



10 CFR 70.5

April 7, 2011

AES-O-NRC-11-00976

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

AREVA Enrichment Services LLC  
Eagle Rock Enrichment Facility  
NRC Docket No: 70-7015

**Subject: Surface Soil Sampling for the Eagle Rock Enrichment Facility**

In October 2010, AREVA Enrichment Services LLC (AES) collected sixty soil samples at the Eagle Rock Enrichment Facility (EREF) site for the purpose of establishing the natural range of background concentrations of radionuclides in on-site, surface soil, prior to the beginning of facility construction activities. The data from the radiological analyses of these samples provide radionuclide background levels that will be used for future assessments of potential impact on the local environment from facility operations or decommissioning. The soil sample results are summarized in Enclosure 1. The complete report is available for inspection at our offices, if needed.

The sampling plan addressed the four pre-construction survey units identified in the AES response to NRC Request for Additional Information D-2 (Reference 1), and satisfies the commitment to the NRC to provide a sufficient number of sampling points to characterize the site area for pre-construction background radionuclide levels. The four survey units were delineated as follows:

- Survey Unit 1: The stormwater detention and retention basins;
- Survey Unit 2: The main cylinder storage pad area north of the main facilities;
- Survey Unit 3: The main facility footprint for the Technical Support Building, the Blending, Sampling and Preparation Building, the Separation Building Modules, the UF<sub>6</sub> Handling Areas, and the Full Product Cylinder Storage Pad, and;
- Survey Unit 4: Areas on-site, but outside those that are scheduled to be disturbed during plant construction.

**AREVA ENRICHMENT SERVICES LLC**

Solomon Pond Park - 400 Donald Lynch Boulevard, Marlborough, MA 01752  
Tel. : 508 229 2100 - Fax : 508 573 6610 - www.aveva.com

KIMS01

Ten surface soil samples were previously collected on the EREF site and the analysis results are reported in the Environmental Report (ER) Table 3.11-3, Radiological Analyses of EREF Site Soil, and the sample locations are shown on ER Figure 3.3-14A, Borehole and Soil Sample Locations. These samples are not included in the summary.

If you have any questions regarding this submittal, please contact me at (508) 573-6554.

Respectfully,



James A. Kay  
Licensing Manager

Reference:

1. James A. Kay (AES) Letter to the U.S. Nuclear Regulatory Commission, Subject: Response to Requests for Additional Information - AREVA Enrichment Services LLC License Application for the Eagle Rock Enrichment Facility, dated September 28, 2009.

Enclosure:

1. Pre-Construction Environmental Surface Soil Sampling Results at the EREF Site

cc:

Breeda Reilly, U.S. NRC Senior Project Manager  
Steve Lemont, U.S. NRC Senior Project Manager  
Bruce Biber, Argonne National Laboratory

## **Pre-Construction Environmental Surface Soil Sampling Results at the EREF Site**

### **1.0 PURPOSE**

In October 2010, AREVA Enrichment Services LLC (AES) collected sixty soil samples at the Eagle Rock Enrichment Facility (EREF) site for the purpose of establishing the natural range of background concentrations of radionuclides in on-site, surface soil, prior to the beginning of facility construction activities. The data from the radiological analyses of these samples provide radionuclide background levels that will be used for future assessments of potential impact on the local environment from facility operations or decommissioning. The sampling plan design satisfies the licensing commitment to the NRC to provide a sufficient number of sampling points to characterize the site area for preconstruction background radionuclide levels.

Ten surface soil samples were previously collected on the EREF site and the analysis results are reported in the Environmental Report (ER) Table 3.11-3, Radiological Analyses of EREF Site Soil, and the sample locations are shown on ER Figure 3.3-14A, Borehole and Soil Sample Locations. These samples are not included in the summary.

### **2.0 METHODOLOGY**

A sampling plan [Reference 1] was written to describe and guide the sampling, processing, and analysis of pre-construction surface soil samples from the EREF site. Personnel collected and performed initial processing on the samples, and then shipped the samples to a laboratory, where they were analyzed for radiological constituents. Additional details of the sample collection, processing, and analysis are found in Section 3.0 of this report.

The sampling plan [Reference 1] addresses the four pre-construction survey units identified in the response to NRC RAI D-2 [Reference 2].

### **3.0 SAMPLING AND ANALYSIS PROGRAM**

#### **3.1 Sample Locations**

As described in the Sampling Plan [Reference 1], the site property was divided into four survey units, with fifteen soil samples taken in each of the survey units, giving a total of sixty samples to cover the facility footprint and areas beyond the plant proper. The four survey units were delineated as follows:

- Survey Unit 1: The Stormwater Detention and Retention Basins;
- Survey Unit 2: The main cylinder storage pad area north of the main facilities;
- Survey Unit 3: The main facility footprint for the Technical Support Building, the Blending, Sampling and Preparation Building, the Separation Building Modules, the UF<sub>6</sub> Handling Areas, and the Full Product Cylinder Storage Pad; and

- Survey Unit 4: Areas on-site, but outside those that are scheduled to be disturbed during plant construction.

### **3.2 Sample Collection and Analysis**

Samples were collected from the EREF site from October 27-29, 2010. At each of the sixty GPS identified sampling locations, a one-square foot area was cleared of vegetation and other non-soil materials (large rocks, roots, twigs, leaves, etc.). Within the one-square foot area, the top one inch of soil was collected, and any non-soil materials were removed. The remaining soil was mixed and placed in a labeled plastic container for shipment to the analytical laboratory. Sufficient sample weight was collected to meet the Minimum Detectable Activity (MDA) requirements. Appropriate data was entered for each sample on the Sample Collection Log. Contamination control measures were implemented throughout. These measures and other sampling procedural details can be found in the Sampling Protocol [Reference 3].

The following radionuclide analyses were performed on each soil sample:

- Gamma isotopic analysis, including K-40, Cs-137, and Ac-228;
- Uranium isotopic analysis for U-233/234, U-235/236, U-238, and by a separate method for U-236; and
- Thorium isotopic analysis for Th-228, Th-230, and Th-232.

Based on the detectable radionuclide concentrations observed for the original ten site area soil samples (EREF ER Table 3.11-3), laboratory MDA requirements were chosen to provide a high likelihood that the actual concentration levels of the radionuclides of interest would be determined for this set of 60 soil samples.

The sampling protocol was governed by the requirements of U.S. NRC Regulatory Guide 4.15 [Reference 4]. As such, soil samples were collected by a field crew in which all members had been trained per Regulatory Guide 4.15 as qualified to conduct the procedure.

### **4.0 SUMMARY**

The radiological analytical results for the sixty surface soil samples are summarized in Table 1.

### **5.0 REFERENCES**

1. AREVA Document No. E000-00-P-TS\_\_05012-00, "EREF Pre-Construction Environmental Soil Sampling Plan (Proprietary)," Rev. 0, October 2010.
2. James A. Kay (AES) Letter to the U.S. Nuclear Regulatory Commission, Subject: Response to Requests for Additional Information - AREVA Enrichment Services LLC License Application for the Eagle Rock Enrichment Facility, dated September 28, 2009.
3. Sampling Protocol: AREVA Document No. E000-00-P-TS\_\_05010-00, "EREF Environmental Soil Sampling Protocol," Rev. 0, October 2010.

4. Regulatory Guide 4.15, Revision 1, Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment, U.S. Nuclear Regulatory Commission, February 1979.

**Table 1: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70**

Sample No.	SS11	SS12	SS13	SS14	SS15	SS16	SS17	SS18	SS19	SS20
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	58.5 (1580)	62.5 (1690)	50.0 (1350)	54.39 (1470)	54.8 (1480)	38.1 (1030)	59.6 (1610)	* *	65.1 (1760)	53.3 (1440)
Cs-137	12.7 (343)	10.4 (281)	13.1 (354)	18.3 (495)	22.6 (610)	21.7 (586)	11.4 (308)	7.62 (206)	6.22 (168)	5.29 (143)
K-40	681 (18400)	755 (20400)	718 (19400)	662 (17900)	751 (20300)	744 (20100)	729 (19700)	740 (20000)	781 (21100)	762 (20600)
Th-228	44.4 (1200)	45.9 (1240)	40.3 (1090)	59.6 (1610)	55.1 (1490)	29.6 (801)	39.2 (1060)	60.3 (1630)	65.9 (1780)	38.5 (1040)
Th-230	38.1 (1030)	17.6 (476)	46.3 (1250)	65.1 (1760)	57.4 (1550)	60.3 (1630)	62.5 (1690)	41.8 (1130)	111 (3000)	42.2 (1140)
Th-232	47.4 (1280)	66.2 (1790)	31.1 (840)	43.7 (1180)	57.4 (1550)	59.2 (1600)	61.1 (1650)	49.2 (1330)	70.7 (1910)	48.1 (1300)
U-233/234	25.1 (679)	29.8 (806)	31.1 (841)	25.4 (687)	31.1 (840)	30.5 (825)	30.0 (811)	33.2 (897)	36.5 (987)	31.9 (863)
U-235/236	1.22 (32.9)	2.06 (55.7)	2.66 (71.8)	3.32 (89.8)	1.27 (34.3)	2.40 (64.8)	2.70 (73.1)	1.82 (49.1)	3.47 (93.7)	* *
U-238	31.8 (860)	32.2 (869)	33.3 (900)	30.2 (816)	32.4 (877)	36.7 (991)	26.8 (725)	31.9 (863)	40.7 (1100)	33.2 (896)

Note:

\* Measurement results that are less than the Measured Minimum Detectable Concentration (MDC) value are shown as an asterisk.

**Table 2: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70 (continued)**

Sample No.	SS21	SS22	SS23	SS24	SS25	SS26	SS27	SS28	SS29	SS30
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	60.7 (1640)	47.7 (1290)	38.5 (1040)	48.5 (1310)	49.6 (1340)	52.9 (1430)	46.3 (1250)	48.1 (1300)	52.5 (1420)	55.9 (1510)
Cs-137	5.25 (142)	4.63 (125)	4.81 (130)	6.36 (172)	3.96 (107)	11.6 (313)	5.33 (144)	10.5 (284)	24.8 (669)	12.1 (326)
K-40	714 (19300)	607 (16400)	625 (16900)	636 (17200)	685 (18500)	781 (21100)	707 (19100)	703 (19000)	733 (19800)	777 (21000)
Th-228	48.8 (1320)	49.6 (1340)	62.2 (1680)	37.7 (1020)	38.5 (1040)	59.6 (1610)	49.2 (1330)	40.3 (1090)	43.3 (1170)	50.7 (1370)
Th-230	88.4 (2390)	39.2 (1060)	44.8 (1210)	47.0 (1270)	46.6 (1260)	55.1 (1490)	46.3 (1250)	20.1 (542)	39.2 (1060)	33.4 (904)
Th-232	38.9 (1050)	58.5 (1580)	41.8 (1130)	38.9 (1050)	51.4 (1390)	31.9 (861)	48.5 (1310)	67.7 (1830)	48.5 (1310)	38.5 (1040)
U-233/234	32.2 (870)	27.1 (732)	27.2 (736)	30.1 (813)	27.1 (733)	24.5 (662)	24.3 (656)	27.8 (750)	71.4 (1930)	26.7 (722)
U-235/236	1.96 (53.1)	1.78 (48.2)	2.18 (58.8)	0.870 (23.5)	1.02 (27.6)	2.39 (64.6)	2.19 (59.1)	2.35 (63.6)	11.4 (307)	2.01 (54.4)
U-238	31.4 (848)	26.1 (706)	35.6 (963)	33.6 (907)	33.9 (916)	27.7 (748)	27.8 (751)	30.0 (810)	31.3 (845)	30.3 (819)

Note:

\* Measurement results that are less than the Measured MDC value are shown as an asterisk.

**Table 3: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70 (continued)**

Sample No.	SS31	SS32	SS33	SS34	SS35	SS36	SS37	SS38	SS39	SS40
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	47.0 (1270)	53.7 (1450)	52.5 (1420)	60.3 (1630)	55.5 (1500)	44.8 (1210)	46.3 (1250)	55.1 (1490)	59.9 (1620)	45.1 (1220)
Cs-137	13.1 (354)	8.14 (220)	9.40 (254)	6.77 (183)	14.6 (395)	18.2 (491)	6.92 (187)	22.4 (606)	11.14 (301)	15.4 (417)
K-40	736 (19900)	770 (20800)	670 (18100)	688 (18600)	729 (19700)	685 (18500)	714 (19300)	799 (21600)	792 (21400)	736 (19900)
Th-228	54.8 (1480)	27.3 (737)	43.3 (1170)	40.3 (1090)	48.8 (1320)	51.1 (1380)	30.5 (825)	41.1 (1110)	51.8 (1400)	51.8 (1400)
Th-230	34.9 (943)	67.3 (1820)	38.9 (1050)	31.3 (847)	50.0 (1350)	31.0 (838)	62.5 (1690)	59.9 (1620)	47.4 (1280)	60.7 (1640)
Th-232	36.5 (987)	45.9 (1240)	47.4 (1280)	27.8 (750)	37.0 (999)	54.4 (1470)	32.6 (880)	46.3 (1250)	48.1 (1300)	50.7 (1370)
U-233/234	26.2 (707)	25.5 (690)	28.4 (768)	27.0 (730)	24.4 (659)	28.1 (760)	26.8 (725)	29.0 (784)	26.7 (721)	29.7 (804)
U-235/236	1.77 (47.8)	1.30 (35)	2.40 (64.8)	1.92 (52)	1.35 (36.6)	1.96 (53.1)	1.60 (43.2)	2.20 (59.5)	1.62 (43.8)	1.20 (32.5)
U-238	27.9 (754)	26.5 (717)	28.9 (781)	33.9 (916)	28.0 (756)	30.4 (821)	32.3 (873)	30.1 (814)	27.5 (744)	30.4 (821)

Note:

\* Measurement results that are less than the Measured MDC value are shown as an asterisk.



**Table 4: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70 (continued)**

Sample No.	SS41	SS42	SS43	SS44	SS45	SS46	SS47	SS48	SS49	SS50
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	49.6 (1340)	48.8 (1320)	* *	40.3 (1090)	54.0 (1460)	61.4 (1660)	52.9 (1430)	46.6 (1260)	58.1 (1570)	55.5 (1500)
Cs-137	4.51 (122)	3.74 (101)	5.11 (138)	5.03 (136)	4.70 (127)	9.62 (260)	6.14 (166)	6.14 (166)	6.70 (181)	5.29 (143)
K-40	759 (20500)	699 (18900)	681 (18400)	655 (17700)	640 (17300)	784 (21200)	692 (18700)	725 (19600)	777 (21000)	696 (18800)
Th-228	57.7 (1560)	33.1 (895)	49.6 (1340)	37.4 (1010)	50.3 (1360)	63.3 (1710)	34.8 (941)	58.8 (1590)	85.5 (2310)	69.2 (1870)
Th-230	45.1 (1220)	40.3 (1090)	37.0 (1000)	34.9 (944)	29.6 (800)	44.4 (1200)	47.0 (1270)	64.4 (1740)	33.4 (904)	37.7 (1020)
Th-232	36.7 (993)	32.3 (874)	54.0 (1460)	48.8 (1320)	40.3 (1090)	77.7 (2100)	29.7 (804)	58.5 (1580)	70.7 (1910)	33.7 (910)
U-233/234	32.0 (864)	32.4 (875)	25.9 (701)	30.2 (817)	28.7 (777)	35.2 (950)	30.7 (830)	33.5 (906)	36.0 (974)	29.6 (799)
U-235/236	2.36 (63.7)	2.02 (54.6)	2.21 (59.7)	2.33 (62.9)	3.29 (88.8)	2.41 (65.1)	3.22 (86.9)	2.89 (78)	1.43 (38.6)	2.96 (80)
U-238	31.5 (851)	34.6 (935)	30.4 (821)	27.5 (744)	32.8 (887)	36.2 (979)	33.8 (913)	36.0 (973)	34.4 (930)	31.3 (845)

Note:

\* Measurement results that are less than the Measured MDC value are shown as an asterisk.

**Table 5: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70 (continued)**

Sample No.	SS51	SS52	SS53	SS54	SS55	SS56	SS57	SS58	SS59	SS60
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	51.8 (1400)	54.4 (1470)	45.9 (1240)	43.3 (1170)	52.5 (1420)	53.3 (1440)	11.1 (299)	56.2 (1520)	50.7 (1370)	33.9 (916)
Cs-137	5.00 (135)	5.77 (156)	4.85 (131)	12.0 (323)	5.33 (144)	21.5 (582)	* *	5.44 (147)	4.96 (134)	2.55 (68.9)
K-40	707 (19100)	722 (19500)	685 (18500)	685 (18500)	651 (17600)	766 (20700)	105 (2830)	681 (18400)	733 (19800)	659 (17800)
Th-228	66.6 (1800)	31.7 (857)	55.1 (1490)	50.0 (1350)	54.8 (1480)	47.4 (1280)	50.3 (1360)	50.7 (1370)	41.4 (1120)	42.2 (1140)
Th-230	41.4 (1120)	32.4 (877)	54.0 (1460)	60.7 (1640)	38.5 (1040)	36.7 (993)	36.9 (996)	41.4 (1120)	67.7 (1830)	17.8 (481)
Th-232	54.4 (1470)	42.9 (1160)	69.9 (1890)	50.7 (1370)	38.9 (1050)	49.2 (1330)	35.2 (951)	48.8 (1320)	43.3 (1170)	37.7 (1020)
U-233/234	30.3 (820)	33.6 (909)	25.6 (692)	29.6 (800)	28.3 (765)	31.6 (853)	30.2 (817)	33.3 (899)	30.0 (810)	31.7 (856)
U-235/236	3.00 (81)	2.53 (68.3)	2.63 (71)	2.02 (54.6)	2.27 (61.3)	2.81 (75.9)	* *	* *	2.12 (57.3)	2.99 (80.7)
U-238	32.4 (877)	30.8 (832)	30.1 (814)	33.5 (905)	27.2 (735)	35.1 (949)	34.1 (922)	41.4 (1120)	36.6 (988)	32.3 (872)

Note:

\* Measurement results that are less than the Measured MDC value are shown as an asterisk.

**Table 6: Summary of Radioanalytical Results for EREF Surface Soil Samples SS11 to SS70 (continued)**

Sample No.	SS61	SS62	SS63	SS64	SS65	SS66	SS67	SS68	SS69	SS70
Nuclide	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)	Bq/kg (pCi/kg)
Ac-228	41.4 (1120)	* *	68.8 (1860)	45.1 (1220)	44.4 (1200)	55.9 (1510)	53.3 (1440)	48.5 (1310)	61.8 (1670)	43.7 (1180)
Cs-137	3.66 (98.9)	4.63 (125)	1.30 (35.2)	* *	11.7 (317)	14.0 (378)	8.40 (227)	1.92 (51.9)	7.59 (205)	34.9 (943)
K-40	651 (17600)	673 (18200)	877 (23700)	666 (18000)	625 (16900)	696 (18800)	799 (21600)	622 (16800)	692 (18700)	740 (20000)
Th-228	30.1 (814)	48.1 (1300)	85.1 (2300)	35.8 (968)	27.5 (742)	54.8 (1480)	53.7 (1450)	34.5 (933)	84.7 (2290)	45.1 (1220)
Th-230	47.0 (1270)	43.3 (1170)	38.1 (1030)	48.5 (1310)	48.5 (1310)	15.1 (407)	77.0 (2080)	30.3 (819)	85.8 (2320)	27.7 (748)
Th-232	47.7 (1290)	36.0 (974)	58.8 (1590)	25.0 (676)	19.7 (533)	37.0 (1000)	38.1 (1030)	52.9 (1430)	74.7 (2020)	44.8 (1210)
U-233/234	33.1 (895)	31.7 (856)	31.6 (855)	30.5 (823)	24.9 (673)	24.8 (669)	29.0 (785)	27.3 (738)	25.7 (695)	28.0 (758)
U-235/236	3.81 (103)	1.85 (50)	1.96 (53)	2.43 (65.8)	3.36 (90.7)	3.31 (89.4)	2.56 (69.2)	2.35 (63.4)	2.11 (57.1)	1.78 (48.2)
U-238	28.6 (774)	35.2 (950)	34.1 (922)	30.1 (814)	25.0 (675)	30.8 (832)	31.6 (854)	28.5 (770)	31.3 (847)	30.5 (824)

Note:

\* Measurement results that are less than the Measured MDC value are shown as an asterisk.