ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

August 9, 2004

Mr. Rick Munoz
U.S. Nuclear Regulatory Commission
Region IV: DNMS: NMLB
Suite 400
611 Ryan Plaza Drive
Arlington, TX 76011

SUBJECT: ANALYTICAL RESULTS FOR SOIL SAMPLES COLLECTED APRIL 28 & 29, 2004 AND MAY 26, 2004 FROM KERR-McGEE CUSHING REFINERY SITE, CUSHING, OKLAHOMA (INSPECTION REPORT #070-03073/004-03) [RFTA NO. 04-001]

Dear Mr. Munoz:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) received 20 soil samples on April 30, 2004 that were collected April 28 & 29, 2004 and 11 soil samples on May 28, 2004 that were collected May 26, 2004. The samples were analyzed for radium-226 and the natural thorium and uranium series by gamma spectroscopy (GS) (Procedure CP1, Revision 13). After reviewing the preliminary GS data, you selected six samples for alpha spectroscopy (AS) (Procedure AP11, Revision 2; Procedure CP2, Revision 12). The GS and AS data for these samples are presented in Tables 1 and 2, respectively.

ESSAP's Quality Control (QC) requirements were met for these analyses. The QC files are available for your review upon request.

Please contact me at (865) 241-3242 or Wade Ivey at (865) 576-9184 with any questions or comments.

Sincerely,

Dale Condra

Dale Condra
Laboratory Manager
Environmental Survey and
Site Assessment Program

RDC/WPI:ar

Enclosure

cc: T. McLaughlin, NRC/NMSS/TWFN 7F27
E. Knox-Davin, NRC/NMSS/TWFN T8A23
File/1611
E. Abelquist, ORISE/ESSAP
T. Vitkus, ORISE/ESSAP

Distribution approval and concurrence:	Initials	Date
Technical Management Team Member	AJB	8/9/04
Quality Manager	ATP	8/9/04

ORISE TABLE 1

CONCENTRATIONS OF SELECTED GAMMA EMITTING RADIONUCLIDES IN SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 13 KERR-McGEE CUSHING REFINERY CUSHING, OKLAHOMA

ESSAP Sample ID	NRC Region IV Sample ID	Radionuclide Concentrations (pCi/g dry weight)[a]							
		U-234[b]	U-235	U-238 by Th-234	Total U[c]	Ra-226 by Pb-214	Th-228 by Pb-212	Th-232 by Ac-228	Total Th[d]
1611S001	04-03-01	1.56 ± 0.73[e]	0.03 ± 0.10	1.56 ± 0.73	3.2 ± 1.0	0.98 ± 0.11	1.23 ± 0.10	1.23 ± 0.20	2.47 ± 0.22
1611S002	04-03-02	1.58 ± 0.89	0.04 ± 0.15	1.58 ± 0.89	3.2 ± 1.3	0.91 ± 0.13	3.48 ± 0.25	3.28 ± 0.39	6.76 ± 0.46
1611S003	04-03-03	2.5 ± 1.1	0.04 ± 0.15	2.5 ± 1.1	5.0 ± 1.6	1.29 ± 0.15	3.55 ± 0.26	3.30 ± 0.40	6.85 ± 0.47
1611S004	04-03-04	0.96 ± 0.50	0.06 ± 0.09	0.96 ± 0.50	1.97 ± 0.72	0.92 ± 0.10	1.31 ± 0.10	1.24 ± 0.20	2.55 ± 0.22
1611S005	04-03-05	0.97 ± 0.77	0.02 ± 0.12	0.97 ± 0.77	2.0 ± 1.1	0.75 ± 0.12	1.56 ± 0.14	1.93 ± 0.29	3.49 ± 0.32
1611S006	04-03-06	3.0 ± 2.1	0.14 ± 0.10	1.05 ± 0.46	4.2 ± 2.1	0.74 ± 0.08	1.01 ± 0.08	0.99 ± 0.14	1.99 ± 0.16
1611S007	04-03-07	0.93 ± 0.48	-0.02 ± 0.07	0.93 ± 0.48	1.83 ± 0.68	0.60 ± 0.07	0.88 ± 0.07	0.95 ± 0.14	1.83 ± 0.16
1611S008	04-03-08	1.00 ± 0.78	-0.01 ± 0.12	1.00 ± 0.78	2.0 ± 1.1	0.60 ± 0.10	2.50 ± 0.18	2.61 ± 0.30	5.11 ± 0.35
1611S009	04-03-09	2.3 ± 2.2	0.11 ± 0.10	1.75 ± 0.78	4.2 ± 2.3	0.79 ± 0.11	1.03 ± 0.09	1.12 ± 0.20	2.15 ± 0.22
1611S010	04-03-10	1.01 ± 0.59	0.06 ± 0.08	1.01 ± 0.59	2.08 ± 0.84	0.78 ± 0.09	1.12 ± 0.09	1.18 ± 0.17	2.30 ± 0.19
1611S011	04-03-11	4.9 ± 3.4	0.22 ± 0.16	1.04 ± 0.60	6.1 ± 3.5	0.79 ± 0.11	1.12 ± 0.10	1.14 ± 0.21	2.26 ± 0.23
1611S012	04-03-12	5.4 ± 4.6	0.25 ± 0.21	2.30 ± 0.93	7.9 ± 4.7	0.78 ± 0.13	4.53 ± 0.32	4.02 ± 0.44	8.54 ± 0.54
1611S013	04-03-13	2.1 ± 1.7	0.10 ± 0.08	0.79 ± 0.48	3.0 ± 1.8	0.56 ± 0.07	1.31 ± 0.10	1.43 ± 0.17	2.74 ± 0.20
1611S014	04-03-14	1.48 ± 0.67	0.08 ± 0.10	1.48 ± 0.67	3.05 ± 0.95	0.72 ± 0.11	1.31 ± 0.11	1.24 ± 0.22	2.55 ± 0.25
1611S015	04-03-15	3.6 ± 2.9	0.17 ± 0.13	1.41 ± 0.84	5.2 ± 3.0	0.87 ± 0.13	2.56 ± 0.19	2.79 ± 0.35	5.35 ± 0.40
1611S016	04-03-16	3.3 ± 3.3	0.15 ± 0.15	3.0 ± 1.2	6.5 ± 3.5	1.06 ± 0.15	2.12 ± 0.17	2.41 ± 0.34	4.53 ± 0.38
1611S017	04-03-17	1.48 ± 0.96	0.00[f] ± 0.16	1.48 ± 0.96	3.0 ± 1.4	1.11 ± 0.14	3.20 ± 0.24	3.25 ± 0.42	6.45 ± 0.49

ORISE TABLE 1 (continued)

CONCENTRATIONS OF SELECTED GAMMA EMITTING RADIONUCLIDES IN SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 13 KERR-McGEE CUSHING REFINERY CUSHING, OKLAHOMA

ESSAP Sample ID	NRC Region IV Sample ID	Radionuclide Concentrations (pCi/g dry weight)[a]							
		U-234[b]	U-235	U-238 by Th-234	Total U[c]	Ra-226 by Pb-214	Th-228 by Pb-212	Th-232 by Ac-228	Total Th[d]
1611S018	04-03-18	1.17 ± 0.74	0.01 ± 0.11	1.17 ± 0.74	2.4 ± 1.0	0.90 ± 0.11	1.50 ± 0.12	1.49 ± 0.22	2.99 ± 0.25
1611S019	04-03-19	2.3 ± 1.8	0.10 ± 0.09	1.11 ± 0.52	3.5 ± 1.9	0.83 ± 0.09	1.31 ± 0.10	1.35 ± 0.19	2.66 ± 0.22
1611S020	04-03-20	1.09 ± 0.81	0.11 ± 0.13	1.09 ± 0.81	2.3 ± 1.1	0.83 ± 0.13	2.11 ± 0.17	2.08 ± 0.32	4.19 ± 0.36
1611S021	04-03-21	0.80 ± 0.55	-0.01 ± 0.09	0.80 ± 0.55	1.59 ± 0.78	0.88 ± 0.11	1.49 ± 0.12	1.40 ± 0.20	2.89 ± 0.24
1611S022	04-03-22	2.2 ± 1.7	0.10 ± 0.08	0.90 ± 0.43	3.2 ± 1.8	0.84 ± 0.09	1.18 ± 0.09	1.10 ± 0.16	2.28 ± 0.19
1611S023	04-03-23	1.37 ± 0.76	-0.04 ± 0.12	1.37 ± 0.76	2.7 ± 1.1	0.81 ± 0.10	3.21 ± 0.24	3.06 ± 0.35	6.26 ± 0.42
1611S024	04-03-24	4.8 ± 2.9	0.22 ± 0.13	1.39 ± 0.60	6.4 ± 3.0	0.86 ± 0.10	2.57 ± 0.18	2.50 ± 0.27	5.07 ± 0.33
1611S025	04-03-25	1.28 ± 0.72	0.08 ± 0.11	1.28 ± 0.72	2.6 ± 1.0	0.89 ± 0.11	1.33 ± 0.11	1.42 ± 0.22	2.76 ± 0.25
1611S026	04-03-26	3.2 ± 3.2	0.15 ± 0.15	1.35 ± 0.94	4.7 ± 3.4	1.02 ± 0.13	4.51 ± 0.33	4.49 ± 0.50	8.99 ± 0.60
1611S027	04-03-27	2.9 ± 2.5	0.13 ± 0.12	1.35 ± 0.71	4.4 ± 2.6	0.71 ± 0.10	1.39 ± 0.11	1.43 ± 0.22	2.82 ± 0.25
1611S028	04-03-28	6.9 ± 2.7	0.32 ± 0.12	1.27 ± 0.47	8.5 ± 2.7	0.73 ± 0.08	1.06 ± 0.08	1.04 ± 0.15	2.09 ± 0.17
1611S029	04-03-29	31.8 ± 5.3	1.47 ± 0.24	3.35 ± 0.80	36.6 ± 5.3	0.74 ± 0.10	1.50 ± 0.12	1.35 ± 0.22	2.85 ± 0.25
1611S030	04-03-30	1.5 ± 1.7	0.07 ± 0.08	0.75 ± 0.48	2.3 ± 1.7	0.78 ± 0.09	1.10 ± 0.09	1.05 ± 0.15	2.15 ± 0.18
1611S031	04-03-31	2.3 ± 1.9	0.11 ± 0.09	1.14 ± 0.55	3.6 ± 2.0	0.85 ± 0.10	1.30 ± 0.10	1.23 ± 0.18	2.54 ± 0.21

[a]The average MDCs for these radionuclides range from 0.05 pCi/g for Th-228 by Pb-212 to 0.78 pCi/g for U-238 by Th-234.

[b]The concentrations of U-234 are set equal to U-235 * 21.7 when the U-235 concentrations are statistically positive above the MDC. Otherwise the concentration is set equal to the U-238 concentrations.

[c]Total U is the sum of U-234, U-235, and U-238.

[d]Total thorium is the sum of Th-228 and Th-232.

[e]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[f]Zero value due to rounding.

ORISE TABLE 2

CONCENTRATIONS OF THORIUM AND URANIUM ALPHA EMITTING RADIONUCLIDES IN SOIL SAMPLES BY ALPHA SPECTROSCOPY AP11, REVISION 2 AND ALPHA SPECTROSCOPY CP2, REVISION 12 KERR-McGEE CUSHING REFINERY CUSHING, OKLAHOMA

ESSAP Sample ID	NRC Region IV Sample ID	Radionuclide Concentrations (pCi/g dry weight)[a]							
		U-234	U-235	U-238	Total U[b]	Th-228	Th-230	Th-232	Total Th[c]
1611S012	04-03-12	3.66 ± 0.33[d]	0.23 ± 0.05	1.48 ± 0.16	5.37 ± 0.37	4.10 ± 0.35	1.38 ± 0.14	4.17 ± 0.35	8.27 ± 0.49
1611S016	04-03-13	1.67 ± 0.17	0.12 ± 0.04	1.80 ± 0.17	3.60 ± 0.24	1.90 ± 0.18	1.69 ± 0.17	1.63 ± 0.16	3.53 ± 0.24
1611S024	04-03-24	2.19 ± 0.21	0.12 ± 0.04	1.31 ± 0.14	3.62 ± 0.26	2.16 ± 0.20	1.13 ± 0.12	2.08 ± 0.20	4.24 ± 0.28
1611S026	04-03-26	1.58 ± 0.16	0.13 ± 0.04	1.19 ± 0.13	2.89 ± 0.22	4.11 ± 0.35	1.48 ± 0.15	4.10 ± 0.35	8.21 ± 0.49
1611S028	04-03-28	5.00 ± 0.43	0.25 ± 0.06	1.16 ± 0.13	6.41 ± 0.45	0.95 ± 0.11	0.96 ± 0.11	1.01 ± 0.11	1.96 ± 0.16
1611S029	04-03-29	28.0 ± 1.2[e]	1.44 ± 0.09[e]	3.86 ± 0.20[e]	33.3 ± 1.3	1.46 ± 0.16	1.07 ± 0.12	1.43 ± 0.15	2.89 ± 0.22

[a]The average MDCs by alpha spectroscopy for Th isotopes are 0.03 pCi/g and for U isotopes are 0.03 pCi/g.

[b]Total U is the sum of U-234, U-235, and U-238.

[c]Total thorium is the sum of Th-228 and Th-232.

[d]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[e]U-234, U-235, and U-238 concentrations were generated averaging the results from three separate sample aliquots.