FINAL
TECHNICAL MEMORANDUM

Radiological Analyses of Samples from the Dredged Materials Piles

Glen Cove Creek

Glen Cove, NY

Contract No. DACA31-01-D-0033

Prepared for:

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1.0 INTRODUCTION

In October 2001, during a field effort to perform a radiological scoping survey on the bed of the Glen Cove Creek (GCC), the U.S. Army Corps of Engineers (USACE) obtained six volumetric samples from piles of dredged materials generated during recent GCC dredging. The former Li Tungsten Corporation Site (a U.S. Environmental Protection Agency National Priorities List (NPL) site) is located along this channel, with approximately 1,000 feet of the property contiguous with the GCC. The USACE samples were obtained from Parcel A of the former Li Tungsten property.

The Li Tungsten site was originally used as a metal processing plant from the early 1940's to the 1980's. Parts of the Li Tungsten site contained tungsten-refining facilities. Radioactive by-products, in the form of slag, are a potential source of the radioactive material identified in dredged materials and from samples obtained in Parcel A of the Li Tungsten site.

The radiological survey work on the Glen Cove creek bottom is described in the work plan for that task, entitled: *Radiological Scoping Survey and Sediment Sampling of Glen Cove Creek, Glen Cove, NY*, dated October 24, 2001. Results of the Glen Cove Creek scoping survey are documented in the report entitled: *Final Report, Radiological Scoping Survey and Sediment Sampling, Glen Cove Creek, Glen Cove, NY,* dated March 4, 2002.

1.1 OBJECTIVE

The objectives of this technical memorandum are to report results of radiological analyses of the samples and to determine whether the sediments surrounding slag pieces contain radioactive contaminants. Results from analysis of the six samples were used, along with results from samples obtained during the GCC scoping survey, to establish the radiological components contained in the dredged materials, including slag samples contained in the sediments.

2.0 SAMPLING METHODOLOGY

To ensure that samples obtained contained sufficient radioactive material to satisfy the sampling objective, sampling locations were selected with the aid of a Bicron microrem meter, along with a Ludlum 44-10/2221 gamma detection system consisting of a 2-inch by 2-inch sodium iodide (NaI) detector coupled to a ratemeter/scaler. The technician selected locations exhibiting elevated gamma count rates relative to surrounding areas and performed the sampling by scooping the sediments into a sample jar. At locations 1 and 2, count rate patterns indicated small discrete pieces of radioactive material were present in the soils, while at locations 3 and 4, measurements indicated more homogeneous radioactive materials. As such, using visual observation and radiation monitoring, samples number 1 and 2 were separated into two components each, slag and surrounding sediment. Each of these two sample components was designated by letter, with the "a" aliquots being the slag and the "b" components being the surrounding sediments. All six resulting samples were submitted to a contract laboratory facility, Eberline Services of Oak Ridge, TN, for gamma spectroscopic, isotopic thorium, and isotopic uranium analyses.

Gamma count rates observed at the locations 1 and 2 ranged from 100,000 cpm to 1,000,000 cpm, with dose rates ranging from 1,000 µrem/hr to 5,000 µrem/hr in close proximity (i.e., within six inches) to the sample locations. At locations 3 and 4, gamma count rates ranged from 100,000 cpm to 300,000 cpm, with dose rates ranging from background to 1,000 µrem/hr.

2.1 RESULTS OF PARCEL A SAMPLES

The samples from the dredged materials on Parcel A were analyzed by both gamma spectroscopy and alpha spectroscopy. Summary results are shown in Tables 1 and 2. The summary result sheets from the contractor laboratory are included as Appendix A to this technical memorandum.

Table 1: Gamma Spectroscopy Results from Dredged Material Samples (pCi/g)

Sample Location ID	Ra-226 [1,2]				U-238 [4]			
	Result [5]		Error [6]	MDA [7]	Result [5]		Error [6]	MDA [7]
1A	1.2E+01	±	1.1E+01	1.7E+01	3.9E+01	±	3.8E+01	46.06
1B	5.3E-01	±	3.7E-01	5.0E-01	-2.6E+00	±	2.7E+00	4.25
2A	8.2E+00	±	2.2E+01	3.4E+01	-1.0E+02	±	1.0E+02	154.70
2B	4.3E-01	±	1.0E-01	8.7E-02	4.2E-01	±	7.2E-01	0.76
3	3.9E-01	±	1.1E-01	1.1E-01	4.5E-01	±	5.3E-01	0.89
4	3.5E-01	±	1.4E-01	1.5E-01	1.5E+00	±	1.3E+00	1.38

Notes: [1] Ra-226 reported based on Bi-214 analysis
[2] Ra-226 analysis performed after 21-day Bi-214 daughter in-growth in sealed container
[3] Th-232 reported based on Ac-228 analysis
[4] U-238 reported based on Th-234 analysis
[5] Results listed as reported directly from the laboratory for the basis radionuclide
[6] Errors reported at the 95% confidence level
[7] Minimum detectable activity (MDA) reported at the 95% confidence level

Table 2: Alpha Spectroscopy Results from Dredged Material Samples (pCi/g)

Sample Location ID	U-234				U-235				U-238			
	Result [2,3]		Error [4]	MDA [5]	Result [2,3]		Error [4]	MDA [5]	Result [2,3]		Error [4]	MDA [5]
1A	5.3E+00	±	2.4E+00	1.7E+00	4.9E-01	±	7.0E-01	6.7E-01	4.5E+00	±	2.1E+00	1.2E+00
1B	1.1E+00	±	3.5E-01	5.0E-02	-3.9E-03	±	7.8E-03	1.1E-01	1.1E+00	±	3.5E-01	1.2E-01
2A	5.1E+00	±	2.2E+00	1.4E+00	8.6E-01	±	9.6E-01	1.3E+00	2.6E+00	±	1.5E+00	1.1E+00
2B	8.2E-01	±	2.8E-01	1.2E-01	2.7E-02	±	6.0E-02	1.4E-01	7.6E-01	±	2.6E-01	1.0E-01
3	8.8E-01	±	2.7E-01	9.9E-02	4.9E-02	±	6.1E-02	8.1E-02	5.5E-01	±	2.0E-01	1.0E-01
4	1.2E+00	±	3.6E-01	9.5E-02	1.5E-01	±	1.2E-01	5.9E-02	8.3E-01	±	2.9E-01	1.1E-01

Sample Location ID	Th-228				Th-230				Th-232			
	Result [1,3]		Error [4]	MDA [5]	Result [1,3]		Error [4]	MDA [5]	Result [1,3]		Error [4]	MDA [5]
1A	1.2E+03	±	4.0E+02	1.8E+02	6.8E+02	±	2.8E+02	1.4E+02	1.2E+03	±	4.0E+02	1.6E+02
1B	3.2E+00	±	9.6E-01	3.2E-01	1.6E+00	±	6.1E-01	3.4E-01	3.4E+00	±	9.8E-01	2.7E-01
2A	8.8E+02	±	3.2E+02	1.5E+02	2.9E+02	±	1.7E+02	1.7E+02	9.2E+02	±	3.2E+02	5.7E+01
2B	7.0E-01	±	2.8E-01	2.0E-01	1.0E+00	±	3.4E-01	2.3E-01	8.8E-01	±	3.1E-01	1.9E-01
3	5.1E-01	±	2.2E-01	1.4E-01	1.1E+00	±	3.5E-01	1.1E-01	3.1E-01	±	1.6E-01	1.3E-01
4	6.7E-01	±	2.7E-01	1.6E-01	7.3E-01	±	2.9E-01	1.7E-01	8.0E-01	±	3.0E-01	1.4E-01

Notes: (1) Results based on EML Th-01 Modified (alpha spectroscopy)
(2) Results based on EML U-02 Modified (alpha spectroscopy)
(3) Results listed as reported directly from the laboratory for the basis radionuclide
(4) Errors reported at the 95% confidence level
(5) Minimum detectable activity (MDA) reported at the 95% confidence level

It should be noted that previous on-site sample analyses conducted by an EPA contractor indicated that Ra-226 was present in the sediments sampled during this task. As is shown in Tables 1 and 2 and discussed in Section 3.0, sample results from the offsite contractor laboratory do not support that result. The analytical method used by the EPA contractor was NaI gamma spectroscopy sample analysis. This method contains inherent limitations that may be at the root of the discrepancy between the two sets of results. NaI gamma spectroscopy is a relatively low-resolution technique, relative to HPGe gamma spectroscopy. This means that NaI gamma spectroscopy is not capable of resolving peaks separated by less than tens of keV, while HPGe gamma spectroscopy can resolve peaks in increments of several keV. This affords the HPGe technique the ability to more readily obtain positive radionuclide identification.

3.0 CONCLUSIONS

It can be seen that the sample results for the "a" sample aliquots exceeded those for the "b" aliquots by approximately two orders of magnitude. Based on this limited evidence, it can be presumed that, although substantial concentrations of thorium are present in the dredged material from the GCC, this material has not significantly migrated into the surrounding sediments. Additional sampling and analysis could be used to more definitively determine whether this is true for the majority of sediments removed from the creek. Additional conclusions include:

- For future work involving the sediments sampled, the USACE should ensure that a radiation protection program is in place sufficient to provide for the radiological safety workers and the environment.

- The material sampled presents primarily a potential external exposure hazard, since the degree to which the radioactive material appears to have migrated is minimal.

- Materials sampled would present only a minimal hazard while located under water (i.e., on the bottom of the creek), due to gamma attenuation inherent in the underwater environment.

- Despite previous analyses indicating that Ra-226 is present in concentrations in excess of background, sample results did not indicate the presence of elevated Ra-226 concentrations.

- No significant uranium was observed in the samples analyzed by the contractor laboratory.

- Th-230:Th-232 concentration ratios observed in the samples ranges from approximately 0.3 to 0.6

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