0.00143	
B1D0N2	HRNM MCG-8	5/10/05	Co-60	-0.00183	0.0091	0.0157	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Cs-134	0.0331	0.013	0.0199	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Cs-137	0.0931	0.02	0.015	
B1D0N2	HRNM MCG-8	5/10/05	Eu-152	-0.00326	0.021	0.0356	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Pu-239/240	0.00823	0.0041	0.00254	
B1D0N2	HRNM MCG-8	5/10/05	Sr-90	-0.0144	0.045	0.0287	Undetected
B1D0N2	HRNM MCG-8	5/10/05	U-234	0.218	0.079	0.00704	
B1D0N2	HRNM MCG-8	5/10/05	U-235	0.0036	0.0073	0.00704	Undetected
B1D0N2	HRNM MCG-8	5/10/05	U-238	0.214	0.1	0.0103	
B1D0N3	HRNM MCG-9	5/10/05	Co-60	0.00335	0.0092	0.016	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Cs-134	0.0506	0.017	0.0223	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Cs-137	0.126	0.022	0.0165	
B1D0N3	HRNM MCG-9	5/10/05	Eu-152	-0.0188	0.024	0.0378	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Pu-239/240	0.00559	0.0029	0.000523	
B1D0N3	HRNM MCG-9	5/10/05	Sr-90	0.00725	0.046	0.0288	Undetected
B1D0N3	HRNM MCG-9	5/10/05	U-234	0.202	0.077	0.00194	
B1D0N3	HRNM MCG-9	5/10/05	U-235	0.00308	0.0067	0.00526	Undetected
B1D0N3	HRNM MCG-9	5/10/05	U-238	0.174	0.098	0.00194	
B1D0N4	HRNM MCG-10	6/28/05	Co-60	-0.00206	0.016	0.0273	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Cs-134	0.0395	0.018	0.0348	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Cs-137	0.183	0.039	0.0301	
B1D0N4	HRNM MCG-10	6/28/05	Eu-152	-0.0323	0.046	0.0745	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0N4	HRNM MCG-10	6/28/05	Pu-239/240	0.00648	0.0019	0.00026	
B1D0N4	HRNM MCG-10	6/28/05	Sr-90	0.0278	0.049	0.0432	Undetected
B1D0N4	HRNM MCG-10	6/28/05	U-234	0.116	0.073	0.015	
B1D0N4	HRNM MCG-10	6/28/05	U-235	0.00332	0.008	0.00921	Undetected
B1D0N4	HRNM MCG-10	6/28/05	U-238	0.133	0.099	0.0123	
B1D0N5	HRNM MCG-11	6/28/05	Co-60	0.00401	0.017	0.032	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Cs-134	0.0321	0.027	0.0425	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Cs-137	0.135	0.038	0.0331	
B1D0N5	HRNM MCG-11	6/28/05	Eu-152	0.00609	0.05	0.0821	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Pu-239/240	0.00362	0.0015	0.000698	
B1D0N5	HRNM MCG-11	6/28/05	Sr-90	0.047	0.049	0.0373	Undetected
B1D0N5	HRNM MCG-11	6/28/05	U-234	0.117	0.073	0.00924	
B1D0N5	HRNM MCG-11	6/28/05	U-235	0.0053	0.0072	0.00482	Undetected
B1D0N5	HRNM MCG-11	6/28/05	U-238	0.117	0.099	0.00787	
B1D0N6	HRNM MCG-12	6/28/05	Co-60	0.0186	0.021	0.0399	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Cs-134	0.0553	0.025	0.0469	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Cs-137	0.179	0.054	0.0367	
B1D0N6	HRNM MCG-12	6/28/05	Eu-152	0.00596	0.055	0.0941	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Pu-239/240	0.0068	0.0021	0.000812	
B1D0N6	HRNM MCG-12	6/28/05	Sr-90	-0.0121	0.045	0.0288	Undetected
B1D0N6	HRNM MCG-12	6/28/05	U-234	0.226	0.082	0.00558	
B1D0N6	HRNM MCG-12	6/28/05	U-235	0.0139	0.0093	0.00558	
B1D0N6	HRNM MCG-12	6/28/05	U-238	0.21	0.1	0.00993	
B1D0N7	HRNM MCG-13	6/28/05	Co-60	-0.0277	0.024	0.0379	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Cs-134	0.0536	0.027	0.0519	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Cs-137	0.499	0.078	0.0419	
B1D0N7	HRNM MCG-13	6/28/05	Eu-152	0.000533	0.063	0.109	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Pu-239/240	0.0106	0.0048	0.00321	
B1D0N7	HRNM MCG-13	6/28/05	Sr-90	0.0541	0.049	0.0353	
B1D0N7	HRNM MCG-13	6/28/05	U-234	0.125	0.073	0.00207	
B1D0N7	HRNM MCG-13	6/28/05	U-235	0.00563	0.0072	0.00207	Undetected
B1D0N7	HRNM MCG-13	6/28/05	U-238	0.132	0.1	0.00563	
B1D0N8	HRNM MCG-14	6/28/05	Co-60	0.0257	0.022	0.043	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Cs-134	0.0254	0.022	0.0413	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Cs-137	0.461	0.072	0.0384	
B1D0N8	HRNM MCG-14	6/28/05	Eu-152	-0.00882	0.058	0.0865	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Pu-239/240	0.0108	0.0021	0.000333	
B1D0N8	HRNM MCG-14	6/28/05	Sr-90	0.037	0.046	0.0287	Undetected
B1D0N8	HRNM MCG-14	6/28/05	U-234	0.125	0.072	0.00834	
B1D0N8	HRNM MCG-14	6/28/05	U-235	0.00295	0.0068	0.00645	Undetected
B1D0N8	HRNM MCG-14	6/28/05	U-238	0.135	0.097	0.00645	
B1D0N9	HRNM MCG-15	6/28/05	Co-60	-0.0101	0.019	0.0315	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Cs-134	0.0679	0.03	0.0405	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0N9	HRNM MCG-15	6/28/05	Cs-137	0.55	0.078	0.0329	
B1D0N9	HRNM MCG-15	6/28/05	Eu-152	-0.0232	0.053	0.0888	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Pu-239/240	0.0185	0.0032	0.000285	
B1D0N9	HRNM MCG-15	6/28/05	Sr-90	0.0547	0.049	0.0339	
B1D0N9	HRNM MCG-15	6/28/05	U-234	0.138	0.073	0.00619	
B1D0N9	HRNM MCG-15	6/28/05	U-235	0.00528	0.0073	0.00545	Undetected
B1D0N9	HRNM MCG-15	6/28/05	U-238	0.137	0.098	0.00545	
B1D0P0	HRNM MCG-16	6/28/05	Co-60	-0.000183	0.016	0.029	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Cs-134	0.0451	0.026	0.0361	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Cs-137	0.443	0.066	0.0299	
B1D0P0	HRNM MCG-16	6/28/05	Eu-152	0.00629	0.04	0.07	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Pu-239/240	0.0117	0.0033	0.000379	
B1D0P0	HRNM MCG-16	6/28/05	Sr-90	0.0662	0.048	0.0342	
B1D0P0	HRNM MCG-16	6/28/05	U-234	0.0929	0.069	0.00416	
B1D0P0	HRNM MCG-16	6/28/05	U-235	0.00246	0.0063	0.00199	Undetected
B1D0P0	HRNM MCG-16	6/28/05	U-238	0.0748	0.094	0.00729	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Co-60	-0.00979	0.024	0.041	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Cs-134	0.0621	0.029	0.055	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Cs-137	0.15	0.04	0.0424	
B1D0P1	HRNM MCG-17	6/28/05	Eu-152	-0.00182	0.059	0.102	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Pu-239/240	0.00396	0.0013	0.000545	
B1D0P1	HRNM MCG-17	6/28/05	Sr-90	0.0241	0.047	0.0318	Undetected
B1D0P1	HRNM MCG-17	6/28/05	U-234	0.0826	0.068	0.0103	
B1D0P1	HRNM MCG-17	6/28/05	U-235	0.0168	0.01	0.00505	
B1D0P1	HRNM MCG-17	6/28/05	U-238	0.073	0.093	0.00242	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Co-60	-0.0183	0.017	0.027	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Cs-134	0.0456	0.021	0.0396	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Cs-137	0.0142	0.02	0.0362	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Eu-152	0.0278	0.052	0.0902	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Pu-239/240	0.00124	0.00048	0.000235	
B1D0P2	HRNM MCG-18	6/28/05	Sr-90	-0.0258	0.046	0.0348	Undetected
B1D0P2	HRNM MCG-18	6/28/05	U-234	0.0718	0.068	0.0102	
B1D0P2	HRNM MCG-18	6/28/05	U-235	0.00312	0.007	0.00671	Undetected
B1D0P2	HRNM MCG-18	6/28/05	U-238	0.0526	0.093	0.0145	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Co-60	-0.0109	0.016	0.0268	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Cs-134	0.0419	0.019	0.0352	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Cs-137	0.0876	0.037	0.0226	
B1D0P3	HRNM MCG-19	6/28/05	Eu-152	-0.00811	0.039	0.0677	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Pu-239/240	0.00247	0.0008	0.000128	
B1D0P3	HRNM MCG-19	6/28/05	Sr-90	0.00795	0.044	0.0306	Undetected
B1D0P3	HRNM MCG-19	6/28/05	U-234	0.0857	0.071	0.0148	
B1D0P3	HRNM MCG-19	6/28/05	U-235	0.00332	0.0079	0.00913	Undetected
B1D0P3	HRNM MCG-19	6/28/05	U-238	0.0831	0.097	0.019	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0H7	HRNM NS-1	4/8/05	Co-60	-0.00396	0.01	0.0176	Undetected
B1D0H7	HRNM NS-1	4/8/05	Cs-134	0.0555	0.02	0.0262	Undetected
B1D0H7	HRNM NS-1	4/8/05	Cs-137	0.186	0.03	0.0165	
B1D0H7	HRNM NS-1	4/8/05	Eu-152	0.00879	0.027	0.0432	Undetected
B1D0H7	HRNM NS-1	4/8/05	Pu-239/240	0.0047	0.0012	0.000125	
B1D0H7	HRNM NS-1	4/8/05	Sr-90	0.0283	0.047	0.0254	Undetected
B1D0H7	HRNM NS-1	4/8/05	U-234	0.136	0.072	0.0072	
B1D0H7	HRNM NS-1	4/8/05	U-235	0.00146	0.0063	0.00492	Undetected
B1D0H7	HRNM NS-1	4/8/05	U-238	0.165	0.098	0.00943	
B1D0H8	HRNM NS-2	9/29/05	Co-60	0.000223	0.011	0.0189	Undetected
B1D0H8	HRNM NS-2	9/29/05	Cs-134	0.0296	0.018	0.0243	Undetected
B1D0H8	HRNM NS-2	9/29/05	Cs-137	0.0382	0.027	0.017	
B1D0H8	HRNM NS-2	9/29/05	Eu-152	-0.0154	0.025	0.042	Undetected
B1D0H8	HRNM NS-2	9/29/05	Pu-239/240	0.0013	0.00057	0.000135	
B1D0H8	HRNM NS-2	9/29/05	Sr-90	-0.0000218	0.048	0.0385	Undetected
B1D0H8	HRNM NS-2	9/29/05	U-234	0.176	0.076	0.0111	
B1D0H8	HRNM NS-2	9/29/05	U-235	0.00395	0.0079	0.00889	Undetected
B1D0H8	HRNM NS-2	9/29/05	U-238	0.207	0.1	0.0134	
B1D0P4	HRNM NS-3	4/22/05	Co-60	0.00425	0.0099	0.0176	Undetected
B1D0P4	HRNM NS-3	4/22/05	Cs-134	0.0525	0.018	0.0231	Undetected
B1D0P4	HRNM NS-3	4/22/05	Cs-137	0.119	0.021	0.0159	
B1D0P4	HRNM NS-3	4/22/05	Eu-152	-0.0121	0.022	0.036	Undetected
B1D0P4	HRNM NS-3	4/22/05	Pu-239/240	0.00413	0.0029	0.00185	
B1D0P4	HRNM NS-3	4/22/05	Sr-90	0.0306	0.05	0.0418	Undetected
B1D0P4	HRNM NS-3	4/22/05	U-234	0.168	0.067	0.00554	
B1D0P4	HRNM NS-3	4/22/05	U-235	0.00263	0.0059	0.00487	Undetected
B1D0P4	HRNM NS-3	4/22/05	U-238	0.154	0.087	0.00401	
B1D0H9	HRNM NS-4	4/8/05	Co-60	0.00328	0.01	0.0177	Undetected
B1D0H9	HRNM NS-4	4/8/05	Cs-134	0.0508	0.02	0.0246	Undetected
B1D0H9	HRNM NS-4	4/8/05	Cs-137	0.0667	0.018	0.0162	
B1D0H9	HRNM NS-4	4/8/05	Eu-152	-0.0213	0.024	0.0398	Undetected
B1D0H9	HRNM NS-4	4/8/05	Pu-239/240	0.00209	0.00062	0.000245	
B1D0H9	HRNM NS-4	4/8/05	Sr-90	-0.00338	0.045	0.0258	Undetected
B1D0H9	HRNM NS-4	4/8/05	U-234	0.18	0.079	0.00828	
B1D0H9	HRNM NS-4	4/8/05	U-235	0.00855	0.0093	0.00959	Undetected
B1D0H9	HRNM NS-4	4/8/05	U-238	0.161	0.1	0.0107	
B1D0J0	HRNM NS-5	9/29/05	Co-60	0.0018	0.012	0.0204	Undetected
B1D0J0	HRNM NS-5	9/29/05	Cs-134	0.0314	0.016	0.0232	Undetected
B1D0J0	HRNM NS-5	9/29/05	Cs-137	0.0179	0.011	0.0188	Undetected
B1D0J0	HRNM NS-5	9/29/05	Eu-152	0.00351	0.025	0.0435	Undetected
B1D0J0	HRNM NS-5	9/29/05	Pu-239/240	0.000421	0.00039	0.00045	Undetected
B1D0J0	HRNM NS-5	9/29/05	Sr-90	-0.0239	0.045	0.0321	Undetected
B1D0J0	HRNM NS-5	9/29/05	U-234	0.174	0.076	0.00867	

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J0	HRNM NS-5	9/29/05	U-235	0.00888	0.0078	0.00196	
B1D0J0	HRNM NS-5	9/29/05	U-238	0.182	0.1	0.00196	
B1D0K2	HRNM NS-6	1/5/06	Co-60	-0.012	0.01	0.0155	Undetected
B1D0K2	HRNM NS-6	1/5/06	Cs-134	0.052	0.018	0.0209	Undetected
B1D0K2	HRNM NS-6	1/5/06	Cs-137	0.22	0.034	0.0178	
B1D0K2	HRNM NS-6	1/5/06	Eu-152	-0.0131	0.024	0.0398	Undetected
B1D0K2	HRNM NS-6	1/5/06	Pu-239/240	0.00821	0.0015	0.000264	
B1D0K2	HRNM NS-6	1/5/06	Sr-90	0.0679	0.05	0.0376	
B1D0K2	HRNM NS-6	1/5/06	U-234	0.0796	0.071	0.00819	
B1D0K2	HRNM NS-6	1/5/06	U-235	0.00216	0.0066	0.00502	Undetected
B1D0K2	HRNM NS-6	1/5/06	U-238	0.0838	0.098	0.00819	Undetected
B1D0P5	HRNM NS-7	4/22/05	Co-60	0.00175	0.012	0.0202	Undetected
B1D0P5	HRNM NS-7	4/22/05	Cs-134	0.0401	0.015	0.0264	Undetected
B1D0P5	HRNM NS-7	4/22/05	Cs-137	0.199	0.033	0.0173	
B1D0P5	HRNM NS-7	4/22/05	Eu-152	-0.0203	0.027	0.0436	Undetected
B1D0P5	HRNM NS-7	4/22/05	Pu-239/240	0.00492	0.003	0.0017	
B1D0P5	HRNM NS-7	4/22/05	Sr-90	0.0149	0.05	0.0461	Undetected
B1D0P5	HRNM NS-7	4/22/05	U-234	0.179	0.069	0.00211	
B1D0P5	HRNM NS-7	4/22/05	U-235	0.00686	0.0071	0.00534	Undetected
B1D0P5	HRNM NS-7	4/22/05	U-238	0.2	0.091	0.00606	
B1D0P6	HRNM NS-8	4/22/05	Co-60	0.00239	0.0087	0.0154	Undetected
B1D0P6	HRNM NS-8	4/22/05	Cs-134	0.0281	0.013	0.0201	Undetected
B1D0P6	HRNM NS-8	4/22/05	Cs-137	0.00432	0.0077	0.0135	Undetected
B1D0P6	HRNM NS-8	4/22/05	Eu-152	-0.0181	0.021	0.0332	Undetected
B1D0P6	HRNM NS-8	4/22/05	Pu-239/240	-0.00075	0.0022	0.0034	Undetected
B1D0P6	HRNM NS-8	4/22/05	Sr-90	-0.0207	0.046	0.0359	Undetected
B1D0P6	HRNM NS-8	4/22/05	U-234	0.153	0.069	0.00611	
B1D0P6	HRNM NS-8	4/22/05	U-235	0.00424	0.0066	0.00241	Undetected
B1D0P6	HRNM NS-8	4/22/05	U-238	0.166	0.091	0.00611	
B1D0K4	HRNM NS-9	4/22/05	Co-60	0.0045	0.013	0.0227	Undetected
B1D0K4	HRNM NS-9	4/22/05	Cs-134	0.0497	0.023	0.0288	Undetected
B1D0K4	HRNM NS-9	4/22/05	Cs-137	0.0932	0.021	0.0209	
B1D0K4	HRNM NS-9	4/22/05	Eu-152	-0.0392	0.029	0.0464	Undetected
B1D0K4	HRNM NS-9	4/22/05	Pu-239/240	0.00395	0.0032	0.00107	
B1D0K4	HRNM NS-9	4/22/05	Sr-90	0.0161	0.048	0.0349	Undetected
B1D0K4	HRNM NS-9	4/22/05	U-234	0.137	0.073	0.00442	
B1D0K4	HRNM NS-9	4/22/05	U-235	0.00347	0.0066	0.00212	Undetected
B1D0K4	HRNM NS-9	4/22/05	U-238	0.117	0.097	0.00212	
B1D0K5	HRNM NS-10	1/5/06	Co-60	0.00193	0.0099	0.0175	Undetected
B1D0K5	HRNM NS-10	1/5/06	Cs-134	0.0471	0.017	0.0243	Undetected
B1D0K5	HRNM NS-10	1/5/06	Cs-137	0.122	0.025	0.0198	
B1D0K5	HRNM NS-10	1/5/06	Eu-152	-0.0262	0.026	0.0425	Undetected
B1D0K5	HRNM NS-10	1/5/06	Pu-239/240	0.00339	0.00072	0.0000529	

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0K5	HRNM NS-10	1/5/06	Sr-90	0.0162	0.048	0.0419	Undetected
B1D0K5	HRNM NS-10	1/5/06	U-234	0.19	0.082	0.00605	
B1D0K5	HRNM NS-10	1/5/06	U-235	0.00852	0.0079	0.00479	
B1D0K5	HRNM NS-10	1/5/06	U-238	0.192	0.11	0.00605	
B1D0P7	HRNM NS-11	4/22/05	Co-60	0.00671	0.0096	0.0172	Undetected
B1D0P7	HRNM NS-11	4/22/05	Cs-134	0.0488	0.019	0.0228	Undetected
B1D0P7	HRNM NS-11	4/22/05	Cs-137	0.0387	0.013	0.0135	
B1D0P7	HRNM NS-11	4/22/05	Eu-152	-0.00494	0.021	0.0349	Undetected
B1D0P7	HRNM NS-11	4/22/05	Pu-239/240	0.000509	0.002	0.00132	Undetected
B1D0P7	HRNM NS-11	4/22/05	Sr-90	-0.0167	0.046	0.0348	Undetected
B1D0P7	HRNM NS-11	4/22/05	U-234	0.218	0.074	0.00266	
B1D0P7	HRNM NS-11	4/22/05	U-235	0.00581	0.0076	0.00724	Undetected
B1D0P7	HRNM NS-11	4/22/05	U-238	0.209	0.093	0.00266	
B1D0P8	HRNM NS-12	4/22/05	Co-60	-0.00217	0.012	0.021	Undetected
B1D0P8	HRNM NS-12	4/22/05	Cs-134	0.0412	0.018	0.0274	Undetected
B1D0P8	HRNM NS-12	4/22/05	Cs-137	0.0959	0.023	0.0216	
B1D0P8	HRNM NS-12	4/22/05	Eu-152	0.016	0.03	0.046	Undetected
B1D0P8	HRNM NS-12	4/22/05	Pu-239/240	0.00204	0.0022	0.000469	Undetected
B1D0P8	HRNM NS-12	4/22/05	Sr-90	0.00563	0.045	0.0349	Undetected
B1D0P8	HRNM NS-12	4/22/05	U-234	0.126	0.071	0.0029	
B1D0P8	HRNM NS-12	4/22/05	U-235	0.00523	0.0075	0.0029	Undetected
B1D0P8	HRNM NS-12	4/22/05	U-238	0.154	0.097	0.0029	
B1D0J1	HRNM NS-13	4/8/05	Co-60	0.0118	0.015	0.0265	Undetected
B1D0J1	HRNM NS-13	4/8/05	Cs-134	0.055	0.025	0.0331	Undetected
B1D0J1	HRNM NS-13	4/8/05	Cs-137	0.166	0.03	0.0224	
B1D0J1	HRNM NS-13	4/8/05	Eu-152	0.0134	0.034	0.0516	Undetected
B1D0J1	HRNM NS-13	4/8/05	Pu-239/240	0.00479	0.0011	0.000374	
B1D0J1	HRNM NS-13	4/8/05	Sr-90	0.0168	0.046	0.027	Undetected
B1D0J1	HRNM NS-13	4/8/05	U-234	0.176	0.077	0.0161	
B1D0J1	HRNM NS-13	4/8/05	U-235	0.00665	0.0082	0.00773	Undetected
B1D0J1	HRNM NS-13	4/8/05	U-238	0.185	0.1	0.0161	
B1D0J2	HRNM NS-14	9/29/05	Co-60	0.00552	0.011	0.0204	Undetected
B1D0J2	HRNM NS-14	9/29/05	Cs-134	0.0498	0.017	0.0247	Undetected
B1D0J2	HRNM NS-14	9/29/05	Cs-137	0.0188	0.011	0.0203	Undetected
B1D0J2	HRNM NS-14	9/29/05	Eu-152	-0.0185	0.026	0.044	Undetected
B1D0J2	HRNM NS-14	9/29/05	Pu-239/240	0.00195	0.00069	0.00034	
B1D0J2	HRNM NS-14	9/29/05	Sr-90	-0.0165	0.046	0.0357	Undetected
B1D0J2	HRNM NS-14	9/29/05	U-234	0.176	0.075	0.00791	
B1D0J2	HRNM NS-14	9/29/05	U-235	0.00687	0.0076	0.00541	Undetected
B1D0J2	HRNM NS-14	9/29/05	U-238	0.201	0.1	0.00682	
B1D0J3	HRNM NS-15	4/8/05	Co-60	-0.00472	0.011	0.0194	Undetected
B1D0J3	HRNM NS-15	4/8/05	Cs-134	0.0335	0.019	0.0266	Undetected
B1D0J3	HRNM NS-15	4/8/05	Cs-137	0.22	0.033	0.0195	

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J3	HRNM NS-15	4/8/05	Eu-152	-0.00459	0.026	0.0445	Undetected
B1D0J3	HRNM NS-15	4/8/05	Pu-239/240	0.00646	0.0014	0.00021	
B1D0J3	HRNM NS-15	4/8/05	Sr-90	0.0618	0.051	0.0389	
B1D0J3	HRNM NS-15	4/8/05	U-234	0.1	0.071	0.0112	
B1D0J3	HRNM NS-15	4/8/05	U-235	0.00219	0.0081	0.0103	Undetected
B1D0J3	HRNM NS-15	4/8/05	U-238	0.136	0.099	0.0149	
B1D0J4	HRNM NS-16	4/8/05	Co-60	-0.00754	0.011	0.018	Undetected
B1D0J4	HRNM NS-16	4/8/05	Cs-134	0.0506	0.02	0.0277	Undetected
B1D0J4	HRNM NS-16	4/8/05	Cs-137	0.347	0.048	0.0199	
B1D0J4	HRNM NS-16	4/8/05	Eu-152	-0.00614	0.026	0.0437	Undetected
B1D0J4	HRNM NS-16	4/8/05	Pu-239/240	0.0102	0.0017	0.000134	
B1D0J4	HRNM NS-16	4/8/05	Sr-90	0.0378	0.051	0.0439	Undetected
B1D0J4	HRNM NS-16	4/8/05	U-234	0.0773	0.07	0.00191	
B1D0J4	HRNM NS-16	4/8/05	U-235	0.00299	0.0068	0.00519	Undetected
B1D0J4	HRNM NS-16	4/8/05	U-238	0.0768	0.096	0.00655	Undetected
B1D0J5	HRNM NS-17	4/8/05	Co-60	0.000153	0.0095	0.0163	Undetected
B1D0J5	HRNM NS-17	4/8/05	Cs-134	0.0313	0.016	0.0233	Undetected
B1D0J5	HRNM NS-17	4/8/05	Cs-137	0.0671	0.019	0.0156	
B1D0J5	HRNM NS-17	4/8/05	Eu-152	-0.0133	0.023	0.0381	Undetected
B1D0J5	HRNM NS-17	4/8/05	Pu-239/240	0.00309	0.00087	0.000234	
B1D0J5	HRNM NS-17	4/8/05	Sr-90	0.00141	0.049	0.0439	Undetected
B1D0J5	HRNM NS-17	4/8/05	U-234	0.0574	0.068	0.00804	Undetected
B1D0J5	HRNM NS-17	4/8/05	U-235	0.00225	0.0064	0.00235	Undetected
B1D0J5	HRNM NS-17	4/8/05	U-238	0.0582	0.094	0.00235	Undetected
B1D0K6	HRNM NS-18	4/8/05	Co-60	-0.00702	0.011	0.0188	Undetected
B1D0K6	HRNM NS-18	4/8/05	Cs-134	0.0436	0.017	0.0263	Undetected
B1D0K6	HRNM NS-18	4/8/05	Cs-137	0.292	0.044	0.0189	
B1D0K6	HRNM NS-18	4/8/05	Eu-152	-0.00651	0.028	0.0453	Undetected
B1D0K6	HRNM NS-18	4/8/05	Pu-239/240	0.00688	0.0029	0.000428	
B1D0K6	HRNM NS-18	4/8/05	Sr-90	0.0691	0.052	0.0424	
B1D0K6	HRNM NS-18	4/8/05	U-234	0.107	0.066	0.0075	
B1D0K6	HRNM NS-18	4/8/05	U-235	0.00374	0.0074	0.00837	Undetected
B1D0K6	HRNM NS-18	4/8/05	U-238	0.109	0.09	0.0116	
B1D0K7	HRNM NS-19	4/8/05	Co-60	0.000548	0.0095	0.0167	Undetected
B1D0K7	HRNM NS-19	4/8/05	Cs-134	0.0664	0.019	0.0251	Undetected
B1D0K7	HRNM NS-19	4/8/05	Cs-137	0.387	0.053	0.0169	
B1D0K7	HRNM NS-19	4/8/05	Eu-152	0.00451	0.025	0.0411	Undetected
B1D0K7	HRNM NS-19	4/8/05	Pu-239/240	0.0144	0.0042	0.00125	
B1D0K7	HRNM NS-19	4/8/05	Sr-90	0.0825	0.05	0.0403	
B1D0K7	HRNM NS-19	4/8/05	U-234	0.0945	0.056	0.00964	
B1D0K7	HRNM NS-19	4/8/05	U-235	0.00208	0.0066	0.00857	Undetected
B1D0K7	HRNM NS-19	4/8/05	U-238	0.0998	0.076	0.0101	
B1D0K8	HRNM NS-20	4/8/05	Co-60	0.00153	0.0089	0.0155	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0K8	HRNM NS-20	4/8/05	Cs-134	0.0583	0.019	0.0234	Undetected
B1D0K8	HRNM NS-20	4/8/05	Cs-137	0.294	0.043	0.0154	
B1D0K8	HRNM NS-20	4/8/05	Eu-152	0.00621	0.023	0.0388	Undetected
B1D0K8	HRNM NS-20	4/8/05	Pu-239/240	0.0128	0.0042	0.00056	
B1D0K8	HRNM NS-20	4/8/05	Sr-90	0.0552	0.047	0.0351	
B1D0K8	HRNM NS-20	4/8/05	U-234	0.102	0.069	0.00911	
B1D0K8	HRNM NS-20	4/8/05	U-235	0.00849	0.0079	0.006	
B1D0K8	HRNM NS-20	4/8/05	U-238	0.138	0.096	0.0108	
B1D0K9	HRNM NS-21	4/8/05	Co-60	0.00187	0.01	0.0182	Undetected
B1D0K9	HRNM NS-21	4/8/05	Cs-134	0.0513	0.019	0.0256	Undetected
B1D0K9	HRNM NS-21	4/8/05	Cs-137	0.271	0.039	0.0164	
B1D0K9	HRNM NS-21	4/8/05	Eu-152	0.00603	0.025	0.0421	Undetected
B1D0K9	HRNM NS-21	4/8/05	Pu-239/240	0.00828	0.0033	0.000522	
B1D0K9	HRNM NS-21	4/8/05	Sr-90	0.189	0.072	0.0837	
B1D0K9	HRNM NS-21	4/8/05	U-234	0.124	0.075	0.0161	
B1D0K9	HRNM NS-21	4/8/05	U-235	0.00399	0.0094	0.0127	Undetected
B1D0K9	HRNM NS-21	4/8/05	U-238	0.121	0.098	0.00469	
B1D0P9	HRNM NS-22	4/22/05	Co-60	0.00645	0.0092	0.0167	Undetected
B1D0P9	HRNM NS-22	4/22/05	Cs-134	0.0586	0.023	0.0228	Undetected
B1D0P9	HRNM NS-22	4/22/05	Cs-137	0.139	0.025	0.0144	
B1D0P9	HRNM NS-22	4/22/05	Eu-152	-0.0122	0.022	0.0356	Undetected
B1D0P9	HRNM NS-22	4/22/05	Pu-239/240	0.00684	0.0032	0.00148	
B1D0P9	HRNM NS-22	4/22/05	Sr-90	0.0355	0.047	0.0293	Undetected
B1D0P9	HRNM NS-22	4/22/05	U-234	0.171	0.069	0.00189	
B1D0P9	HRNM NS-22	4/22/05	U-235	0.00449	0.0066	0.00514	Undetected
B1D0P9	HRNM NS-22	4/22/05	U-238	0.16	0.09	0.00752	
B1D0R0	HRNM NS-23	4/22/05	Co-60	0.00821	0.01	0.0181	Undetected
B1D0R0	HRNM NS-23	4/22/05	Cs-134	0.0614	0.02	0.0254	Undetected
B1D0R0	HRNM NS-23	4/22/05	Cs-137	0.112	0.021	0.018	
B1D0R0	HRNM NS-23	4/22/05	Eu-152	0.00307	0.027	0.0411	Undetected
B1D0R0	HRNM NS-23	4/22/05	Pu-239/240	0.00387	0.0026	0.000525	
B1D0R0	HRNM NS-23	4/22/05	Sr-90	0.0198	0.046	0.0272	Undetected
B1D0R0	HRNM NS-23	4/22/05	U-234	0.185	0.067	0.00183	
B1D0R0	HRNM NS-23	4/22/05	U-235	0.00777	0.0071	0.00498	
B1D0R0	HRNM NS-23	4/22/05	U-238	0.192	0.087	0.00183	
B1D0J6	HRNM NS-24	9/29/05	Co-60	0.00283	0.012	0.0203	Undetected
B1D0J6	HRNM NS-24	9/29/05	Cs-134	0.0554	0.018	0.0243	Undetected
B1D0J6	HRNM NS-24	9/29/05	Cs-137	0.00452	0.011	0.0183	Undetected
B1D0J6	HRNM NS-24	9/29/05	Eu-152	0.00732	0.028	0.0432	Undetected
B1D0J6	HRNM NS-24	9/29/05	Pu-239/240	0.00149	0.0023	0.00172	Undetected
B1D0J6	HRNM NS-24	9/29/05	Sr-90	-0.00857	0.045	0.0268	Undetected
B1D0J6	HRNM NS-24	9/29/05	U-234	0.179	0.078	0.00733	
B1D0J6	HRNM NS-24	9/29/05	U-235	0.00629	0.0075	0.00508	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J6	HRNM NS-24	9/29/05	U-238	0.169	0.1	0.00635	
B1D0R1	HRNM NS-25	4/22/05	Co-60	0.00613	0.0092	0.0165	Undetected
B1D0R1	HRNM NS-25	4/22/05	Cs-134	0.032	0.016	0.0218	Undetected
B1D0R1	HRNM NS-25	4/22/05	Cs-137	0.369	0.049	0.0154	
B1D0R1	HRNM NS-25	4/22/05	Eu-152	-0.00996	0.024	0.0391	Undetected
B1D0R1	HRNM NS-25	4/22/05	Pu-239/240	0.0139	0.0057	0.00124	
B1D0R1	HRNM NS-25	4/22/05	Sr-90	0.0717	0.047	0.0256	
B1D0R1	HRNM NS-25	4/22/05	U-234	0.171	0.069	0.00745	
B1D0R1	HRNM NS-25	4/22/05	U-235	0.00775	0.0073	0.00218	
B1D0R1	HRNM NS-25	4/22/05	U-238	0.163	0.089	0.00218	
B1D0K3	HRNM NS-26	4/22/05	Co-60	0.000869	0.012	0.0207	Undetected
B1D0K3	HRNM NS-26	4/22/05	Cs-134	0.0611	0.021	0.029	Undetected
B1D0K3	HRNM NS-26	4/22/05	Cs-137	0.112	0.023	0.0182	
B1D0K3	HRNM NS-26	4/22/05	Eu-152	-0.0211	0.028	0.0456	Undetected
B1D0K3	HRNM NS-26	4/22/05	Pu-239/240	0.00259	0.003	0.00274	Undetected
B1D0K3	HRNM NS-26	4/22/05	Sr-90	-0.0129	0.047	0.0329	Undetected
B1D0K3	HRNM NS-26	4/22/05	U-234	0.221	0.082	0.00722	
B1D0K3	HRNM NS-26	4/22/05	U-235	0.0106	0.0091	0.00722	
B1D0K3	HRNM NS-26	4/22/05	U-238	0.216	0.11	0.00722	
B1D0J7	HRNM NS-27	4/8/05	Co-60	0.00503	0.011	0.019	Undetected
B1D0J7	HRNM NS-27	4/8/05	Cs-134	0.0367	0.017	0.0256	Undetected
B1D0J7	HRNM NS-27	4/8/05	Cs-137	0.283	0.04	0.0166	
B1D0J7	HRNM NS-27	4/8/05	Eu-152	-0.00882	0.026	0.041	Undetected
B1D0J7	HRNM NS-27	4/8/05	Pu-239/240	0.0117	0.002	0.000247	
B1D0J7	HRNM NS-27	4/8/05	Sr-90	0.0398	0.05	0.0413	Undetected
B1D0J7	HRNM NS-27	4/8/05	U-234	0.0885	0.071	0.00562	
B1D0J7	HRNM NS-27	4/8/05	U-235	0.0041	0.0069	0.00207	Undetected
B1D0J7	HRNM NS-27	4/8/05	U-238	0.0897	0.098	0.00562	Undetected
B1D0J8	HRNM NS-28	9/29/05	Co-60	-0.00211	0.01	0.017	Undetected
B1D0J8	HRNM NS-28	9/29/05	Cs-134	0.0493	0.018	0.0227	Undetected
B1D0J8	HRNM NS-28	9/29/05	Cs-137	0.027	0.016	0.0176	
B1D0J8	HRNM NS-28	9/29/05	Eu-152	-0.0111	0.026	0.0418	Undetected
B1D0J8	HRNM NS-28	9/29/05	Pu-239/240	0.000233	0.00037	0.000506	Undetected
B1D0J8	HRNM NS-28	9/29/05	Sr-90	-0.0204	0.046	0.035	Undetected
B1D0J8	HRNM NS-28	9/29/05	U-234	0.0854	0.07	0.00602	
B1D0J8	HRNM NS-28	9/29/05	U-235	0.0028	0.0068	0.00495	Undetected
B1D0J8	HRNM NS-28	9/29/05	U-238	0.102	0.097	0.00495	
B1D0R2	HRNM NS-29	4/22/05	Co-60	-0.00464	0.01	0.0174	Undetected
B1D0R2	HRNM NS-29	4/22/05	Cs-134	0.058	0.018	0.023	Undetected
B1D0R2	HRNM NS-29	4/22/05	Cs-137	0.23	0.033	0.017	
B1D0R2	HRNM NS-29	4/22/05	Eu-152	-0.00286	0.022	0.0364	Undetected
B1D0R2	HRNM NS-29	4/22/05	Pu-239/240	0.00823	0.0038	0.000834	
B1D0R2	HRNM NS-29	4/22/05	Sr-90	0.0418	0.047	0.0291	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0R2	HRNM NS-29	4/22/05	U-234	0.154	0.07	0.00262	
B1D0R2	HRNM NS-29	4/22/05	U-235	0.00853	0.008	0.00262	
B1D0R2	HRNM NS-29	4/22/05	U-238	0.177	0.094	0.00896	
B1D0R3	HRNM NS-30	4/22/05	Co-60	0.0025	0.012	0.0207	Undetected
B1D0R3	HRNM NS-30	4/22/05	Cs-134	0.0535	0.024	0.0259	Undetected
B1D0R3	HRNM NS-30	4/22/05	Cs-137	0.18	0.03	0.0171	
B1D0R3	HRNM NS-30	4/22/05	Eu-152	-0.0176	0.026	0.0413	Undetected
B1D0R3	HRNM NS-30	4/22/05	Pu-239/240	0.00479	0.0027	0.000483	
B1D0R3	HRNM NS-30	4/22/05	Sr-90	0.0391	0.047	0.0286	Undetected
B1D0R3	HRNM NS-30	4/22/05	U-234	0.148	0.077	0.008	
B1D0R3	HRNM NS-30	4/22/05	U-235	0.0048	0.0081	0.008	Undetected
B1D0R3	HRNM NS-30	4/22/05	U-238	0.178	0.1	0.0122	
B1D0L0	HRNM NS-31	6/14/05	Co-60	-0.00137	0.0079	0.0136	Undetected
B1D0L0	HRNM NS-31	6/14/05	Cs-134	0.0518	0.018	0.0204	Undetected
B1D0L0	HRNM NS-31	6/14/05	Cs-137	0.188	0.029	0.0124	
B1D0L0	HRNM NS-31	6/14/05	Eu-152	0.000287	0.02	0.0335	Undetected
B1D0L0	HRNM NS-31	6/14/05	Pu-239/240	0.00403	0.0031	0.000921	
B1D0L0	HRNM NS-31	6/14/05	Sr-90	-0.0297	0.043	0.0302	Undetected
B1D0L0	HRNM NS-31	6/14/05	U-234	1.57	0.27	0.00611	
B1D0L0	HRNM NS-31	6/14/05	U-235	0.0566	0.016	0.00178	
B1D0L0	HRNM NS-31	6/14/05	U-238	1.38	0.25	0.00484	
B1D0L1	HRNM NS-32	5/10/05	Co-60	0.000604	0.01	0.0175	Undetected
B1D0L1	HRNM NS-32	5/10/05	Cs-134	0.0789	0.025	0.0246	Undetected
B1D0L1	HRNM NS-32	5/10/05	Cs-137	0.0726	0.02	0.0179	
B1D0L1	HRNM NS-32	5/10/05	Eu-152	-0.0045	0.024	0.0408	Undetected
B1D0L1	HRNM NS-32	5/10/05	Pu-239/240	0.00149	0.0021	0.00115	Undetected
B1D0L1	HRNM NS-32	5/10/05	Sr-90	-0.0208	0.049	0.0479	Undetected
B1D0L1	HRNM NS-32	5/10/05	U-234	0.346	0.11	0.0332	
B1D0L1	HRNM NS-32	5/10/05	U-235	0.019	0.017	0.0186	
B1D0L1	HRNM NS-32	5/10/05	U-238	0.359	0.13	0.0402	
B1D0L2	HRNM NS-33	5/10/05	Co-60	0.00612	0.014	0.0251	Undetected
B1D0L2	HRNM NS-33	5/10/05	Cs-134	0.066	0.023	0.0342	Undetected
B1D0L2	HRNM NS-33	5/10/05	Cs-137	0.34	0.053	0.0236	
B1D0L2	HRNM NS-33	5/10/05	Eu-152	-0.015	0.033	0.0547	Undetected
B1D0L2	HRNM NS-33	5/10/05	Pu-239/240	0.0202	0.0057	0.00144	
B1D0L2	HRNM NS-33	5/10/05	Sr-90	0.0249	0.048	0.0433	Undetected
B1D0L2	HRNM NS-33	5/10/05	U-234	1.13	0.2	0.00781	
B1D0L2	HRNM NS-33	5/10/05	U-235	0.0346	0.013	0.00604	
B1D0L2	HRNM NS-33	5/10/05	U-238	0.948	0.18	0.00917	
B1D0L3	HRNM NS-34	5/10/05	Co-60	0.00709	0.014	0.0243	Undetected
B1D0L3	HRNM NS-34	5/10/05	Cs-134	0.156	0.035	0.042	Undetected
B1D0L3	HRNM NS-34	5/10/05	Cs-137	0.101	0.027	0.0259	
B1D0L3	HRNM NS-34	5/10/05	Eu-152	-0.0582	0.04	0.0626	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0L3	HRNM NS-34	5/10/05	Pu-239/240	0.00282	0.0027	0.00197	
B1D0L3	HRNM NS-34	5/10/05	Sr-90	-0.015	0.046	0.0439	Undetected
B1D0L3	HRNM NS-34	5/10/05	U-234	1.52	0.28	0.0331	
B1D0L3	HRNM NS-34	5/10/05	U-235	0.052	0.024	0.0177	
B1D0L3	HRNM NS-34	5/10/05	U-238	1.3	0.26	0.0249	
B1D0L4	HRNM NS-35	5/10/05	Co-60	-0.00567	0.0095	0.0157	Undetected
B1D0L4	HRNM NS-35	5/10/05	Cs-134	0.0661	0.02	0.023	Undetected
B1D0L4	HRNM NS-35	5/10/05	Cs-137	0.107	0.019	0.0152	
B1D0L4	HRNM NS-35	5/10/05	Eu-152	0.0122	0.023	0.0381	Undetected
B1D0L4	HRNM NS-35	5/10/05	Pu-239/240	0.00228	0.0025	0.000722	Undetected
B1D0L4	HRNM NS-35	5/10/05	Sr-90	-0.0119	0.046	0.0388	Undetected
B1D0L4	HRNM NS-35	5/10/05	U-234	0.524	0.11	0.0133	
B1D0L4	HRNM NS-35	5/10/05	U-235	0.0132	0.011	0.0122	
B1D0L4	HRNM NS-35	5/10/05	U-238	0.448	0.12	0.0169	
B1D0L5	HRNM NS-36	5/10/05	Co-60	0.0146	0.0096	0.0176	Undetected
B1D0L5	HRNM NS-36	5/10/05	Cs-134	0.0194	0.016	0.0197	Undetected
B1D0L5	HRNM NS-36	5/10/05	Cs-137	0.0221	0.013	0.0151	
B1D0L5	HRNM NS-36	5/10/05	Eu-152	0.000201	0.02	0.0336	Undetected
B1D0L5	HRNM NS-36	5/10/05	Pu-239/240	0.0245	0.0058	0.00134	
B1D0L5	HRNM NS-36	5/10/05	Sr-90	-0.0192	0.044	0.0344	Undetected
B1D0L5	HRNM NS-36	5/10/05	U-234	0.141	0.073	0.00987	
B1D0L5	HRNM NS-36	5/10/05	U-235	0.00413	0.0071	0.00288	Undetected
B1D0L5	HRNM NS-36	5/10/05	U-238	0.156	0.097	0.00288	
B1D0L6	HRNM NS-37	5/10/05	Co-60	-0.00143	0.011	0.0188	Undetected
B1D0L6	HRNM NS-37	5/10/05	Cs-134	0.0548	0.02	0.0263	Undetected
B1D0L6	HRNM NS-37	5/10/05	Cs-137	-0.000484	0.0099	0.0169	Undetected
B1D0L6	HRNM NS-37	5/10/05	Eu-152	-0.0567	0.029	0.0422	Undetected
B1D0L6	HRNM NS-37	5/10/05	Pu-239/240	-0.000743	0.0022	0.00329	Undetected
B1D0L6	HRNM NS-37	5/10/05	Sr-90	-0.0261	0.043	0.0289	Undetected
B1D0L6	HRNM NS-37	5/10/05	U-234	0.241	0.078	0.00699	
B1D0L6	HRNM NS-37	5/10/05	U-235	0.0103	0.0084	0.00257	
B1D0L6	HRNM NS-37	5/10/05	U-238	0.202	0.094	0.00699	
B1D0L7	HRNM NS-38	5/10/05	Co-60	0.006	0.0095	0.017	Undetected
B1D0L7	HRNM NS-38	5/10/05	Cs-134	0.0492	0.018	0.0221	Undetected
B1D0L7	HRNM NS-38	5/10/05	Cs-137	0.00159	0.0088	0.015	Undetected
B1D0L7	HRNM NS-38	5/10/05	Eu-152	0.00141	0.023	0.0369	Undetected
B1D0L7	HRNM NS-38	5/10/05	Pu-239/240	-0.000198	0.0018	0.000505	Undetected
B1D0L7	HRNM NS-38	5/10/05	Sr-90	-0.0184	0.044	0.0265	Undetected
B1D0L7	HRNM NS-38	5/10/05	U-234	0.128	0.068	0.0084	
B1D0L7	HRNM NS-38	5/10/05	U-235	0.00848	0.0072	0.00174	
B1D0L7	HRNM NS-38	5/10/05	U-238	0.132	0.091	0.0069	
B1D0L8	HRNM NS-39	5/10/05	Co-60	0.00444	0.01	0.0184	Undetected
B1D0L8	HRNM NS-39	5/10/05	Cs-134	0.0816	0.025	0.0268	Undetected

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0L8	HRNM NS-39	5/10/05	Cs-137	0.0202	0.012	0.0203	Undetected
B1D0L8	HRNM NS-39	5/10/05	Eu-152	-0.00844	0.026	0.043	Undetected
B1D0L8	HRNM NS-39	5/10/05	Pu-239/240	0.000632	0.002	0.000461	Undetected
B1D0L8	HRNM NS-39	5/10/05	Sr-90	-0.00485	0.045	0.028	Undetected
B1D0L8	HRNM NS-39	5/10/05	U-234	0.33	0.083	0.00517	
B1D0L8	HRNM NS-39	5/10/05	U-235	0.0306	0.012	0.00191	
B1D0L8	HRNM NS-39	5/10/05	U-238	0.381	0.11	0.00921	
B1D0L9	HRNM NS-40	5/10/05	Co-60	-0.0031	0.013	0.0215	Undetected
B1D0L9	HRNM NS-40	5/10/05	Cs-134	0.173	0.034	0.039	Undetected
B1D0L9	HRNM NS-40	5/10/05	Cs-137	-0.0125	0.014	0.0231	Undetected
B1D0L9	HRNM NS-40	5/10/05	Eu-152	-0.0172	0.037	0.0597	Undetected
B1D0L9	HRNM NS-40	5/10/05	Pu-239/240	0.000213	0.002	0.00147	Undetected
B1D0L9	HRNM NS-40	5/10/05	Sr-90	0.00353	0.046	0.0369	Undetected
B1D0L9	HRNM NS-40	5/10/05	U-234	3.5	0.57	0.00728	
B1D0L9	HRNM NS-40	5/10/05	U-235	0.0975	0.023	0.00183	
B1D0L9	HRNM NS-40	5/10/05	U-238	2.88	0.47	0.00628	
B1D0M0	HRNM NS-41	5/10/05	Co-60	0.0104	0.014	0.0257	Undetected
B1D0M0	HRNM NS-41	5/10/05	Cs-134	0.0581	0.023	0.0329	Undetected
B1D0M0	HRNM NS-41	5/10/05	Cs-137	0.144	0.026	0.0226	
B1D0M0	HRNM NS-41	5/10/05	Eu-152	0.047	0.036	0.0582	Undetected
B1D0M0	HRNM NS-41	5/10/05	Pu-239/240	0.00149	0.0023	0.00173	Undetected
B1D0M0	HRNM NS-41	5/10/05	Sr-90	-0.00322	0.046	0.0314	Undetected
B1D0M0	HRNM NS-41	5/10/05	U-234	0.66	0.13	0.00849	
B1D0M0	HRNM NS-41	5/10/05	U-235	0.0274	0.012	0.00588	
B1D0M0	HRNM NS-41	5/10/05	U-238	0.583	0.13	0.0124	
B1D0M1	HRNM NS-42	5/10/05	Co-60	-0.00754	0.0097	0.016	Undetected
B1D0M1	HRNM NS-42	5/10/05	Cs-134	0.0473	0.018	0.0233	Undetected
B1D0M1	HRNM NS-42	5/10/05	Cs-137	0.0234	0.016	0.0151	
B1D0M1	HRNM NS-42	5/10/05	Eu-152	-0.0106	0.023	0.0377	Undetected
B1D0M1	HRNM NS-42	5/10/05	Pu-239/240	0.000448	0.002	0.00122	Undetected
B1D0M1	HRNM NS-42	5/10/05	Sr-90	-0.0217	0.045	0.0259	Undetected
B1D0M1	HRNM NS-42	5/10/05	U-234	0.287	0.086	0.00683	
B1D0M1	HRNM NS-42	5/10/05	U-235	0.0102	0.0084	0.00237	
B1D0M1	HRNM NS-42	5/10/05	U-238	0.293	0.11	0.00683	
B1D0M2	HRNM NS-43	5/10/05	Co-60	-0.00429	0.011	0.0185	Undetected
B1D0M2	HRNM NS-43	5/10/05	Cs-134	0.0579	0.019	0.027	Undetected
B1D0M2	HRNM NS-43	5/10/05	Cs-137	0.0587	0.02	0.0175	
B1D0M2	HRNM NS-43	5/10/05	Eu-152	-0.00247	0.026	0.0443	Undetected
B1D0M2	HRNM NS-43	5/10/05	Pu-239/240	0.000598	0.0021	0.0018	Undetected
B1D0M2	HRNM NS-43	5/10/05	Sr-90	-0.00857	0.045	0.0304	Undetected
B1D0M2	HRNM NS-43	5/10/05	U-234	0.367	0.095	0.00795	
B1D0M2	HRNM NS-43	5/10/05	U-235	0.0133	0.0097	0.00699	
B1D0M2	HRNM NS-43	5/10/05	U-238	0.327	0.11	0.00575	

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0M3	HRNM NS-44	5/10/05	Co-60	-0.0072	0.011	0.0185	Undetected
B1D0M3	HRNM NS-44	5/10/05	Cs-134	0.0873	0.028	0.0309	Undetected
B1D0M3	HRNM NS-44	5/10/05	Cs-137	0.0995	0.023	0.0223	
B1D0M3	HRNM NS-44	5/10/05	Eu-152	-0.0193	0.027	0.0452	Undetected
B1D0M3	HRNM NS-44	5/10/05	Pu-239/240	0.00182	0.0025	0.00228	Undetected
B1D0M3	HRNM NS-44	5/10/05	Sr-90	-0.0167	0.044	0.0245	Undetected
B1D0M3	HRNM NS-44	5/10/05	U-234	0.504	0.11	0.00259	
B1D0M3	HRNM NS-44	5/10/05	U-235	0.0152	0.01	0.00655	
B1D0M3	HRNM NS-44	5/10/05	U-238	0.481	0.13	0.00745	
B1D0J9	HRNM NS-45	4/8/05	Co-60	0.0162	0.014	0.0254	Undetected
B1D0J9	HRNM NS-45	4/8/05	Cs-134	0.0713	0.025	0.0319	Undetected
B1D0J9	HRNM NS-45	4/8/05	Cs-137	0.00523	0.013	0.0217	Undetected
B1D0J9	HRNM NS-45	4/8/05	Eu-152	-0.0285	0.029	0.0472	Undetected
B1D0J9	HRNM NS-45	4/8/05	Pu-239/240	0.000374	0.00036	0.000346	
B1D0J9	HRNM NS-45	4/8/05	Sr-90	-0.0436	0.047	0.0374	Undetected
B1D0J9	HRNM NS-45	4/8/05	U-234	0.223	0.08	0.00966	
B1D0J9	HRNM NS-45	4/8/05	U-235	0.00845	0.0078	0.00218	
B1D0J9	HRNM NS-45	4/8/05	U-238	0.237	0.1	0.00218	
B1D0M4	HRNM NS-46	5/10/05	Co-60	-0.00714	0.0085	0.0139	Undetected
B1D0M4	HRNM NS-46	5/10/05	Cs-134	0.0662	0.019	0.0224	Undetected
B1D0M4	HRNM NS-46	5/10/05	Cs-137	0.0338	0.014	0.0148	
B1D0M4	HRNM NS-46	5/10/05	Eu-152	-0.0146	0.025	0.0361	Undetected
B1D0M4	HRNM NS-46	5/10/05	Pu-239/240	0.000275	0.002	0.00144	Undetected
B1D0M4	HRNM NS-46	5/10/05	Sr-90	-0.0284	0.043	0.0351	Undetected
B1D0M4	HRNM NS-46	5/10/05	U-234	0.25	0.079	0.00681	
B1D0M4	HRNM NS-46	5/10/05	U-235	0.00981	0.0083	0.00269	
B1D0M4	HRNM NS-46	5/10/05	U-238	0.196	0.094	0.00681	
B1D0K0	HRNM NS-47	4/8/05	Co-60	0.00992	0.022	0.0415	Undetected
B1D0K0	HRNM NS-47	4/8/05	Cs-134	0.0632	0.029	0.0547	Undetected
B1D0K0	HRNM NS-47	4/8/05	Cs-137	-0.0109	0.022	0.0364	Undetected
B1D0K0	HRNM NS-47	4/8/05	Eu-152	-0.00398	0.055	0.0946	Undetected
B1D0K0	HRNM NS-47	4/8/05	Pu-239/240	0.000191	0.00026	0.000197	Undetected
B1D0K0	HRNM NS-47	4/8/05	Sr-90	-0.00363	0.046	0.0332	Undetected
B1D0K0	HRNM NS-47	4/8/05	U-234	0.455	0.11	0.00574	
B1D0K0	HRNM NS-47	4/8/05	U-235	0.0198	0.01	0.00211	
B1D0K0	HRNM NS-47	4/8/05	U-238	0.415	0.12	0.00724	
B1D0K1	HRNM NS-48	4/8/05	Co-60	0.00721	0.015	0.0265	Undetected
B1D0K1	HRNM NS-48	4/8/05	Cs-134	0.0936	0.025	0.0357	Undetected
B1D0K1	HRNM NS-48	4/8/05	Cs-137	0.658	0.085	0.0229	
B1D0K1	HRNM NS-48	4/8/05	Eu-152	0.16	0.055	0.0697	Undetected
B1D0K1	HRNM NS-48	4/8/05	Pu-239/240	0.00675	0.0012	0.000114	
B1D0K1	HRNM NS-48	4/8/05	Sr-90	-0.0121	0.046	0.0294	Undetected
B1D0K1	HRNM NS-48	4/8/05	U-234	0.755	0.17	0.0302	

Table B.2. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0K1	HRNM NS-48	4/8/05	U-235	0.0296	0.022	0.0206	
B1D0K1	HRNM NS-48	4/8/05	U-238	0.663	0.17	0.0206	

Table B.3. Raw Results from HEIS for Soil Samples Collected on the McGee Ranch-Riverlands and North Slope Units of the HRNM for Radionuclides not Included in the Authorized Limits

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0M5	HRNM MCG-1	4/22/05	Be-7	0.0656	0.42	0.707	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Eu-154	-0.0213	0.029	0.0487	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Eu-155	0.0278	0.026	0.0427	Undetected
B1D0M5	HRNM MCG-1	4/22/05	K-40	13.6	1.7	0.116	
B1D0M5	HRNM MCG-1	4/22/05	Pu-238	-0.000141	0.001	0.00206	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Ru-106	0.0567	0.091	0.16	Undetected
B1D0M5	HRNM MCG-1	4/22/05	Sb-125	0.0174	0.022	0.0387	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Be-7	0.182	0.47	0.809	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Eu-154	0.0136	0.032	0.0556	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Eu-155	0.118	0.045	0.0517	Undetected
B1D0M6	HRNM MCG-2	4/22/05	K-40	14.7	1.9	0.147	
B1D0M6	HRNM MCG-2	4/22/05	Pu-238	-0.000142	0.00091	0.00195	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Ru-106	-0.0541	0.1	0.166	Undetected
B1D0M6	HRNM MCG-2	4/22/05	Sb-125	-0.0062	0.026	0.0428	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Be-7	-0.00362	0.45	0.747	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Eu-154	0.00334	0.031	0.0533	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Eu-155	0.0548	0.032	0.055	Undetected
B1D0M7	HRNM MCG-3	4/22/05	K-40	13.7	1.8	0.132	
B1D0M7	HRNM MCG-3	4/22/05	Pu-238	0.00046	0.001	0.00147	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Ru-106	-0.00662	0.093	0.158	Undetected
B1D0M7	HRNM MCG-3	4/22/05	Sb-125	0.00699	0.023	0.0387	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Be-7	0.164	0.43	0.724	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Eu-154	-0.00989	0.03	0.051	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Eu-155	0.0811	0.032	0.0438	Undetected
B1D0M8	HRNM MCG-4	4/22/05	K-40	13.4	1.7	0.105	
B1D0M8	HRNM MCG-4	4/22/05	Pu-238	0.000447	0.00098	0.000799	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Ru-106	0.0119	0.086	0.148	Undetected
B1D0M8	HRNM MCG-4	4/22/05	Sb-125	0.00994	0.023	0.0393	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Be-7	0.0106	0.39	0.676	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Eu-154	0.00983	0.029	0.0503	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Eu-155	0.0268	0.025	0.0429	Undetected
B1D0M9	HRNM MCG-5	4/22/05	K-40	15.3	1.9	0.109	
B1D0M9	HRNM MCG-5	4/22/05	Pu-238	-0.000141	0.00075	0.000609	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Ru-106	-0.041	0.086	0.144	Undetected
B1D0M9	HRNM MCG-5	4/22/05	Sb-125	0.00613	0.022	0.0369	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Be-7	-0.052	0.46	0.764	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Eu-154	-0.0178	0.034	0.0575	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Eu-155	0.0672	0.03	0.0505	Undetected
B1D0N0	HRNM MCG-6	4/22/05	K-40	14.1	1.9	0.123	
B1D0N0	HRNM MCG-6	4/22/05	Pu-238	0.000534	0.0011	0.000916	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0N0	HRNM MCG-6	4/22/05	Ru-106	-0.0621	0.098	0.162	Undetected
B1D0N0	HRNM MCG-6	4/22/05	Sb-125	0.000458	0.024	0.0403	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Be-7	0.0551	0.46	0.764	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Eu-154	-0.0233	0.031	0.0515	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Eu-155	0.0515	0.032	0.0543	Undetected
B1D0N1	HRNM MCG-7	4/22/05	K-40	13.9	1.9	0.129	
B1D0N1	HRNM MCG-7	4/22/05	Pu-238	0.0015	0.0013	0.00134	
B1D0N1	HRNM MCG-7	4/22/05	Ru-106	-0.0315	0.091	0.151	Undetected
B1D0N1	HRNM MCG-7	4/22/05	Sb-125	0.0102	0.024	0.0409	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Be-7	0.00663	0.33	0.549	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Eu-154	0.0114	0.03	0.0535	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Eu-155	0.045	0.025	0.0417	Undetected
B1D0N2	HRNM MCG-8	5/10/05	K-40	13.9	1.8	0.119	
B1D0N2	HRNM MCG-8	5/10/05	Pu-238	0.00124	0.0018	0.00255	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Ru-106	-0.0223	0.085	0.143	Undetected
B1D0N2	HRNM MCG-8	5/10/05	Sb-125	-0.0106	0.022	0.0366	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Be-7	0.0817	0.33	0.569	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Eu-154	-0.0054	0.028	0.0479	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Eu-155	0.0289	0.027	0.0454	Undetected
B1D0N3	HRNM MCG-9	5/10/05	K-40	13.6	1.7	0.112	
B1D0N3	HRNM MCG-9	5/10/05	Pu-238	0.000827	0.001	0.000525	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Ru-106	0.00651	0.085	0.145	Undetected
B1D0N3	HRNM MCG-9	5/10/05	Sb-125	-0.00546	0.023	0.0388	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Be-7	0.175	0.15	0.273	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Eu-154	0.0079	0.047	0.0847	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Eu-155	-0.00314	0.052	0.0881	Undetected
B1D0N4	HRNM MCG-10	6/28/05	K-40	14	1.9	0.246	
B1D0N4	HRNM MCG-10	6/28/05	Pu-238	0.000715	0.00056	0.000542	
B1D0N4	HRNM MCG-10	6/28/05	Ru-106	-0.161	0.14	0.219	Undetected
B1D0N4	HRNM MCG-10	6/28/05	Sb-125	-0.0366	0.042	0.0668	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Be-7	0.00901	0.15	0.261	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Eu-154	-0.007	0.052	0.0915	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Eu-155	0.0483	0.055	0.0974	Undetected
B1D0N5	HRNM MCG-11	6/28/05	K-40	9.8	1.5	0.284	
B1D0N5	HRNM MCG-11	6/28/05	Pu-238	0.000209	0.00047	0.000966	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Ru-106	0.0467	0.16	0.273	Undetected
B1D0N5	HRNM MCG-11	6/28/05	Sb-125	0.00161	0.044	0.0748	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Be-7	0.152	0.19	0.343	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Eu-154	0.000956	0.072	0.126	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Eu-155	0.0215	0.057	0.098	Undetected
B1D0N6	HRNM MCG-12	6/28/05	K-40	16.4	2.2	0.283	

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0N6	HRNM MCG-12	6/28/05	Pu-238	0.0014	0.00082	0.000588	
B1D0N6	HRNM MCG-12	6/28/05	Ru-106	-0.0574	0.17	0.295	Undetected
B1D0N6	HRNM MCG-12	6/28/05	Sb-125	-0.0149	0.055	0.0921	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Be-7	0.16	0.21	0.38	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Eu-154	-0.0327	0.074	0.127	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Eu-155	0.0304	0.072	0.124	Undetected
B1D0N7	HRNM MCG-13	6/28/05	K-40	14.9	2.3	0.406	
B1D0N7	HRNM MCG-13	6/28/05	Pu-238	-0.000164	0.0013	0.0037	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Ru-106	-0.0867	0.18	0.305	Undetected
B1D0N7	HRNM MCG-13	6/28/05	Sb-125	0.0135	0.062	0.107	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Be-7	0.215	0.2	0.362	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Eu-154	-0.004	0.061	0.11	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Eu-155	0.038	0.052	0.0897	Undetected
B1D0N8	HRNM MCG-14	6/28/05	K-40	14.5	2	0.292	
B1D0N8	HRNM MCG-14	6/28/05	Pu-238	0.000212	0.00021	0.000123	
B1D0N8	HRNM MCG-14	6/28/05	Ru-106	-0.144	0.17	0.281	Undetected
B1D0N8	HRNM MCG-14	6/28/05	Sb-125	0.0129	0.051	0.0882	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Be-7	0.0819	0.19	0.33	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Eu-154	0.0156	0.052	0.0946	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Eu-155	0.0631	0.061	0.107	Undetected
B1D0N9	HRNM MCG-15	6/28/05	K-40	14.2	2	0.322	
B1D0N9	HRNM MCG-15	6/28/05	Pu-238	0.000334	0.00027	0.000285	
B1D0N9	HRNM MCG-15	6/28/05	Ru-106	-0.0193	0.15	0.265	Undetected
B1D0N9	HRNM MCG-15	6/28/05	Sb-125	0.0142	0.049	0.0846	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Be-7	-0.104	0.16	0.258	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Eu-154	0.00895	0.051	0.0911	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Eu-155	0.0292	0.049	0.0866	Undetected
B1D0P0	HRNM MCG-16	6/28/05	K-40	13.8	2.6	0.252	
B1D0P0	HRNM MCG-16	6/28/05	Pu-238	-4.22E-05	0.00034	0.00109	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Ru-106	0.0498	0.13	0.23	Undetected
B1D0P0	HRNM MCG-16	6/28/05	Sb-125	0.000458	0.042	0.0712	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Be-7	-0.0267	0.2	0.345	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Eu-154	-0.00771	0.071	0.127	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Eu-155	0.00161	0.069	0.117	Undetected
B1D0P1	HRNM MCG-17	6/28/05	K-40	14.9	2.3	0.351	
B1D0P1	HRNM MCG-17	6/28/05	Pu-238	0.000356	0.00045	0.000688	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Ru-106	0.0308	0.18	0.315	Undetected
B1D0P1	HRNM MCG-17	6/28/05	Sb-125	-0.0246	0.057	0.095	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Be-7	0.138	0.17	0.3	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Eu-154	0.00549	0.054	0.0958	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Eu-155	0.0947	0.062	0.109	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0P2	HRNM MCG-18	6/28/05	K-40	16.4	2.2	0.279	
B1D0P2	HRNM MCG-18	6/28/05	Pu-238	0.0000497	0.0001	0.0000865	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Ru-106	0.117	0.16	0.29	Undetected
B1D0P2	HRNM MCG-18	6/28/05	Sb-125	0.0388	0.048	0.0844	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Be-7	0.146	0.15	0.27	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Eu-154	-0.0289	0.052	0.0865	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Eu-155	0.0595	0.049	0.087	Undetected
B1D0P3	HRNM MCG-19	6/28/05	K-40	15.6	2.9	0.219	
B1D0P3	HRNM MCG-19	6/28/05	Pu-238	0.0000806	0.00014	0.000128	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Ru-106	0.0504	0.13	0.227	Undetected
B1D0P3	HRNM MCG-19	6/28/05	Sb-125	0.0387	0.037	0.0672	Undetected
B1D0H7	HRNM NS-1	4/8/05	Be-7	-0.123	0.86	1.45	Undetected
B1D0H7	HRNM NS-1	4/8/05	Eu-154	0.00033	0.034	0.0583	Undetected
B1D0H7	HRNM NS-1	4/8/05	Eu-155	0.0496	0.03	0.0496	Undetected
B1D0H7	HRNM NS-1	4/8/05	K-40	15.7	2	0.129	
B1D0H7	HRNM NS-1	4/8/05	Pu-238	0.000217	0.00022	0.000126	
B1D0H7	HRNM NS-1	4/8/05	Ru-106	-0.0385	0.11	0.183	Undetected
B1D0H7	HRNM NS-1	4/8/05	Sb-125	-0.00629	0.027	0.0447	Undetected
B1D0H8	HRNM NS-2	9/29/05	Be-7	0.0903	0.096	0.172	Undetected
B1D0H8	HRNM NS-2	9/29/05	Eu-154	0.0156	0.035	0.0618	Undetected
B1D0H8	HRNM NS-2	9/29/05	Eu-155	0.0491	0.032	0.0539	Undetected
B1D0H8	HRNM NS-2	9/29/05	K-40	16	2.2	0.144	
B1D0H8	HRNM NS-2	9/29/05	Pu-238	-0.000064	0.00018	0.000462	Undetected
B1D0H8	HRNM NS-2	9/29/05	Ru-106	-0.0914	0.087	0.139	Undetected
B1D0H8	HRNM NS-2	9/29/05	Sb-125	0.0184	0.023	0.0405	Undetected
B1D0P4	HRNM NS-3	4/22/05	Be-7	0.338	0.47	0.83	Undetected
B1D0P4	HRNM NS-3	4/22/05	Eu-154	-0.00958	0.032	0.0538	Undetected
B1D0P4	HRNM NS-3	4/22/05	Eu-155	0.0469	0.031	0.0521	Undetected
B1D0P4	HRNM NS-3	4/22/05	K-40	14.6	2	0.126	
B1D0P4	HRNM NS-3	4/22/05	Pu-238	-0.000393	0.001	0.00234	Undetected
B1D0P4	HRNM NS-3	4/22/05	Ru-106	0.0725	0.091	0.159	Undetected
B1D0P4	HRNM NS-3	4/22/05	Sb-125	0.0157	0.022	0.0384	Undetected
B1D0H9	HRNM NS-4	4/8/05	Be-7	0.158	0.81	1.39	Undetected
B1D0H9	HRNM NS-4	4/8/05	Eu-154	0.00631	0.033	0.0567	Undetected
B1D0H9	HRNM NS-4	4/8/05	Eu-155	0.0572	0.028	0.0471	Undetected
B1D0H9	HRNM NS-4	4/8/05	K-40	16.4	2.1	0.118	
B1D0H9	HRNM NS-4	4/8/05	Pu-238	0.000387	0.00024	0.0000906	
B1D0H9	HRNM NS-4	4/8/05	Ru-106	0.0214	0.1	0.181	Undetected
B1D0H9	HRNM NS-4	4/8/05	Sb-125	0.0013	0.024	0.0416	Undetected
B1D0J0	HRNM NS-5	9/29/05	Be-7	0.0269	0.097	0.169	Undetected
B1D0J0	HRNM NS-5	9/29/05	Eu-154	-0.0118	0.038	0.0652	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J0	HRNM NS-5	9/29/05	Eu-155	0.0415	0.033	0.0568	Undetected
B1D0J0	HRNM NS-5	9/29/05	K-40	17.4	2.4	0.137	
B1D0J0	HRNM NS-5	9/29/05	Pu-238	0.000111	0.00023	0.000389	Undetected
B1D0J0	HRNM NS-5	9/29/05	Ru-106	0.0265	0.09	0.154	Undetected
B1D0J0	HRNM NS-5	9/29/05	Sb-125	0.0274	0.025	0.0436	Undetected
B1D0K2	HRNM NS-6	1/5/06	Be-7	0.0213	0.095	0.164	Undetected
B1D0K2	HRNM NS-6	1/5/06	Eu-154	0.019	0.032	0.0565	Undetected
B1D0K2	HRNM NS-6	1/5/06	Eu-155	0.0175	0.03	0.051	Undetected
B1D0K2	HRNM NS-6	1/5/06	K-40	14.1	1.9	0.134	
B1D0K2	HRNM NS-6	1/5/06	Pu-238	0.000281	0.00023	0.000295	Undetected
B1D0K2	HRNM NS-6	1/5/06	Ru-106	-0.07	0.07	0.115	Undetected
B1D0K2	HRNM NS-6	1/5/06	Sb-125	0.00147	0.023	0.0395	Undetected
B1D0P5	HRNM NS-7	4/22/05	Be-7	-0.125	0.61	1.01	Undetected
B1D0P5	HRNM NS-7	4/22/05	Eu-154	-0.036	0.041	0.0665	Undetected
B1D0P5	HRNM NS-7	4/22/05	Eu-155	0.0197	0.03	0.05	Undetected
B1D0P5	HRNM NS-7	4/22/05	K-40	16	3	0.158	
B1D0P5	HRNM NS-7	4/22/05	Pu-238	0.000322	0.00084	0.000628	Undetected
B1D0P5	HRNM NS-7	4/22/05	Ru-106	-0.0577	0.11	0.188	Undetected
B1D0P5	HRNM NS-7	4/22/05	Sb-125	-0.0118	0.028	0.0471	Undetected
B1D0P6	HRNM NS-8	4/22/05	Be-7	-0.276	0.41	0.671	Undetected
B1D0P6	HRNM NS-8	4/22/05	Eu-154	-0.00714	0.027	0.0464	Undetected
B1D0P6	HRNM NS-8	4/22/05	Eu-155	0.0432	0.029	0.0441	Undetected
B1D0P6	HRNM NS-8	4/22/05	K-40	13.8	1.8	0.106	
B1D0P6	HRNM NS-8	4/22/05	Pu-238	0.000228	0.0014	0.00271	Undetected
B1D0P6	HRNM NS-8	4/22/05	Ru-106	0.0882	0.08	0.143	Undetected
B1D0P6	HRNM NS-8	4/22/05	Sb-125	0.00859	0.019	0.0333	Undetected
B1D0K4	HRNM NS-9	4/22/05	Be-7	-0.0886	0.89	1.5	Undetected
B1D0K4	HRNM NS-9	4/22/05	Eu-154	-0.0242	0.041	0.0688	Undetected
B1D0K4	HRNM NS-9	4/22/05	Eu-155	0.066	0.035	0.0573	Undetected
B1D0K4	HRNM NS-9	4/22/05	K-40	16.1	3.1	0.149	
B1D0K4	HRNM NS-9	4/22/05	Pu-238	-0.000142	0.0017	0.00368	Undetected
B1D0K4	HRNM NS-9	4/22/05	Ru-106	0.0111	0.13	0.221	Undetected
B1D0K4	HRNM NS-9	4/22/05	Sb-125	-0.00305	0.03	0.0506	Undetected
B1D0K5	HRNM NS-10	1/5/06	Be-7	0.0392	0.11	0.184	Undetected
B1D0K5	HRNM NS-10	1/5/06	Eu-154	-0.00529	0.032	0.0546	Undetected
B1D0K5	HRNM NS-10	1/5/06	Eu-155	0.0713	0.03	0.0507	Undetected
B1D0K5	HRNM NS-10	1/5/06	K-40	15.4	2	0.121	
B1D0K5	HRNM NS-10	1/5/06	Pu-238	0.0017	0.00044	0.0000529	
B1D0K5	HRNM NS-10	1/5/06	Ru-106	-0.0291	0.082	0.138	Undetected
B1D0K5	HRNM NS-10	1/5/06	Sb-125	0.023	0.025	0.0431	Undetected
B1D0P7	HRNM NS-11	4/22/05	Be-7	0.163	0.43	0.751	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0P7	HRNM NS-11	4/22/05	Eu-154	0.00126	0.032	0.0546	Undetected
B1D0P7	HRNM NS-11	4/22/05	Eu-155	0.0605	0.029	0.0491	Undetected
B1D0P7	HRNM NS-11	4/22/05	K-40	15.7	2.1	0.119	
B1D0P7	HRNM NS-11	4/22/05	Pu-238	0.00166	0.0013	0.000488	
B1D0P7	HRNM NS-11	4/22/05	Ru-106	-0.054	0.089	0.146	Undetected
B1D0P7	HRNM NS-11	4/22/05	Sb-125	0.0183	0.022	0.0372	Undetected
B1D0P8	HRNM NS-12	4/22/05	Be-7	0.21	0.6	1.02	Undetected
B1D0P8	HRNM NS-12	4/22/05	Eu-154	-0.0256	0.044	0.0721	Undetected
B1D0P8	HRNM NS-12	4/22/05	Eu-155	0.0502	0.031	0.0526	Undetected
B1D0P8	HRNM NS-12	4/22/05	K-40	16.7	3.2	0.159	
B1D0P8	HRNM NS-12	4/22/05	Pu-238	0.00108	0.0011	0.000472	
B1D0P8	HRNM NS-12	4/22/05	Ru-106	-0.0389	0.12	0.2	Undetected
B1D0P8	HRNM NS-12	4/22/05	Sb-125	0.0226	0.028	0.0492	Undetected
B1D0J1	HRNM NS-13	4/8/05	Be-7	-0.164	1.1	1.83	Undetected
B1D0J1	HRNM NS-13	4/8/05	Eu-154	-0.0127	0.045	0.0761	Undetected
B1D0J1	HRNM NS-13	4/8/05	Eu-155	0.0658	0.035	0.0593	Undetected
B1D0J1	HRNM NS-13	4/8/05	K-40	13.9	2.7	0.164	
B1D0J1	HRNM NS-13	4/8/05	Pu-238	0.000188	0.00019	0.00011	Undetected
B1D0J1	HRNM NS-13	4/8/05	Ru-106	0.0491	0.14	0.243	Undetected
B1D0J1	HRNM NS-13	4/8/05	Sb-125	-0.00775	0.033	0.0561	Undetected
B1D0J2	HRNM NS-14	9/29/05	Be-7	0.0025	0.1	0.17	Undetected
B1D0J2	HRNM NS-14	9/29/05	Eu-154	0.0179	0.036	0.0639	Undetected
B1D0J2	HRNM NS-14	9/29/05	Eu-155	0.0548	0.029	0.0484	Undetected
B1D0J2	HRNM NS-14	9/29/05	K-40	18.3	2.3	0.147	
B1D0J2	HRNM NS-14	9/29/05	Pu-238	0.000264	0.00023	0.000126	
B1D0J2	HRNM NS-14	9/29/05	Ru-106	-0.0035	0.087	0.15	Undetected
B1D0J2	HRNM NS-14	9/29/05	Sb-125	-0.00948	0.026	0.0427	Undetected
B1D0J3	HRNM NS-15	4/8/05	Be-7	-0.123	0.89	1.48	Undetected
B1D0J3	HRNM NS-15	4/8/05	Eu-154	-0.0453	0.036	0.0582	Undetected
B1D0J3	HRNM NS-15	4/8/05	Eu-155	0.0582	0.032	0.0547	Undetected
B1D0J3	HRNM NS-15	4/8/05	K-40	13.9	1.8	0.159	
B1D0J3	HRNM NS-15	4/8/05	Pu-238	0.000465	0.0003	0.000292	
B1D0J3	HRNM NS-15	4/8/05	Ru-106	0.0871	0.12	0.204	Undetected
B1D0J3	HRNM NS-15	4/8/05	Sb-125	0.0275	0.029	0.0504	Undetected
B1D0J4	HRNM NS-16	4/8/05	Be-7	-0.115	0.91	1.52	Undetected
B1D0J4	HRNM NS-16	4/8/05	Eu-154	0.00288	0.033	0.0561	Undetected
B1D0J4	HRNM NS-16	4/8/05	Eu-155	0.0392	0.03	0.0512	Undetected
B1D0J4	HRNM NS-16	4/8/05	K-40	14.4	1.8	0.123	
B1D0J4	HRNM NS-16	4/8/05	Pu-238	0.000666	0.00026	0.000153	
B1D0J4	HRNM NS-16	4/8/05	Ru-106	-0.0138	0.11	0.187	Undetected
B1D0J4	HRNM NS-16	4/8/05	Sb-125	-0.00873	0.028	0.0463	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J5	HRNM NS-17	4/8/05	Be-7	0.0475	0.76	1.27	Undetected
B1D0J5	HRNM NS-17	4/8/05	Eu-154	0.0303	0.03	0.0531	Undetected
B1D0J5	HRNM NS-17	4/8/05	Eu-155	0.0516	0.028	0.0467	Undetected
B1D0J5	HRNM NS-17	4/8/05	K-40	14	1.8	0.106	
B1D0J5	HRNM NS-17	4/8/05	Pu-238	0.0000607	0.00016	0.000325	Undetected
B1D0J5	HRNM NS-17	4/8/05	Ru-106	-0.0343	0.099	0.166	Undetected
B1D0J5	HRNM NS-17	4/8/05	Sb-125	0.00275	0.024	0.0402	Undetected
B1D0K6	HRNM NS-18	4/8/05	Be-7	0.702	0.68	1.19	Undetected
B1D0K6	HRNM NS-18	4/8/05	Eu-154	-0.0192	0.036	0.0603	Undetected
B1D0K6	HRNM NS-18	4/8/05	Eu-155	0.0776	0.038	0.0643	Undetected
B1D0K6	HRNM NS-18	4/8/05	K-40	13.3	1.8	0.15	
B1D0K6	HRNM NS-18	4/8/05	Pu-238	0.00145	0.0011	0.000431	
B1D0K6	HRNM NS-18	4/8/05	Ru-106	0.0261	0.11	0.185	Undetected
B1D0K6	HRNM NS-18	4/8/05	Sb-125	0.0176	0.028	0.0472	Undetected
B1D0K7	HRNM NS-19	4/8/05	Be-7	0.353	0.6	1.03	Undetected
B1D0K7	HRNM NS-19	4/8/05	Eu-154	-0.0314	0.032	0.0516	Undetected
B1D0K7	HRNM NS-19	4/8/05	Eu-155	0.0626	0.028	0.0471	Undetected
B1D0K7	HRNM NS-19	4/8/05	K-40	13.5	1.7	0.123	
B1D0K7	HRNM NS-19	4/8/05	Pu-238	0.00157	0.0013	0.00126	
B1D0K7	HRNM NS-19	4/8/05	Ru-106	-0.0179	0.098	0.167	Undetected
B1D0K7	HRNM NS-19	4/8/05	Sb-125	-0.000482	0.025	0.0422	Undetected
B1D0K8	HRNM NS-20	4/8/05	Be-7	-0.327	0.56	0.915	Undetected
B1D0K8	HRNM NS-20	4/8/05	Eu-154	-0.00337	0.029	0.05	Undetected
B1D0K8	HRNM NS-20	4/8/05	Eu-155	0.0251	0.028	0.0468	Undetected
B1D0K8	HRNM NS-20	4/8/05	K-40	9.4	1.2	0.806	Undetected
B1D0K8	HRNM NS-20	4/8/05	Pu-238	0.00194	0.0016	0.00153	
B1D0K8	HRNM NS-20	4/8/05	Ru-106	-0.0124	0.095	0.161	Undetected
B1D0K8	HRNM NS-20	4/8/05	Sb-125	0.00521	0.025	0.0427	Undetected
B1D0K9	HRNM NS-21	4/8/05	Be-7	0.885	0.61	1.07	Undetected
B1D0K9	HRNM NS-21	4/8/05	Eu-154	0.0273	0.031	0.0559	Undetected
B1D0K9	HRNM NS-21	4/8/05	Eu-155	0.0606	0.028	0.0473	Undetected
B1D0K9	HRNM NS-21	4/8/05	K-40	13	1.7	0.124	
B1D0K9	HRNM NS-21	4/8/05	Pu-238	-0.000142	0.00093	0.0018	Undetected
B1D0K9	HRNM NS-21	4/8/05	Ru-106	-0.04	0.098	0.165	Undetected
B1D0K9	HRNM NS-21	4/8/05	Sb-125	0.0161	0.025	0.043	Undetected
B1D0P9	HRNM NS-22	4/22/05	Be-7	-0.119	0.46	0.772	Undetected
B1D0P9	HRNM NS-22	4/22/05	Eu-154	0.0185	0.031	0.0549	Undetected
B1D0P9	HRNM NS-22	4/22/05	Eu-155	0.0368	0.028	0.0471	Undetected
B1D0P9	HRNM NS-22	4/22/05	K-40	15.3	2	0.107	
B1D0P9	HRNM NS-22	4/22/05	Pu-238	-0.000142	0.00077	0.00148	Undetected
B1D0P9	HRNM NS-22	4/22/05	Ru-106	-0.0485	0.087	0.145	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0P9	HRNM NS-22	4/22/05	Sb-125	-0.0132	0.022	0.0367	Undetected
B1D0R0	HRNM NS-23	4/22/05	Be-7	0.192	0.53	0.891	Undetected
B1D0R0	HRNM NS-23	4/22/05	Eu-154	0.025	0.033	0.058	Undetected
B1D0R0	HRNM NS-23	4/22/05	Eu-155	0.0496	0.03	0.0498	Undetected
B1D0R0	HRNM NS-23	4/22/05	K-40	16.8	2.1	0.112	
B1D0R0	HRNM NS-23	4/22/05	Pu-238	0.000637	0.0011	0.00143	Undetected
B1D0R0	HRNM NS-23	4/22/05	Ru-106	-0.0184	0.1	0.174	Undetected
B1D0R0	HRNM NS-23	4/22/05	Sb-125	0.0257	0.025	0.0433	Undetected
B1D0J6	HRNM NS-24	9/29/05	Be-7	0.0389	0.1	0.173	Undetected
B1D0J6	HRNM NS-24	9/29/05	Eu-154	-0.0434	0.04	0.0641	Undetected
B1D0J6	HRNM NS-24	9/29/05	Eu-155	0.0366	0.029	0.0485	Undetected
B1D0J6	HRNM NS-24	9/29/05	K-40	18.2	3.4	0.145	
B1D0J6	HRNM NS-24	9/29/05	Pu-238	0.000328	0.0014	0.00252	Undetected
B1D0J6	HRNM NS-24	9/29/05	Ru-106	-0.0111	0.087	0.147	Undetected
B1D0J6	HRNM NS-24	9/29/05	Sb-125	-0.0171	0.024	0.0403	Undetected
B1D0R1	HRNM NS-25	4/22/05	Be-7	-0.0839	0.49	0.824	Undetected
B1D0R1	HRNM NS-25	4/22/05	Eu-154	-0.0136	0.028	0.047	Undetected
B1D0R1	HRNM NS-25	4/22/05	Eu-155	0.0411	0.026	0.043	Undetected
B1D0R1	HRNM NS-25	4/22/05	K-40	15	1.9	0.118	
B1D0R1	HRNM NS-25	4/22/05	Pu-238	-0.000604	0.0025	0.00555	Undetected
B1D0R1	HRNM NS-25	4/22/05	Ru-106	-0.000673	0.089	0.154	Undetected
B1D0R1	HRNM NS-25	4/22/05	Sb-125	0.00377	0.023	0.04	Undetected
B1D0K3	HRNM NS-26	4/22/05	Be-7	-0.194	0.82	1.4	Undetected
B1D0K3	HRNM NS-26	4/22/05	Eu-154	-0.0127	0.038	0.0638	Undetected
B1D0K3	HRNM NS-26	4/22/05	Eu-155	0.0751	0.038	0.0642	Undetected
B1D0K3	HRNM NS-26	4/22/05	K-40	14	1.9	0.171	
B1D0K3	HRNM NS-26	4/22/05	Pu-238	-0.000142	0.0016	0.00348	Undetected
B1D0K3	HRNM NS-26	4/22/05	Ru-106	0.0304	0.12	0.201	Undetected
B1D0K3	HRNM NS-26	4/22/05	Sb-125	0.0479	0.037	0.0495	Undetected
B1D0J7	HRNM NS-27	4/8/05	Be-7	-0.101	0.89	1.48	Undetected
B1D0J7	HRNM NS-27	4/8/05	Eu-154	-0.0203	0.033	0.0545	Undetected
B1D0J7	HRNM NS-27	4/8/05	Eu-155	0.0669	0.031	0.052	Undetected
B1D0J7	HRNM NS-27	4/8/05	K-40	14	1.8	0.128	
B1D0J7	HRNM NS-27	4/8/05	Pu-238	0.000575	0.00029	0.000248	
B1D0J7	HRNM NS-27	4/8/05	Ru-106	-0.0197	0.1	0.176	Undetected
B1D0J7	HRNM NS-27	4/8/05	Sb-125	0.00702	0.026	0.0441	Undetected
B1D0J8	HRNM NS-28	9/29/05	Be-7	0.144	0.098	0.171	Undetected
B1D0J8	HRNM NS-28	9/29/05	Eu-154	0.00751	0.036	0.0616	Undetected
B1D0J8	HRNM NS-28	9/29/05	Eu-155	0.0416	0.029	0.0489	Undetected
B1D0J8	HRNM NS-28	9/29/05	K-40	18.9	2.4	0.128	
B1D0J8	HRNM NS-28	9/29/05	Pu-238	0.000477	0.00034	0.000148	

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0J8	HRNM NS-28	9/29/05	Ru-106	0.0166	0.081	0.14	Undetected
B1D0J8	HRNM NS-28	9/29/05	Sb-125	0.00618	0.024	0.0402	Undetected
B1D0R2	HRNM NS-29	4/22/05	Be-7	0.149	0.48	0.831	Undetected
B1D0R2	HRNM NS-29	4/22/05	Eu-154	-0.00137	0.031	0.0528	Undetected
B1D0R2	HRNM NS-29	4/22/05	Eu-155	0.0481	0.03	0.051	Undetected
B1D0R2	HRNM NS-29	4/22/05	K-40	14.3	1.9	0.12	
B1D0R2	HRNM NS-29	4/22/05	Pu-238	-0.000142	0.0013	0.00287	Undetected
B1D0R2	HRNM NS-29	4/22/05	Ru-106	0.0141	0.089	0.151	Undetected
B1D0R2	HRNM NS-29	4/22/05	Sb-125	0.0187	0.024	0.0407	Undetected
B1D0R3	HRNM NS-30	4/22/05	Be-7	-0.249	0.59	0.972	Undetected
B1D0R3	HRNM NS-30	4/22/05	Eu-154	-0.0349	0.039	0.0634	Undetected
B1D0R3	HRNM NS-30	4/22/05	Eu-155	0.0288	0.03	0.0497	Undetected
B1D0R3	HRNM NS-30	4/22/05	K-40	14.6	2.8	0.126	
B1D0R3	HRNM NS-30	4/22/05	Pu-238	0.00129	0.0012	0.000486	
B1D0R3	HRNM NS-30	4/22/05	Ru-106	0.0728	0.11	0.189	Undetected
B1D0R3	HRNM NS-30	4/22/05	Sb-125	-0.00307	0.027	0.045	Undetected
B1D0L0	HRNM NS-31	6/14/05	Be-7	-0.0244	0.2	0.34	Undetected
B1D0L0	HRNM NS-31	6/14/05	Eu-154	-0.0241	0.026	0.0427	Undetected
B1D0L0	HRNM NS-31	6/14/05	Eu-155	0.0429	0.027	0.0469	Undetected
B1D0L0	HRNM NS-31	6/14/05	K-40	11.5	1.5	0.116	
B1D0L0	HRNM NS-31	6/14/05	Pu-238	-0.000484	0.00086	0.00251	Undetected
B1D0L0	HRNM NS-31	6/14/05	Ru-106	-0.0751	0.075	0.12	Undetected
B1D0L0	HRNM NS-31	6/14/05	Sb-125	-0.000203	0.02	0.0344	Undetected
B1D0L1	HRNM NS-32	5/10/05	Be-7	-0.178	0.38	0.614	Undetected
B1D0L1	HRNM NS-32	5/10/05	Eu-154	0.0355	0.034	0.0603	Undetected
B1D0L1	HRNM NS-32	5/10/05	Eu-155	0.0973	0.037	0.0608	Undetected
B1D0L1	HRNM NS-32	5/10/05	K-40	16.2	2.2	0.123	
B1D0L1	HRNM NS-32	5/10/05	Pu-238	0.00211	0.0015	0.00145	
B1D0L1	HRNM NS-32	5/10/05	Ru-106	-0.063	0.096	0.157	Undetected
B1D0L1	HRNM NS-32	5/10/05	Sb-125	0.0182	0.025	0.0429	Undetected
B1D0L2	HRNM NS-33	5/10/05	Be-7	0.0372	0.51	0.86	Undetected
B1D0L2	HRNM NS-33	5/10/05	Eu-154	0.0244	0.041	0.0748	Undetected
B1D0L2	HRNM NS-33	5/10/05	Eu-155	0.0674	0.035	0.0592	Undetected
B1D0L2	HRNM NS-33	5/10/05	K-40	12.5	1.7	0.201	
B1D0L2	HRNM NS-33	5/10/05	Pu-238	0.00109	0.0014	0.002	Undetected
B1D0L2	HRNM NS-33	5/10/05	Ru-106	0.0252	0.13	0.23	Undetected
B1D0L2	HRNM NS-33	5/10/05	Sb-125	0.0169	0.033	0.0576	Undetected
B1D0L3	HRNM NS-34	5/10/05	Be-7	0.137	0.56	0.97	Undetected
B1D0L3	HRNM NS-34	5/10/05	Eu-154	-0.0131	0.042	0.0695	Undetected
B1D0L3	HRNM NS-34	5/10/05	Eu-155	0.125	0.049	0.0795	Undetected
B1D0L3	HRNM NS-34	5/10/05	K-40	13.7	1.8	0.19	

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0L3	HRNM NS-34	5/10/05	Pu-238	0.00362	0.0024	0.00249	
B1D0L3	HRNM NS-34	5/10/05	Ru-106	0.0543	0.14	0.248	Undetected
B1D0L3	HRNM NS-34	5/10/05	Sb-125	0.0275	0.039	0.0656	Undetected
B1D0L4	HRNM NS-35	5/10/05	Be-7	0.112	0.34	0.581	Undetected
B1D0L4	HRNM NS-35	5/10/05	Eu-154	-0.0109	0.03	0.0508	Undetected
B1D0L4	HRNM NS-35	5/10/05	Eu-155	0.0423	0.028	0.0474	Undetected
B1D0L4	HRNM NS-35	5/10/05	K-40	14.2	1.9	0.134	
B1D0L4	HRNM NS-35	5/10/05	Pu-238	0.000662	0.0013	0.00197	Undetected
B1D0L4	HRNM NS-35	5/10/05	Ru-106	-0.00955	0.089	0.15	Undetected
B1D0L4	HRNM NS-35	5/10/05	Sb-125	0.00527	0.022	0.0378	Undetected
B1D0L5	HRNM NS-36	5/10/05	Be-7	0.271	0.3	0.522	Undetected
B1D0L5	HRNM NS-36	5/10/05	Eu-154	-0.0199	0.03	0.0486	Undetected
B1D0L5	HRNM NS-36	5/10/05	Eu-155	0.0247	0.026	0.0453	Undetected
B1D0L5	HRNM NS-36	5/10/05	K-40	15.7	2.1	0.113	
B1D0L5	HRNM NS-36	5/10/05	Pu-238	0.00315	0.0017	0.000495	
B1D0L5	HRNM NS-36	5/10/05	Ru-106	-0.0219	0.078	0.133	Undetected
B1D0L5	HRNM NS-36	5/10/05	Sb-125	0.00425	0.02	0.034	Undetected
B1D0L6	HRNM NS-37	5/10/05	Be-7	0.0567	0.4	0.682	Undetected
B1D0L6	HRNM NS-37	5/10/05	Eu-154	-0.0186	0.032	0.0541	Undetected
B1D0L6	HRNM NS-37	5/10/05	Eu-155	0.0649	0.034	0.0572	Undetected
B1D0L6	HRNM NS-37	5/10/05	K-40	14	1.9	0.149	
B1D0L6	HRNM NS-37	5/10/05	Pu-238	0.00128	0.0018	0.00262	Undetected
B1D0L6	HRNM NS-37	5/10/05	Ru-106	0.000397	0.1	0.174	Undetected
B1D0L6	HRNM NS-37	5/10/05	Sb-125	0.00649	0.026	0.0444	Undetected
B1D0L7	HRNM NS-38	5/10/05	Be-7	-0.201	0.32	0.536	Undetected
B1D0L7	HRNM NS-38	5/10/05	Eu-154	-0.00518	0.033	0.0571	Undetected
B1D0L7	HRNM NS-38	5/10/05	Eu-155	0.026	0.026	0.0441	Undetected
B1D0L7	HRNM NS-38	5/10/05	K-40	18.8	2.4	0.113	
B1D0L7	HRNM NS-38	5/10/05	Pu-238	0.000795	0.00099	0.000507	Undetected
B1D0L7	HRNM NS-38	5/10/05	Ru-106	0.0209	0.088	0.151	Undetected
B1D0L7	HRNM NS-38	5/10/05	Sb-125	0.00968	0.022	0.0374	Undetected
B1D0L8	HRNM NS-39	5/10/05	Be-7	-0.136	0.39	0.664	Undetected
B1D0L8	HRNM NS-39	5/10/05	Eu-154	-0.0287	0.038	0.0613	Undetected
B1D0L8	HRNM NS-39	5/10/05	Eu-155	0.0969	0.037	0.0627	Undetected
B1D0L8	HRNM NS-39	5/10/05	K-40	16.1	2.1	0.149	
B1D0L8	HRNM NS-39	5/10/05	Pu-238	0.00174	0.0013	0.000463	
B1D0L8	HRNM NS-39	5/10/05	Ru-106	0.0146	0.094	0.164	Undetected
B1D0L8	HRNM NS-39	5/10/05	Sb-125	0.027	0.027	0.0464	Undetected
B1D0L9	HRNM NS-40	5/10/05	Be-7	0.28	0.54	0.917	Undetected
B1D0L9	HRNM NS-40	5/10/05	Eu-154	-0.0253	0.043	0.0714	Undetected
B1D0L9	HRNM NS-40	5/10/05	Eu-155	0.228	0.086	0.0828	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0L9	HRNM NS-40	5/10/05	K-40	16.1	2.2	0.199	
B1D0L9	HRNM NS-40	5/10/05	Pu-238	0.00127	0.0013	0.00148	Undetected
B1D0L9	HRNM NS-40	5/10/05	Ru-106	0.136	0.14	0.236	Undetected
B1D0L9	HRNM NS-40	5/10/05	Sb-125	0.024	0.035	0.0594	Undetected
B1D0M0	HRNM NS-41	5/10/05	Be-7	0.864	0.51	0.909	Undetected
B1D0M0	HRNM NS-41	5/10/05	Eu-154	-0.0107	0.043	0.0727	Undetected
B1D0M0	HRNM NS-41	5/10/05	Eu-155	0.0715	0.039	0.0647	Undetected
B1D0M0	HRNM NS-41	5/10/05	K-40	16.3	2.1	0.17	
B1D0M0	HRNM NS-41	5/10/05	Pu-238	0.000801	0.0011	0.000639	Undetected
B1D0M0	HRNM NS-41	5/10/05	Ru-106	0.266	0.13	0.24	Undetected
B1D0M0	HRNM NS-41	5/10/05	Sb-125	-0.00968	0.033	0.0564	Undetected
B1D0M1	HRNM NS-42	5/10/05	Be-7	-0.257	0.39	0.634	Undetected
B1D0M1	HRNM NS-42	5/10/05	Eu-154	-0.016	0.031	0.0525	Undetected
B1D0M1	HRNM NS-42	5/10/05	Eu-155	0.07	0.03	0.0499	Undetected
B1D0M1	HRNM NS-42	5/10/05	K-40	17.2	2.2	0.121	
B1D0M1	HRNM NS-42	5/10/05	Pu-238	0.000528	0.00084	0.000453	Undetected
B1D0M1	HRNM NS-42	5/10/05	Ru-106	0.0797	0.091	0.16	Undetected
B1D0M1	HRNM NS-42	5/10/05	Sb-125	-0.00518	0.023	0.0384	Undetected
B1D0M2	HRNM NS-43	5/10/05	Be-7	-0.471	0.47	0.745	Undetected
B1D0M2	HRNM NS-43	5/10/05	Eu-154	-0.00591	0.034	0.0571	Undetected
B1D0M2	HRNM NS-43	5/10/05	Eu-155	0.0605	0.042	0.0544	Undetected
B1D0M2	HRNM NS-43	5/10/05	K-40	18.7	2.4	0.135	
B1D0M2	HRNM NS-43	5/10/05	Pu-238	0.000844	0.0013	0.00181	Undetected
B1D0M2	HRNM NS-43	5/10/05	Ru-106	0.00135	0.1	0.179	Undetected
B1D0M2	HRNM NS-43	5/10/05	Sb-125	0.013	0.028	0.0475	Undetected
B1D0M3	HRNM NS-44	5/10/05	Be-7	0.23	0.48	0.829	Undetected
B1D0M3	HRNM NS-44	5/10/05	Eu-154	-0.00813	0.036	0.0604	Undetected
B1D0M3	HRNM NS-44	5/10/05	Eu-155	0.0885	0.054	0.0528	Undetected
B1D0M3	HRNM NS-44	5/10/05	K-40	15.1	1.9	0.155	
B1D0M3	HRNM NS-44	5/10/05	Pu-238	0.00134	0.0013	0.00067	
B1D0M3	HRNM NS-44	5/10/05	Ru-106	0.0469	0.11	0.19	Undetected
B1D0M3	HRNM NS-44	5/10/05	Sb-125	-0.0113	0.028	0.047	Undetected
B1D0J9	HRNM NS-45	4/8/05	Be-7	-0.102	1	1.7	Undetected
B1D0J9	HRNM NS-45	4/8/05	Eu-154	0.00621	0.045	0.0767	Undetected
B1D0J9	HRNM NS-45	4/8/05	Eu-155	0.0651	0.034	0.0569	Undetected
B1D0J9	HRNM NS-45	4/8/05	K-40	16.4	3.1	0.174	
B1D0J9	HRNM NS-45	4/8/05	Pu-238	0.0000566	0.0002	0.000435	Undetected
B1D0J9	HRNM NS-45	4/8/05	Ru-106	-0.0499	0.14	0.225	Undetected
B1D0J9	HRNM NS-45	4/8/05	Sb-125	0.00782	0.03	0.052	Undetected
B1D0M4	HRNM NS-46	5/10/05	Be-7	0.121	0.37	0.629	Undetected
B1D0M4	HRNM NS-46	5/10/05	Eu-154	-0.0158	0.03	0.0502	Undetected

Table B.3. (contd)

Sample Number	Sampling Location	Collection Date	Isotope	Result (pCi/g)	Total Analytical Error (pCi/g)	Minimum Detectable Activity (pCi/g)	Lab Qualifier
B1D0M4	HRNM NS-46	5/10/05	Eu-155	0.0216	0.029	0.049	Undetected
B1D0M4	HRNM NS-46	5/10/05	K-40	16.1	2.1	0.131	
B1D0M4	HRNM NS-46	5/10/05	Pu-238	0.0000629	0.00096	0.002	Undetected
B1D0M4	HRNM NS-46	5/10/05	Ru-106	-0.0643	0.087	0.145	Undetected
B1D0M4	HRNM NS-46	5/10/05	Sb-125	-0.00624	0.022	0.0372	Undetected
B1D0K0	HRNM NS-47	4/8/05	Be-7	-0.00833	1.8	3.12	Undetected
B1D0K0	HRNM NS-47	4/8/05	Eu-154	-0.0357	0.068	0.114	Undetected
B1D0K0	HRNM NS-47	4/8/05	Eu-155	0.0198	0.057	0.0979	Undetected
B1D0K0	HRNM NS-47	4/8/05	K-40	19.7	2.7	0.276	
B1D0K0	HRNM NS-47	4/8/05	Pu-238	0.0000277	0.00012	0.00024	Undetected
B1D0K0	HRNM NS-47	4/8/05	Ru-106	-0.00821	0.23	0.396	Undetected
B1D0K0	HRNM NS-47	4/8/05	Sb-125	-0.0533	0.059	0.0943	Undetected
B1D0K1	HRNM NS-48	4/8/05	Be-7	-0.555	1.2	2.04	Undetected
B1D0K1	HRNM NS-48	4/8/05	Eu-154	0.0369	0.041	0.0746	Undetected
B1D0K1	HRNM NS-48	4/8/05	Eu-155	0.151	0.06	0.0672	Undetected
B1D0K1	HRNM NS-48	4/8/05	K-40	15.6	2	0.153	
B1D0K1	HRNM NS-48	4/8/05	Pu-238	0.0006	0.00025	0.00014	
B1D0K1	HRNM NS-48	4/8/05	Ru-106	0.0791	0.15	0.261	Undetected
B1D0K1	HRNM NS-48	4/8/05	Sb-125	0.00575	0.039	0.0657	Undetected

Not all results from gamma scan included in this table.

Appendix C

Historical Environmental Monitoring Data Summary

Appendix C

Historical Environmental Monitoring Data Summary

Table C.1. Historical Environmental Monitoring Data Taken from Fritz et al. (2003) (North Slope samples collected from north end of Vernita Bridge and Berg Ranch environmental monitoring locations.)

North Slope Soil Sample Data (pCi/g dry wt)

Period	Data	Co-60	Sr-90	Cs-137	Eu-152	Eu-154	Eu-155	Total U
1971-1989	Median	0.002	0.11	0.40	0.16	0.001	0.052	0.35
	Maximum	0.14	1.8	1.8	0.23	0.089	0.11	1.2
	Number of samples	82	82	82	6	36	31	54
	Number detected	25	80	80	6	5	7	54
1990-2001	Median	-0.001	0.07	0.36	NA	0.005	0.038	NA
	Maximum	0.012	0.20	0.95	NA	0.11	0.099	NA
	Number of samples	15	15	15	NA	15	15	NA
	Number detected	0	15	15	NA	0	1	NA

Period	Data	U-234	U-235	U-238	Total Pu	Pu-238	Pu-239/240	Am-241
1971-1989	Median	NA	0.031	0.68	0.006	0.0010	0.008	0.052
	Maximum	NA	0.23	1.8	0.022	0.016	0.033	0.087
	Number of samples	NA	11	11	20	82	82	3
	Number detected	NA	2	11	20	45	81	1
1990-2001	Median	0.41	0.020	0.58	NA	0.0005	0.011	NA
	Maximum	0.89	0.17	0.88	NA	0.0025	0.030	NA
	Number of samples	10	16	16	NA	15	15	NA
	Number detected	10	10	14	NA	13	15	NA

Upwind (Sunnyside) Soil Sample Data (pCi/g dry wt)

Period	Data	Co-60	Sr-90	Cs-137	Eu-152	Eu-154	Eu-155	Total U
1971-1989	Median	0.003	0.22	0.6	NA	-0.01	0.039	0.29
	Maximum	0.032	1.6	1.5	NA	0.094	0.1	0.47
	Number of samples	14	14	14	NA	9	9	11
	Number detected	2	14	14	NA	0	2	11
1990-2001	Median	-0.004	0.084	0.4	NA	-0.009	0.026	
	Maximum	0.01	0.35	1.2	NA	0.028	0.05	
	Number of samples	6	6	6	NA	6	6	
	Number detected	0	6	6	NA	0	0	

Period	Data	U-234	U-235	U-238	Total Pu	Pu-238	Pu-239/240	Am-241
1971-1989	Median	NA	0.077	0.71	NA	0.00027	0.013	0.01
	Maximum	NA	0.11	1	NA	0.0022	0.026	0.034
	Number of samples	NA	4	4	NA	14	14	9
	Number detected	NA	0	4	NA	6	14	1
1990-2001	Median	0.35	0.014	0.6	NA	0.00028	0.011	0.004
	Maximum	0.63	0.03	0.8	NA	0.0062	0.029	0.0066
	Number of samples	4	6	6	NA	6	6	6
	Number detected	4	4	6	NA	3	6	4

Reference

Fritz BG, RL Dirkes, TM Poston, and RW Hanf, JR. 2003. *Historical Site Assessment: Hanford Reach National Monument—Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE), McGee Ranch/Riverlands, and North Slope Units*. PNNL-13989, Pacific Northwest National Laboratory, Richland, Washington.

Appendix D

Development and Implementation of a Resident Child Dose Assessment Scenario

Appendix D

Development and Implementation of a Resident Child Dose Assessment Scenario

D.1 Scenario Development

As a result of inquiries by interested parties, a third dose assessment scenario was developed in addition to the two scenarios evaluated in determining the authorized limits. A hypothetical maximally exposed individual dose scenario was developed for a child, in response to public concern that the two other scenarios may not address all potential uses. In particular, there was concern that doses to children of a Native American family who reside on the Hanford Reach National Monument (HRNM) were not adequately characterized. The key exposure pathways and parameters for the scenarios used to model radiation doses to the maximally exposed individual (i.e., Native American child) are shown in Table D.1. The key parameters for the scenario are consistent with those documented in Napier and Snyder (2002). Additional parameters were established based on consideration of information provided by the Washington State Department of Health (WDOH 1997). Other parameters needed for the RESRAD computer program were selected based on those identified in Napier and Snyder (2002), with some minor modifications to adjust for the input requirements in RESRAD.

Table D.1. Key Parameters Used for the Resident Child Scenario on the Hanford Reach National Monument

Pathway Parameters	Child
Cover/Hydrology	
Irrigation rate, m/year	0.76
Surface Water/ Hydrology	
Effective watershed, m ²	1.1x10 ⁹
External Exposure	
Years	1
Time indoors, fraction	0.60
Time outdoors, fraction	0.20
Shielding	0.8
Soil density, g/cc	1.6
Inhalation	
Breathing rate, m ³ /year	1050
Mass loading, g/m ³	0.000050
Dust filtration factor	0.4
Soil Ingestion	
Ingestion rate, g/year	73
Other Ingestion	
Groundwater, L/year	Not used
Fruit, vegetable, grain, kg/year	45.6
Milk, L/year	365

For the sake of analysis, it is assumed that one or more families take up residence in the area. Local foods are gathered, prepared, and eaten. The environment is assumed to be similar to that defined by the WDOH, although specific food types and practices may differ. The WDOH has defined a set of RESRAD input parameters that differ from the RESRAD default template as shown in Table D.1. (Table D.1 shows neither the WDOH default values, the RESRAD default values, nor the differences between these two data sets.) The advantage of the WDOH set of parameters is that the environmental parameters are all related to the Hanford Site. Consumption of Columbia River water or HRNM groundwater is not considered for the scenario.

An important parameter revised from the WDOH environmental parameters is the mass loading of dust in the air for the inhalation pathway. Because the dust in frequented areas, such as dirt roads, might be enhanced because of mechanical disturbances, an annual average mass-loading value of $50 \mu\text{g}/\text{m}^3$ is appropriate. This value is approximately three times higher than the annual average concentration of respirable dust measured on and around the Hanford Site (Neitzel et al. 2006).

The child is assumed to be between 6 to 18 months old. This age is old enough that the parents may be comfortable leaving the child briefly unattended on the ground, and old enough that the child will be mobile enough to move around on the ground and potentially put interesting items and/or soil into his or her mouth. As a result, the soil intake rate is increased to 200 milligrams/day. For a year-round resident, this results in an annual 73-gram intake, as reflected in Table D.1.

The breathing rate of the child will be lower than that for an adult. The International Commission on Radiological Protection (1974) estimates that 1-year-old children inhales about 2 liters/minute (which converts to $1.050 \text{ m}^3/\text{year}$ as reflected in Table D.1).

It is also assumed that the child has begun to eat solid foods, and that these foods are produced in the local area. Based on a 1977 U.S. Department of Agriculture *Food Consumption Survey* (USDA 1977), it is estimated that 1-year-old rural children will eat about 125 grams/day of produce and drink about 1 liter of milk each day. Cows' milk is assumed for this calculation, because cows' milk is one of the readily obtained outputs from RESRAD. The annualized versions of these values are shown in Table D.1.

The RESRAD code output was abstracted to generate environmental concentrations of contaminants, starting with an initial condition of 100 pCi/gram of each radionuclide, results in soil, air, and food concentrations as shown in Table D.2. These are the concentrations used in the agricultural resident scenario as described in Napier et al. (2004).

Very young children have different metabolisms than adults. Their gastrointestinal tract does not discriminate against certain chemicals as well as those of adults, and uptake of trace materials such as radionuclides can be higher. In addition, for a given intake, their body mass is smaller, and the energy emitted from decaying radionuclides may be absorbed in a smaller body or organ mass, resulting in a larger dose per unit intake. The U.S. Environmental Protection Agency has evaluated progress made in understanding these effects, and prepared federal guidance (Eckerman and Ryman 1993) that incorporates many of the age-dependent factors. The ingestion and inhalation dose coefficients used in the RESRAD code for adults are compared to those for 1-year-old children from FGR-13 in Table D.3.

Table D.2. Environmental Concentrations of Radionuclides and Direct Exposure Rates, Normalized to 100 pCi/gram of Soil (Concentrations are at time of consumption and include radioactive decay and in-growth during storage.)

Radionuclide	Nonleafy Vegetable (pCi/kg)	Milk (pCi/L)	Ground External (mrem/yr)	Air Concentration Resuspension (pCi/m ³)
Cobalt-60	1.33E+03	2.47E+02	8.83E+02	2.23E-03
Strontium-90	5.00E+03	6.50E+02	1.57E+00	2.23E-03
Cesium-134	6.67E+02	6.94E+02	4.92E+02	2.23E-03
Cesium-137	6.67E+02	6.94E+02	2.07E+02	2.23E-03
Europium-152	4.19E+01	1.05E+00	4.08E+02	2.23E-03
Uranium-234	4.19E+01	3.14E+01	2.65E-02	2.23E-03
Uranium-235	4.19E+01	3.14E+01	4.85E+01	2.23E-03
Uranium-238	4.19E+01	3.14E+01	9.13E+00	2.23E-03
Plutonium-239	1.69E+01	5.10E-02	1.94E-02	2.23E-03
Plutonium-240	1.69E+01	5.10E-02	9.98E-03	2.23E-03
Americium-241	1.69E+01	1.02E-01	2.97E+00	2.23E-03

Table D.3. Radiation Dose Coefficients for Adults and Children (mrem/pCi)

Radionuclide	Ingestion Coefficients		Inhalation Coefficients		
	RESRAD Adult	FGR13 1-yr-old	RESRAD Adult	FGR13 1-yr-old	Inhalation Class
Cobalt-60	2.69E-05	9.90E-05	2.19E-04	3.17E-04	Y
Strontium-90	1.53E-04	2.68E-04	1.31E-03	1.46E-03	Y
Cesium-134	7.33E-05	5.82E-05	4.63E-05	2.73E-05	D
Cesium-137	5.00E-05	4.58E-05	3.19E-05	2.01E-05	D
Europium-152	6.48E-06	2.77E-05	2.21E-04	3.84E-04	W
Uranium-234	2.83E-04	4.94E-04	1.32E-01	1.07E-01	Y
Uranium-235	2.67E-04	4.77E-04	1.23E-01	9.69E-02	Y
Uranium-238	2.69E-04	4.47E-04	1.18E-01	9.19E-02	Y
Plutonium-239	3.54E-03	1.56E-03	4.29E-01	7.53E-01	W/F
Plutonium-240	3.54E-03	1.56E-03	4.29E-01	7.53E-01	W/F
Americium-241	3.64E-03	1.39E-03	4.44E-01	6.57E-01	W/F

D.2 Estimated Radiation Doses for the Resident Child Scenario

In developing authorized limits for the HRNM, radiation doses above background for the identified scenario are developed using a standard concentration (100 pCi/g) of each radionuclide in soil. The results can be normalized to scenario unit dose factors, with units of millirem per year per picocurie per gram of soil (Table D.4). This analysis provides insight to which pathways are important for each

radionuclide. For example, some radionuclides contribute a higher dose externally than when inhaled. The normalized radiation doses estimated for the resident child scenario are summarized in Table D.4 for each radionuclide considered in this analysis. The dominant pathways are external exposure to soil or ingestion (milk). For all radionuclides, the adult RESRAD results indicated that the normalized doses are highest at the beginning of the analysis. The dose decreases monotonically with time through decay and erosion loss. For radionuclides with chain decay ingrowth of progeny over long (thousand-year) periods, the decay ingrowth is also less than the decay and erosion loss. The primary exposure is from contamination of the soil in the immediate vicinity. The maximum soil concentrations for the McGee Ranch-Riverlands and North Slope Units measured in this study (Table D.5) were used as RESRAD input to estimate the dose to a Native American child according to the scenario described in this appendix. As shown in Table D.5, the maximum estimated dose to a resident child would be 4.2 mrem/year.

Table D.4. Normalized Doses for the Resident Child Scenario (mrem yr⁻¹ pCi⁻¹ g⁻¹)

Radiouclide	External	Soil	Plants	Milk	Inhalation	Total
Cobalt-60	8.83E+00	7.23E-05	6.03E-02	8.92E-02	7.42E-06	8.98E+00
Strontium-90	1.57E-02	1.96E-04	6.11E-01	6.36E-01	3.42E-05	1.26E+00
Cesium-134	4.92E+00	4.25E-05	1.77E-02	1.47E-01	6.39E-07	5.09E+00
Cesium-137	2.07E+00	3.34E-05	1.39E-02	1.16E-01	4.70E-07	2.20E+00
Europium-152	4.08E+00	2.02E-05	5.30E-04	1.06E-04	8.98E-06	4.08E+00
Uranium-234	2.65E-04	3.61E-04	9.45E-03	5.67E-02	2.50E-03	6.92E-02
Uranium-235	4.85E-01	3.48E-04	9.12E-03	5.47E-02	2.27E-03	5.52E-01
Uranium-238	9.13E-02	3.26E-04	8.55E-03	5.13E-02	2.15E-03	1.54E-01
Plutonium-239	1.94E-04	1.14E-03	1.20E-02	2.90E-04	1.76E-02	3.13E-02
Plutonium-240	9.98E-05	1.14E-03	1.20E-02	2.90E-04	1.76E-02	3.12E-02
Americium-241	2.97E-02	1.01E-03	1.07E-02	5.17E-04	1.54E-02	5.73E-02
Total	2.05E+01	4.69E-03	7.65E-01	1.15E+00	5.76E-02	

D.3 Discussion

It is interesting, and perhaps somewhat unexpected, that the estimated doses to children are slightly lower than those to adults for the agricultural resident scenario. The ingestion dose coefficients (radiation dose per unit intake) for children for some radionuclides are larger than those for adults, primarily because children's gastrointestinal tracts do not protect as well against these materials. However, for the higher-energy gamma emitters with high uptakes (e.g., cesium-137), the internal dose coefficient is lower since more of the emitted gamma rays are able to exit the much smaller body of the child before being absorbed and depositing their energy. Children are assumed to consume much more soil and milk than adults; however, adults consume more of a wider range of foods, which ultimately results in higher total intakes.

Table D.5. Results of the RESRAD Dose Estimate for the Resident Child Scenario (based on measured soil concentrations)

Radionuclide	McGee Ranch-Riverlands or North Slope Maximum Measured Soil Concentration (pCi/g) ^(a)	Total Dose (mrem/yr)
Cobalt-60	0.026	0.23
Strontium-90	0.19	0.24
Cesium-134	0.17	0.88
Cesium-137	0.66	1.45
Europium-152	0.16	0.65
Uranium-234	3.5	0.24
Uranium-235	0.098	0.054
Uranium-238	2.9	0.44
Plutonium-239/240	0.025	0.00077
Americium-241 ^(b)	0.49	0.0021
Combined Total Dose		4.2
(a) From Table 3 of the main text.		
(b) Maximum americium-241 soil concentration measured on the Fitzner/Eberhardt Arid Lands Ecology Reserve Unit used.		

The inhalation dose coefficients for alpha-emitting radionuclides are higher for children than for adults, in part, because of the smaller organ mass of children. However, a child's inhalation rate is substantially smaller than that of an adult, which more than compensates for the increased dose per unit intake.

External doses are assumed to be the same for adults and children. Although it may be argued that children are "closer to the ground" than adults, and the dose coefficients are calculated for a point 1 meter above the soil, the difference in dose rate at different distances from an infinite emitting plane (the way the dose rate factors are modeled) is small, and the total elapsed times of exposure assumed for both adults and children are the same.

An important supposition in the impetus to estimate doses to children is the belief that a child's increased intake of contaminated soil would result in increased doses. This is not the case. As can be seen from the pathway-specific results in Table D.4, the soil ingestion pathway contributes less than 4% of the dose for any one radionuclide. The soil ingestion rate could be increased by one to two orders of magnitude (factors of 10 to 100) without having a significant impact on the estimated dose.

Because the dose for children and adults, from the radionuclide spectrum found at various locations within the McGee Ranch-Riverlands and North Slope Units of the HRNM, is dominated by the external exposure from cesium-137, the primary parameter determining potential future radiation doses is the assumed period of occupancy. Thus, doses may be considered essentially a direct function of the amount of time spent onsite. Any type of residential scenario (farmer, suburban resident, or Native American subsistence lifestyle) would have approximately the same doses and would result in higher doses than any type of transient scenario (ranger, hunter, or HRNM visitor).

D.4 References

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Appendix E

Results of the Biota Dose Assessment Screening

Appendix E

Results of the Biota Dose Assessment Screening

Table E.1. Terrestrial Biota Dose Screening Results for the McGee Ranch-Riverlands and North Slope Units of the Hanford Reach National Monument.

Terrestrial BCG Report for Level 1								
Title: McGee Ranch / Riverlands - screening								
Sum of Total Ratio: 5.81E-02								
Sum of Water Ratio: 0.00E+00								
Sum of Soil Ratio: 5.81E-02								
Terrestrial Animal								
Water					Soil			
Nuclide	Concentration (pCi/L)	BCG (pCi/L)	Ratio	Limiting Organism	Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism
Co-60	0	1.19E+06	0.00E+00	Yes	0.0257	6.92E+02	3.72E-05	Yes
Cs-134	0	3.26E+05	0.00E+00	Yes	0.173	1.13E+01	1.53E-02	Yes
Cs-137	0	5.99E+05	0.00E+00	Yes	0.658	2.08E+01	3.17E-02	Yes
Eu-152	0	2.55E+06	0.00E+00	Yes	0.16	1.52E+03	1.05E-04	Yes
Pu-239	0	2.00E+05	0.00E+00	Yes	0.0245	6.11E+03	4.01E-06	Yes
Sr-90	0	5.45E+04	0.00E+00	Yes	0.189	2.25E+01	8.40E-03	Yes
U-234	0	4.04E+05	0.00E+00	Yes	3.5	5.13E+03	6.82E-04	Yes
U-235	0	4.19E+05	0.00E+00	Yes	0.0975	2.77E+03	3.52E-05	Yes
U-238	0	4.06E+05	0.00E+00	Yes	2.88	1.58E+03	1.83E-03	Yes
Summed	-	-	0.00E+00	-	-	-	5.81E-02	-

Table E.2. Aquatic Biota Dose Screening Results for the McGee Ranch-Riverlands and North Slope Units of the Hanford Reach National Monument (Water concentrations are calculated from soil concentrations based on RESRAD default sediment:water equilibrium ratios.)

Aquatic BCG Report for Level 1

Title: McGee Ranch / Riverlands - screening

Sum of Total Ratio: 6.86E-01

Sum of Water Ratio: 6.84E-01

Sum of Sediment Ratio: 2.57E-03

Aquatic Animal								
	Water				Sediment			
Nuclide	Concentration (pCi/L)	BCG (pCi/L)	Ratio	Limiting Organism	Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism
Co-60	0.0257	3.76E+03	6.84E-08	Yes	0.0257	1.49E+04	1.72E-06	No
Cs-134	0.346	5.18E+02	6.67E-04	No	0.173	2.28E+04	7.58E-06	No
Cs-137	1.316	1.05E+03	1.26E-03	No	0.658	4.93E+04	1.34E-05	No
Eu-152	0.32	2.55E+04	1.26E-05	Yes	0.16	3.06E+04	5.23E-06	No
Pu-239	0.01225	1.87E+02	6.56E-05	Yes	0.0245	7.04E+06	3.48E-09	No
Sr-90	6.3	5.39E+04	1.17E-04	No	0.189	3.52E+04	5.37E-06	No
U-234	70	2.02E+02	3.47E-01	Yes	3.5	3.08E+06	1.14E-06	No
U-235	1.95	2.17E+02	8.97E-03	Yes	0.0975	1.05E+05	9.30E-07	No
U-238	57.6	2.23E+02	2.58E-01	Yes	2.88	4.28E+04	6.72E-05	No
Summed	-	-	6.16E-01	-	-	-	1.03E-04	-

Riparian Animal								
	Water				Sediment			
Nuclide	Concentration (pCi/L)	BCG (pCi/L)	Ratio	Limiting Organism	Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism
Co-60	0.0257	4.78E+03	5.37E-08	No	0.0257	1.46E+03	1.76E-05	Yes
Cs-134	0.346	2.11E+01	1.64E-02	Yes	0.173	1.48E+03	1.17E-04	Yes
Cs-137	1.316	4.26E+01	3.09E-02	Yes	0.658	3.12E+03	2.11E-04	Yes
Eu-152	0.32	6.77E+04	4.73E-06	No	0.16	3.04E+03	5.27E-05	Yes
Pu-239	0.01225	6.22E+02	1.97E-05	No	0.0245	5.86E+03	4.18E-06	Yes
Sr-90	6.3	2.78E+02	2.26E-02	Yes	0.189	5.82E+02	3.25E-04	Yes
U-234	70	6.83E+02	1.02E-01	No	3.5	5.27E+03	6.64E-04	Yes
U-235	1.95	7.36E+02	2.65E-03	No	0.0975	3.73E+03	2.62E-05	Yes
U-238	57.6	7.56E+02	7.62E-02	No	2.88	2.49E+03	1.16E-03	Yes
Summed	-	-	2.51E-01	-	-	-	2.57E-03	-

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Environmental Restoration and Waste
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The Confederated Tribes and Bands of the
Yakama Nation
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D. Landeen
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