U.S. Environmental Protection Agency
Region II

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Response Action Contract

DRAFT FINAL
FEASIBILITY STUDY REPORT
LI TUNGSTEN
GLEN COVE, NEW YORK
WORK ASSIGNMENT NO. 028-RICO-024
VOLUME I OF II

July 1999

Contract No: 68-W-98-214

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FOSTER WHEELER ENVIRONMENTAL CORPORATION

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USEPA WORK ASSIGNMENT NUMBER 028-RICO-024L
USEPA CONTRACT NUMBER 68-W-98-214
FOSTER WHEELER ENVIRONMENTAL CORPORATION

DRAFT FINAL
FEASIBILITY STUDY REPORT
LI TUNGSTEN
GLEN COVE, NEW YORK
WORK ASSIGNMENT NO. 028-RICO-024L
VOLUME I OF II

July 1999

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FOSTER WHEELER ENVIRONMENTAL CORPORATION

DRAFT FINAL
FEASIBILITY STUDY REPORT
LI TUNGTEN CORPORATION
GLEN COVE, NEW YORK

July 1999

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GLEN COVE, NY
WA# 028-RICO-024L

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1.0 INTRODUCTION

1.1 PURPOSE

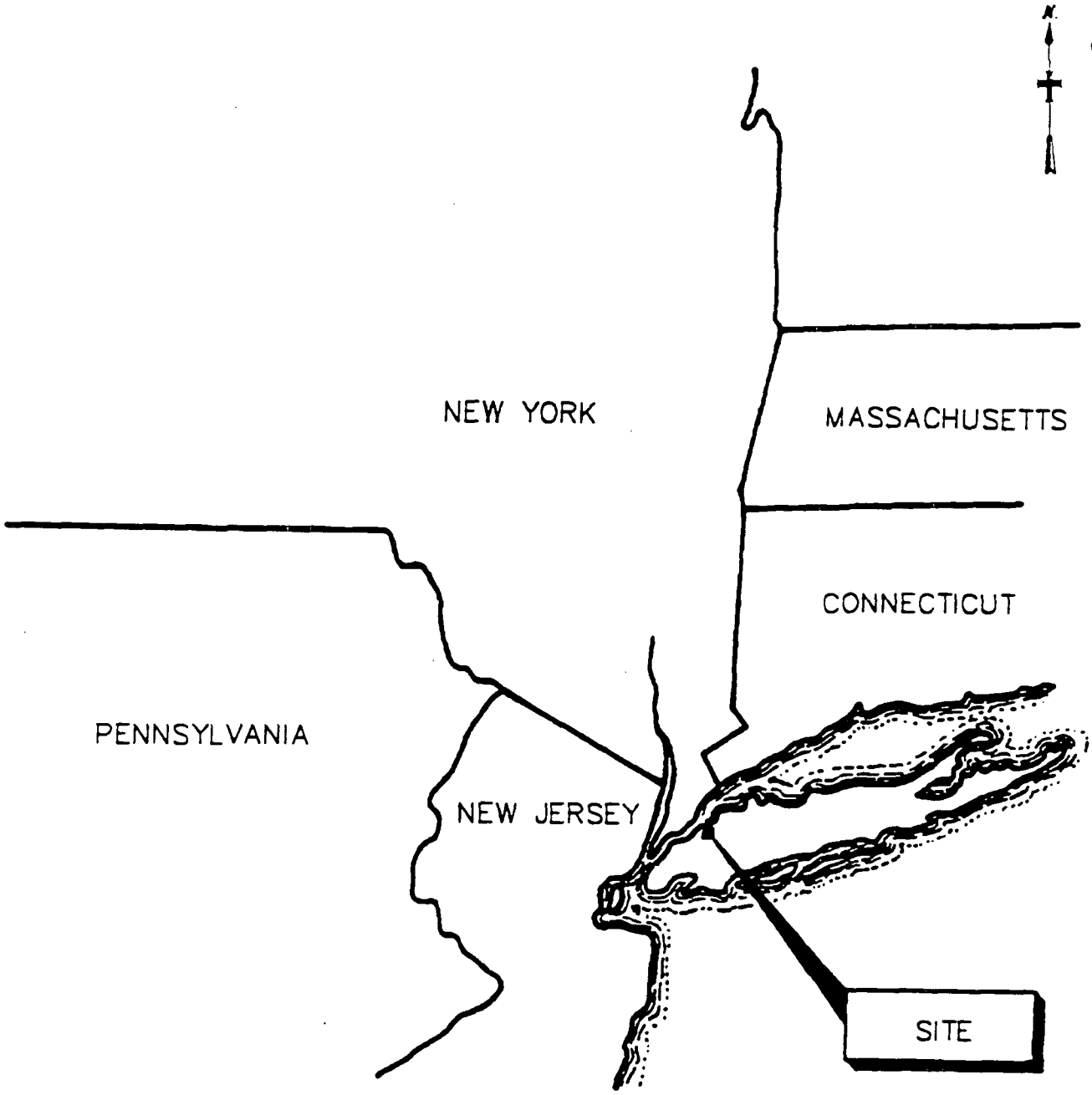
The purpose of this Draft Final Feasibility Study (FS) Report is to identify, screen and evaluate remedial alternatives for the protection of human health and the environment from unacceptable risks associated with the environmental contamination present at the Li Tungsten Superfund Site (hereinafter referred to as the Li Tungsten site) in Glen Cove, New York. In addition, the Draft Final FS Report also address remedial alternatives for the protection of human health and the environment from unacceptable risks associated with the radiological contamination at the Captain's Cove portion of the Li Tungsten Superfund Site (hereinafter referred to as the Captain's Cove site). The FS was performed by Malcolm Pirnie, Inc. (Malcolm Pirnie) in accordance with USEPA RI/FS guidance (USEPA, 1988a), the RI/FS Work Plan for the Li Tungsten site (Malcolm Pirnie, 1993) and the Focussed Feasibility Study (FFS) Work Plan for the Captain's Cove site (Malcolm Pirnie, 1997), on behalf of the United States Environmental Protection Agency (USEPA) - Region II, under the Alternative Remedial Contracting Strategy (ARCS) Contract Number 68-W9-0051, Work Assignment Number 025-2L4L and the RAC II Program, Contract Number 68-W-98-214, Work Assignment Number 028-RICO-024L. The Draft Final RI Report for the Li Tungsten site (Malcolm Pirnie, 1998a) was submitted to the USEPA in May 1998; results of the investigation conducted at the Captain's Cove site are presented in Appendix A of this Draft Final FS Report.

1.2 BACKGROUND INFORMATION

1.2.1 Li Tungsten Site

1.2.1.1 Description

The Li Tungsten site is located at 63 Herb Hill Road in the City of Glen Cove, Nassau County, Long Island, New York. A regional map and a site location map are provided in Figures 1-1 and 1-2, respectively. The geographic coordinates are latitude 40^0 51' 36" North and



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TITLE:	DATE:	FIGURE NO.:
REGIONAL LOCATION MAP	NOV 1998	FIGURE 1-1

MALCOLM PIRNIE

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

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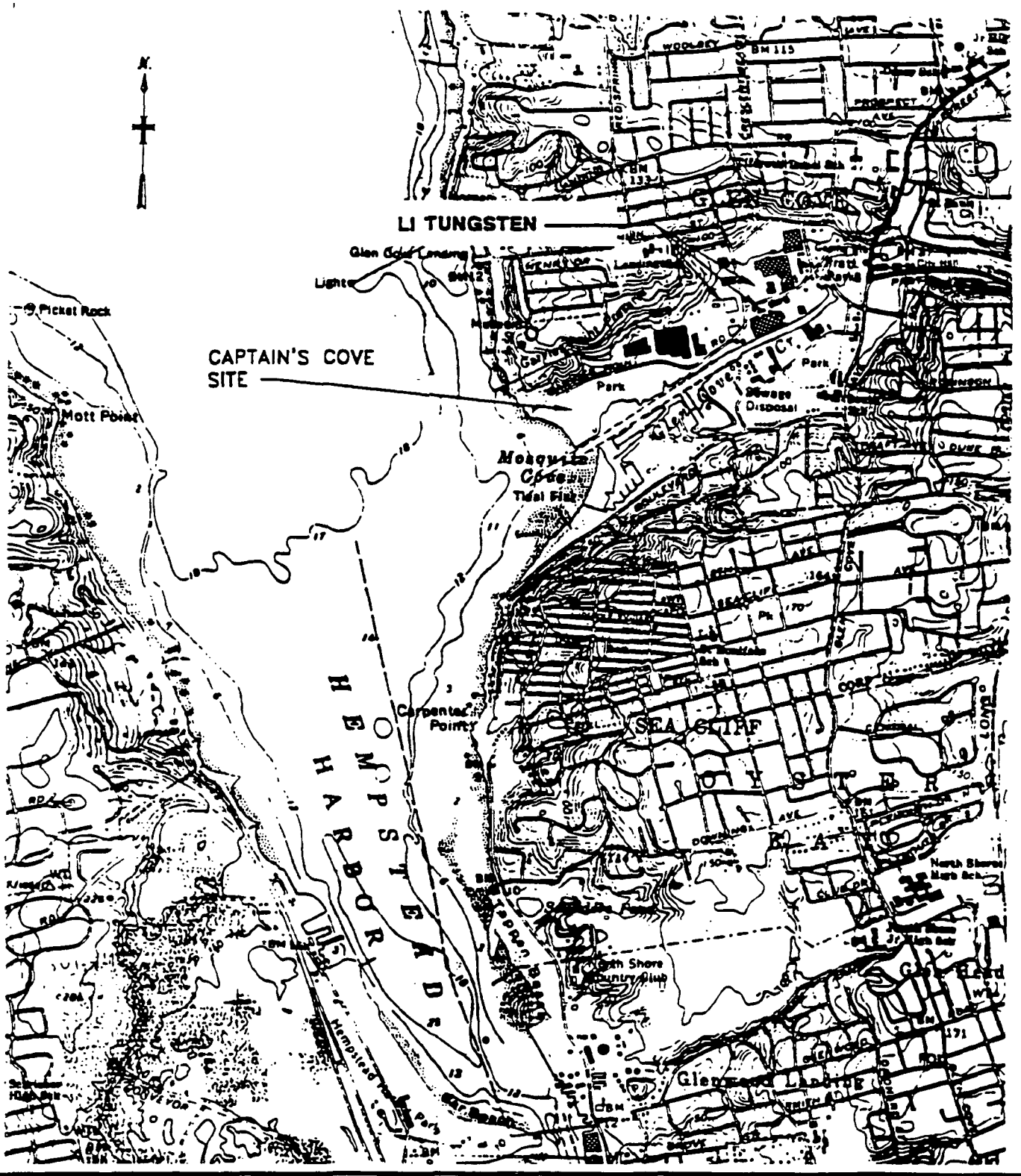

TITLE:	DATE:	FIGURE NO.:
SITE LOCATION MAP	NOV. 1998	FIGURE 1-2

MALCOLM PIRNIE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

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longitude 73^0 38' 25" West. The Captain's Cove site is located 0.5 miles to the west of the Li Tungsten site and is depicted on Figure 1-2.

The Li Tungsten site is approximately 26 acres in size and consists of four parcels designated for the purposes of the RI/S as A, B, C and C'. Parcel A is approximately seven acres and served as the main operations center when the Li Tungsten site was active. Historically, Parcel A contained the majority of the buildings and structures (mostly aboveground tanks). Until 1995, Parcel A contained numerous drums and crates of processed tungsten ore residues. In 1995-1996, ore residues formerly located at Parcel A were temporarily relocated to the Dickson Warehouse (Parcel C) during interim remedial actions (IRAs). Between October 1996 and October 1998, the USEPA Removal Branch conducted a removal action, primarily on Parcels A and C, to empty and remove all tanks. During the course of this removal action, it became necessary to demolish the Dice Complex and the East Building on Parcel A to access the tanks that were inside the two buildings. The only portions of these two buildings that remain are the concrete floor slabs.

Parcel B is approximately six acres, and is located north of Parcel A. Parcel B is undeveloped but contains a small pond, an intermittent stream and a small wetland. Two separate areas on Parcel B , south of the pond and directly opposite the Benbow Building were used as parking areas when the Li Tungsten site was active. The northernmost area of Parcel B was used as an employee picnic area (Personal communication, 1996). The area between the two parking areas was used for disposal of ore residues. This disposal area has been referred to in previous reports (Hart, 1990; NUS, 1991, 1990, 1989) as a "landfill." Observations of partially buried drums and mounds of ore residue made during the field investigation and interviews with a former employee have confirmed that disposal activities took place in this portion of Parcel B.

Parcel C is the largest of the three parcels, approximately 10 acres and contains two buildings (the Dickson Warehouse and the Benbow Building). A 500,000 gallon aboveground fuel oil tank and two additional aboveground storage tanks (one hydrogen tank that was reportedly never placed into service and a propane tank) were removed during the recently completed USEPA removal action. In addition, three surface impoundments (one lined impoundment called Mud Pond and two unlined structures called "Mud Holes") were present on Parcel C. The ground surface in the vicinity of Mud Pond and the two Mud Holes has been

regraded during the removal action to the point of removing most physical traces of these features.

The present owners of the Li Tungsten site, the Glen Cove Development Corporation (GCDC), acquired approximately four acres of undeveloped property adjacent to Parcel C sometime after 1984. This area has been designated Parcel C′. It is bounded in part by Dickson Lane and Parcel C on the east, two adjoining properties, including the Mattiace Petrochemical National Priorities List (NPL) site (hereinafter referred to as the Mattiace site) on the south, Garvies Point Preserve on the west, and a housing complex and another private property on the north. Parcel C′ was not part of the Li Tungsten site during active operations. A Li Tungsten site plan, showing the boundaries of each parcel, is presented in Figure 1-3. Also shown on Figure 1-3 are several other hazardous waste sites including the Mattiace site, the Konica Imaging, USA, Inc., property (formerly known as both the Powers Chemco and the Columbia Ribbon and Carbon Company) and the Crown Dykman site.

1.2.1.2 History

The Li Tungsten site has a complex history of name and ownership changes. Beginning in 1988 and continuing through the present, the site was the subject of several environmental site assessments, investigations and removal actions. Specific details are discussed in the paragraphs below. The chronological history of ownership, operations, previous investigations, interim remedial actions and removal actions is summarized in Table 1-1.

Early in the 1940's the National Reconditioning Company (NRC) was formed by Kuo Ching (K. C.) Li. NRC was operated and managed by the Wah Chang Trading Corporation, a company which K.C. Li had formed in New York in 1916. In addition to being the chairman and chief engineer of Wah Chang Trading Corporation, K. C. Li was also a distinguished mining engineer, who was credited with the discovery of tungsten in China, and as being the first to import tungsten into the United States. The initial purpose of NRC was to act as Wah Chang Trading Corporation's "operating affiliate" in purifying through smelting, refining, or other treatment off-grade tungsten ores under tolling arrangements with the U.S. Government to support the nation's defense needs. Following World War II, ores were processed at the Li Tungsten site through tolling agreements with both U.S. government entities and private companies (see below for more on tolling agreements).

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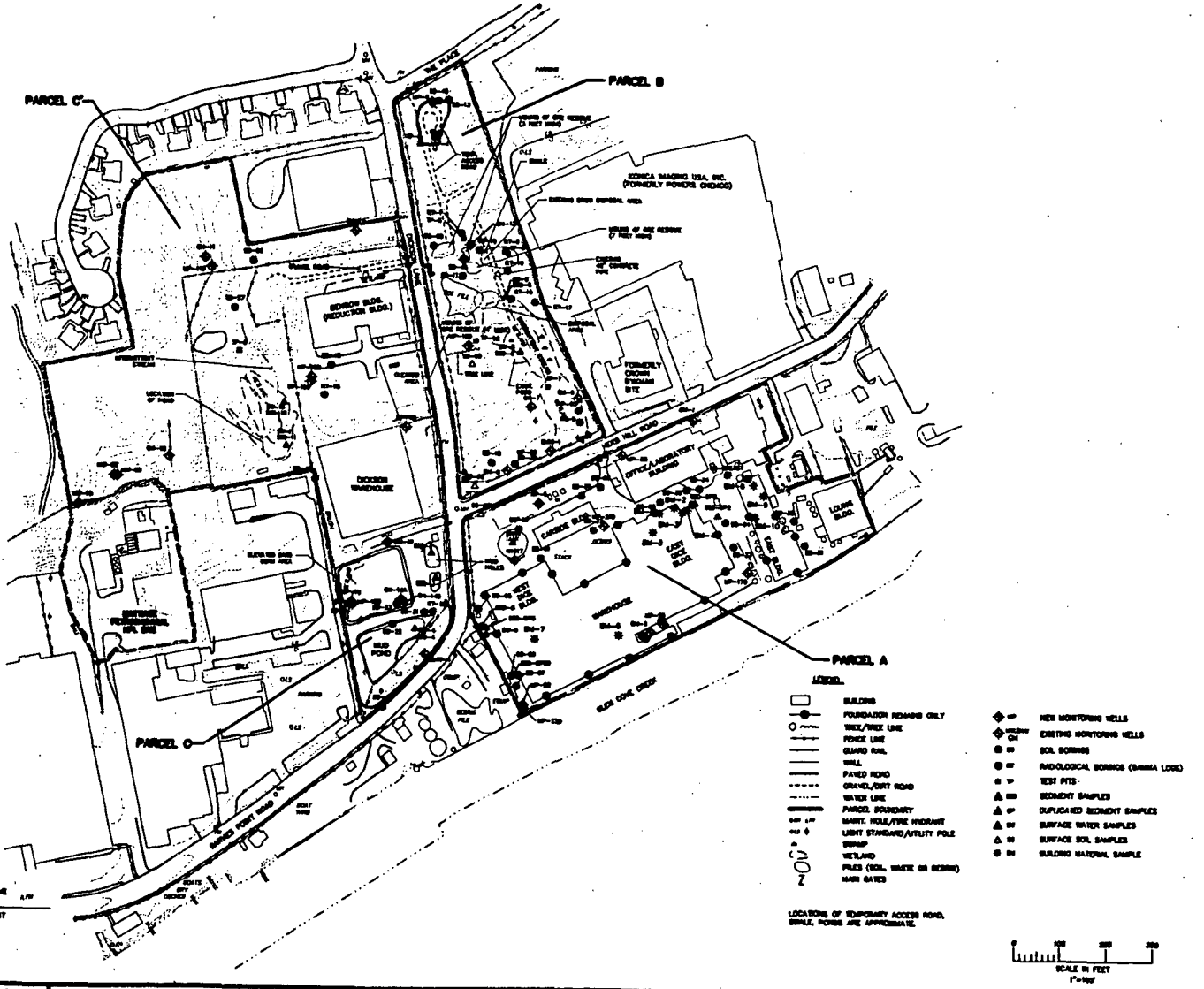

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LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0061; W.A. NO. 025-2L4L

SITE PLAN

AS SHOWN

TABLE 1-1
CHRONOLOGY OF SITE HISTORY AND INVESTIGATIONS, INTERNAL REMEDIAL ACTIONS AND REMOVAL ACTIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
1940	National Reconditioning Corporation formed by K. C. Li, sharing common ownership and management with Wah Chang Trading Corporation, to act as Wah Chang's "operating affiliate" in purifying through smelting, refining, or other treatment, off-grade tungsten ores under tolling agreements with the U.S. Government (throughout lifetime of operations at Site, ores processed primarily through tolling ageeements with U.S. Government entities and/or private sector companies).
1942	Facility becomes operational in October 1942 on land acquired by the Defense Plant Corporation (a World War II-era agency of the U.S. Government) from Wah Chang Trading Corporation in August 1942. Operation initially consists of processing raw ore and scrap tungsten concentrates to produce ammonium p-aratungstate (APT) and subsequently formulating APT to metal tungsten powder and tungsten carbide powder. Other specialty products including tungsten carbide powder plus cobalt and other material for plasma spraying; tungsten titanium carbide powder; tantalum carbide powder; tungsten spray powder; crystalline tungsten powder; and molybdenum spray powder are also produced over the lifetime of the Site facility.
1945	Facility's capacity expanded through the efforts of the Defene Plant Corporation to provide for processing of antimony (sulphide) ore concentrates into pure antimony metal.
1948	National Reconditioning Corporation changes its name to Wah Chang Smelting and Refining Corporation (WCSRC).
1948 - 1964	Site operated by WCSRC.
1964	WCSRC leases Site equipment/real property to the Wah Chang Corporation (WCC) (formerly Wah Chang Trading Corporation), which continued to operate the facility.
April 1967 - 1972	Teledyne, Inc., acquires the stock of WCC and WCC eventually merges into Teledyne. Operations at the Site continued by Teledyne (through lease arrangement with WCSRC) under the name of Teledyne Wah Chang Glen Cove Tungsten Chemicals & Reduction Plant until termination of lease with WCSRC.
1972	WCSRC forms a wholly-owned subsidiary (Li Tungsten Corporation) which continues to operate the Site facility after lease of Site to Teledyne is terminated.

TABLE 1-1 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
1984	Site property acquired by Glen Cove Development Company (GCDC), which in turn leases the Site back to Li Tungsten Corporation.
June 1985	Li Tungsten Corporation files for Chapter 11 bankruptcy. Manufacturing operations at the facility cease.
May 1988	RTP Environmental Associates, Inc., (Westbury, NY) completes Site Investigation Report for Campon Reality Corporation (RTP, 1988). Site investigation undertaken to evaluate environmental conditions prior to residential development. Geraghty and Miller was subcontracted to perform the hydrogeology investigation.
March 29, 1989	New York State Department of Environmental Conservation (NYSDEC) performs site inspection.
April 14-16, 1989	USEPA assumes lead enforcement role on response actions at the site. USEPA FIT2 contractor (NUS) initiates Preliminary Assessment.
July 21, 1989	Administrative Order On Consent (ACO) issued by USEPA to Glen Cove Development Corporation which specified nine (9) interim remedial actions.
September 18, 1989	USEPA FIT2 contractor (NUS) issues Preliminary Assessment Report (NUS, 1989).
April 4, 1990	Interim remedial actions completed and final report submitted (HART, 1990).
September 28, 1990	USEPA FIT2 contractor (NUS) issues Site Inspection Report (NUS, 1990).
July 1991	Li Tungsten site proposed for inclusion on the National Priorities List (NPL).
February 12, 1992	Special Notice letters were sent by USEPA to five PRPs (Teledyne, Inc.; Li Tungsten Inc.; the Glen Cove Development Corporation; and Mr. John Li (son of Mr. K. C. Li). These letters gave the PRPs until April 14, 1992 to submit a good faith proposal to finance or undertake an RI/FS. A good faith proposal was received, but subsequent negotiations have not resulted in a settlement.

TABLE 1-1 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
August 26, 1992	Malcolm Pirnie receives work assignment to prepare RI/FS Work Plan.
August 1995 - April 1996	Malcolm Pirnie completes the second set of interim remedial actions (Phase I and Phase II).
January 4, 1996	NaOH tank leaks.
April 1996	USEPA RAB reponds to acid tank leak.
October 1996- present	USEPA RAB conducts removal actions.
June 1997	Malcolm Pirnie submits Draft Work Plan for Focussed Feasibility Study at the Captain's Cove Site.

The Li Tungsten facility, which became substantially operational in October 1942, was primarily built on land acquired by the Defense Plant Corporation (a World Was II-era agency of the U.S. Government) from Wah Chang Trading Corporation in August 1942. The facility's operation initially consisted of processing of tungsten ore and scrap tungsten to produce ammonium paratungstate (APT) and the formulating of APT into metal tungsten powder and tungsten carbide powder. Other specialty products that were produced included: tungsten carbide powder for plasma spraying; tungsten titanium carbide powder; tantalum carbide powder; tungsten spray powder; crystalline tungsten powder; and molybdenum spray powder. Beginning in 1945, the facility's capacity was expanded through the direct efforts of the Defense Plant Corporation to provide for processing of antimony (sulfide) ore concentrates into pure antimony metal.

Based on available information, a variety of extraction processes (or treatments) were used to separate the various accessory metals (or other impurities) from the tungsten or antimony depending upon the specific type of ore or concentrate. The smelting or refining was generally conducted in relatively small batches, to permit any individual or combination of extraction treatments. Typical treatments in the smelting process included physical, chemical and mechanical processes such as: sizing and crushing; gravity, magnetic and electrostatic separation; roasting; leaching; flotation; and fusion.

Numerous aboveground wooden, steel, or fiberglass tanks were used in performing some of these treatments and to store reactants (e.g., hydrochloric acid, ammonia, sodium hydroxide) and/or intermediate compounds (e.g., APT). As the ore concentrates moved through its various processing stages, radioactive isotopes of thorium, uranium and radium, naturally-occurring in the ore, became more concentrated in the residue or slag. Accessory metals which constitute the impurities that were removed during the extraction process included: antimony, arsenic, barium, bismuth, copper, cobalt, chromium, lead, manganese, mercury, molybdenum, nickel, thorium, uranium, vanadium and zinc.

In 1948 the National Reconditioning Company changed its name to Wah Chang Smelting and Refining Corporation (WCSRC), and in 1949, its affiliate Wah Chang Trading Corporation changed its name to Wah Chang Corporation (WCC). WCSRC continued to operate the site until 1964 when it fully leased the Site equipment and real property to WCC. WCC may have leased equipment and real property from WCSRC for purposes of operating at the facility as

early as 1951. In 1967, WCC was acquired by and made a wholly-owned subsidiary of Teledyne, Inc., and in 1969 WCC was merged into Teledyne. From 1969 to December 1971 when Teledyne terminated its lease with WCSRC for the Li Tungsten site, the site was operated by Teledyne as the Teledyne Wah Chang Glen Cove Tungsten Chemicals & Reduction Plant.

In 1972, after termination of its lease with Teledyne, WCSRC formed a wholly-owned subsidiary, Li Tungsten Corporation, which continued to operate the facility. In 1984, the Li Tungsten property was acquired by the Glen Cove Development Company (GCDC). GCDC continued to lease the site to Li Tungsten Corporation until 1985 when Li Tungsten Corporation ceased operations at the site and filed for bankruptcy. There are indications that Li Tungsten Corporation may have reconstituted itself as Buffalo Tungsten, Inc., in Depew, New York in 1986. In addition to sharing common ownership and management with WCSRC, Buffalo Tungsten (a subsidiary of Cleveland Tungsten, Inc. from 1987 to 1997) purchased and removed from the site facility in 1987 certain equipment and inventory needed for the processing of tungsten ore.

Under a typical tolling agreement, throughout the treatment process carried out at the Li Tungsten facility, the supplier of the tungsten or antimony ore retained ownership of the ore, including its refined concentrates and residual waste. Through such an arrangement, the supplier of ore would receive the refined tungsten or antimony product and the Li Tungsten facility operators would dispose of the waste constituents on behalf of the supplier. In addition to tungsten and antimony ore that they may have themselves owned, NRC/WCSRC/Li Tungsten Corporation or Wah Chang Trading Corporation/WCC processed tungsten or antimony ore through tolling agreements with a number of U.S. Government and non-U.S. Government entities, including among potentially others: Metals Reserve Company of the Defense Plant Corporation (later Office of Metals Reserve of the Reconstruction Finance Corporation, General Services Administration); Department of Defense; W.R. Grace & Company; Kennametal, Inc.; China National Metals and Minerals Import and Export Corporation (Minmetals); Chi Mei Corporation (Chi Mei Metals Corporation); American National Carbide; and H.R. Taylor Company, Inc.

Specific information regarding waste volumes generated or waste disposal practices at the Li Tungsten site is still being developed by the USEPA, particularly with regard to tolling arrangements. It is known, however, that some waste from the site, including radioactive waste,

was taken to a nearby dump that later began to be developed as the Captain's Cove Condominium project (Hart, 1989). Drummed waste was reported to have been buried on-site in a portion of Parcel B (NUS, 1989, 1990). Numerous partially buried drums are visible at the ground surface on Parcel B. Liquid wastes are believed to have been disposed of through numerous subsurface drainage pipes that have been noted in the bulkhead and empty directly into Glen Cove Creek. SPDES permits allowed for up to as many as 250,000 gallons per day of discharge to Glen Cove Creek. The Mud Pond and the two Mud Holes were also reportedly used to dispose of liquid wastes.

On April 14, 1989 the USEPA received a request from the NYSDEC to use its Superfund authority to respond to threats posed by hazardous materials at the Li Tungsten site. USEPA's preliminary assessment and site inspection (NUS, 1989; 1990), revealed a large quantity of ore residues that were the source of low-level beta-gamma radiation. In addition, large quantities of laboratory reagents, various hazardous materials in drums and tanks, asbestos, transformers, and cylinders containing compressed liquids and gases were found in several buildings. Air monitoring showed no dangerous levels of organic compounds either on-site or off-site. As a result of the conditions identified at the Li Tungsten site, the USEPA issued an Administrative Order on Consent (AOC) to GCDC in July 1989 to address some of the most serious chemical and radiological hazards and to stabilize all potential threats to the public and the environment.

The results of Preliminary Assessment (PA) and Site Inspection (SI), conducted by the USEPA (NUS, 1989; 1990), indicated continued possible human health and environmental threats from the radioactive and chemical sources and potential soil, groundwater, and Glen Cove Creek sediment contamination with organic and inorganic hazardous substances.

In July 1991, USEPA proposed that Li Tungsten be included on the NPL after the site scored a numerical value of 50 in the hazard ranking score (HRS) (NUS, 1991). A score of 50 is above the threshold value of 28.5 needed for eligibility for NPL listing.

Subsequent investigations of the Glen Cove Creek (surface water and sediment sampling) near the Mattiace, Li Tungsten and Captain's Cove sites have been conducted by the USEPA and U.S. Army Corps of Engineers (USACOE) between 1996 and 1998, to evaluate the water quality and sediment in the vicinity of the sites. In addition, the USEPA Removal Branch conducted a soil sampling event at various locations at Li Tungsten and Captain's Cove sites in March, 1999. The results of the investigations are included in Appendix B.

1.2.1.3 Nature and Extent of Contamination

Surface and Subsurface Soils

Volatile organic compounds (VOCs) detected during the RI at the Li Tungsten site were limited to a few soil samples at low concentrations (less than 5 μg/Kg) and at shallow depths (less than 4 feet). VOCs were detected in three main areas; the northern portion of Parcel A; the southern portion of Parcel B; and the southern portion of Parcel C in the vicinity of the former aboveground fuel oil tank and Mud Pond. VOCs which exceeded their respective New York State Department of Environmental Conservation (NYSDEC) Technical and Administration Guidance Memorandum (TAGM) guidance values included: acetone, 2-butanone, methylene chloride, benzene, toluene, trichloroethene (TCE) and tetrachloroethene (PCE).

Thirteen semi-volatile organic compounds (SVOCs) were detected in the surface and subsurface soils at concentrations that exceeded either the TAGM or USEPA Soil Screening Level (SSL) guidance values (USEPA, 1996a; 1996b). The 13 SVOC compounds included: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, pentachlorophenol, fluoranthene, phenanthrene, pyrene, dibenz(a,h)anthracene, N-nitrosodiphenylamine and carbozole. Areas where these compounds were detected included Parcel A, the middle portion of Parcel B and the upper and lower portions of Parcel C. No SVOCs were detected in four soil background samples (MP-11D, MP-5B, SB-13 and TP-6).

Pesticides/PCBs which exceeded either the TAGM guidance or the USEPA SSL values included total PCBs (the summation of Aroclor-1242, 1248, 1254, and 1260), Endrin, and 4-4-DDT. Total PCBs exceeded the TAGM guidance value (1,000 μg/Kg) in three of four samples near a mound of ore residue in the central portion of Parcel B. Endrin was detected in three samples on Parcel B including one source area soil boring sample and two test pit samples. 4,4'-DDT was also detected in one test pit sample on Parcel B, below the TAGM guidance value of 1,050 μg/Kg.

Inorganics were widely detected in the soils and included: antimony, arsenic, barium, copper, cobalt, chromium, lead, manganese, mercury, nickel, thorium, uranium, vanadium and zinc. Laboratory analysis of three ore residue samples (collected from the materials temporarily being stored in the Dickson Warehouse) confirmed that high concentrations of accessory metals are present in the ore residues. In general, many of the individual inorganic constituents had

vertical and horizontal distribution patterns that were similar to one another. For example, arsenic, detected in 85 soil samples (exceeding the site background and TAGM guidance value in 69 and 67 samples, respectively) was detected at high concentrations in the middle and lower portions of Parcel B, the upper portion of Parcel C and the lower portion of Parcel C. Antimony, chromium and manganese also showed horizontal and vertical distribution patterns similar to arsenic.

Radionuclides (^{238}U, ^{226}Ra, ^{228}Ra, ^{230}Th, and ^{232}Th) detected in surface and subsurface soils were compared to the average site-specific background concentrations. Average site-specific background concentrations were calculated from both on-site and off-site sampling locations. The average site-specific background concentration for each radionuclide was as follows: ^{238}U (0.7 pCi/g), ^{226}Ra (1.0 pCi/g), ^{228}Ra (1.1 pCi/g), ^{230}Th (0.7 pCi/g) and ^{232}Th (0.8 pCi/g).

Concentrations of ^{238}U in the surface soils (0-4 feet) 1.5 times greater than site-specific background were detected in five main areas: outside the fence along Herb Hill Road in the northeast corner of Parcel A, the middle portion of Parcel B, the upper portion of Parcel C, the vegetated area north of the Dickson Warehouse on Parcel C and the lower portion of Parcel C. At depths greater than four feet, the concentration of ^{238}U generally decreased.

The distribution of ^{232}Th closely matched ^{238}U in the five areas discussed above. Thorium-232 was also detected on Parcels A and B, including two surface soil samples collected along Herb Hill Road, three storm sewer soil boring samples in the eastern portion of Parcel A and two surface soil samples along the bulkhead on Parcel A. At depths greater than four feet, ^{232}Th was detected in 34 samples at concentrations that ranged from less than background to 5.1 pCi/g (approximately 6 times background) in a source area soil boring sample (SB-28B) in the upper portion of Parcel C.

The distribution of ^{226}Ra closely matched ^{238}U and ^{232}Th in the areas discussed above. Two surface soil samples collected along Herb Hill Road in the northeast corner of Parcel A exceeded 1.5 times site-specific background. Two storm sewer soil boring samples and one source area soil boring sample in the eastern portion of Parcel A, and two surface soil samples along the bulkhead on Parcel A also exceeded 1.5 times site-specific background. In the middle of Parcel B, the concentration of ^{226}Ra exceeded 1.5 times site-specific background (1.5 pCi/g) in seven radiological soil boring samples, eight source area soil boring samples and three test pit samples. Several samples collected in the lower portion of Parcel B also exceeded 1.5 times site-

specific background including one surface soil sample, two source area soil boring samples and one radiological soil boring sample. The highest concentration of ^{226}Ra (250 pCi/g) was measured in a surface soil sample located in the upper portion of Parcel C. Two other source area soil boring samples in the upper portion of Parcel C reflected concentrations of ^{226}Ra that exceeded 1.5 times site-specific background. Other areas on Parcel C where the concentration of ^{226}Ra exceeded 1.5 times site-specific background included three radiological borings and one surface soil sample collected north of the Dickson Warehouse. Four samples collected in the lower portion of Parcel C exceeded 1.5 times site-specific background including two radiological soil boring samples, two surface soil samples, and three source area soil boring samples.

Groundwater

Three rounds of groundwater samples were collected between November 1996 and October 1998. The first two rounds (November 1996 and January 1997) were collected with a dedicated bailer using the traditional purge and sampling method. The third round (October 1998) was collected using the low stress (low flow) purging and sampling method. The low stress method is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing. This method minimizes disturbance of sediment in the bottom of the well (thereby producing a sample with low turbidity) and minimizes aeration, which improves the sample quality for VOC analysis. The low stress purging and sampling method gained regulatory acceptance after the Field Sampling Plan (FSP) (Malcolm Pirnie, 1996a) and Quality Assurance Project Plan (QAPjP) (Malcolm Pirnie, 1996b) for the Li Tungsten site were approved. Currently, the low flow purging and sampling method is the standard for collecting groundwater samples from monitoring wells in USEPA Region II. Summary tables for the third round of groundwater sampling, which were not available previously, are presented in Appendix C.

Based on the three rounds of groundwater sampling, the highest concentration of volatile organic compounds (VOCs) were detected in four wells (MW-8S, MW-8D, MW-10 and GM-10) adjacent to the Mattiace site. VOCs were also detected in the middle portion of Parcel A/lower portion of Parcel B (downgradient or cross-gradient to the former Crown Dykman site), the middle portion of Parcel B, and the area around the former aboveground fuel oil tank on Parcel C.

The second round of groundwater sampling yielded results similar to the first round in terms of specific compounds and concentrations, but with a few notable differences. TCE was detected in thirteen samples, ranging in concentration from 1 J µg/L (MP-17) to 28,000 µg/L (MW-10) and exceeded the NYS Maximum Contaminant Levels (MCLs) 10 NYCRR Part 1 of (5 µg/L) in ten samples. The distribution of TCE in the second round and the concentrations detected at each well were virtually identical to the first round with two exceptions. At well GM-1 on the eastern end of Parcel A, the concentration of TCE increased to 2,200 µg/L from 4.1 J µg/L. TCE was undetected at well M-16D in the second round after being detected at a concentration of 3 µg/L during the first round. In the 3rd round, the concentration of TCE increased in downgradient monitoring well MP-2D on Parcel A compared to the first two rounds and decreased in the upgradient wells. Tetrachloroethene, trichloroethene, 1,2-dichlorethene (total), and vinyl chloride were all detected at higher concentrations in MP-2D and generally lower concentrations in upgradient monitoring wells EMW-1, MP-6, GM-1, and MP-21D. This pattern together with the 21-month time interval between the 2nd and 3rd round of sampling suggests that the VOC plume on the middle portion of Parcel A/Lower Parcel B has migrated in a southerly direction.

During the second round, one groundwater sample was collected from an off-site monitoring well (Konica-1), located on The Place, approximately 400 feet from the northeast corner of Parcel B, hydraulically upgradient from each of the three parcels. Methylene chloride and acetone were detected at concentrations of 170 J µg/L and 16 µg/L, respectively in the Konica-1 well. In the 3rd round of sampling, methylene chloride and acetone were not detected in the Konica well, however, 1,2-Dichloroethene (total) and 1,1,2,2-Tetrachloroethane were detected at 26 µg/L and 15 µg/L, respectively.

Several SVOCs were detected in all three rounds of groundwater sampling. There were no SVOCs detected in the sample collected from the off-site background monitoring well (Konica-1). The primary SVOCs detected included phenols, polynuclear aromatic hydrocarbons (PAHs) and phthalates. SVOCs were primarily detected in the wells north of the Mattiace Petrochemical site (MW-8S, MW-8D and MW-10). Isolated detections of SVOCs were found in the following locations: in the southwestern corner of Parcel A; in the vicinity of the aboveground fuel oil tank on Parcel C; and in isolated wells on Parcel A, Parcel B and Parcel C.

Several pesticides were detected in all three rounds of groundwater sampling. The pesticides that were detected were limited to wells MW-8D, MW-10, GM-14A and MP-18. Polychlorinated biphenyls (PCBs) were not detected in any of the samples from either round.

Inorganics (filtered and unfiltered) were detected frequently in all three rounds of groundwater samples. The vertical and horizontal distribution patterns were similar. The highest concentrations of any individual inorganic constituent was generally detected in wells near the former aboveground fuel oil tank, Mud Pond and the two Mud Holes on Parcel C. For example, arsenic was detected in 10 groundwater samples at concentrations ranging from 4.2 J µg/L (GM-1) to 14,500 µg/L (GM-14B). The highest concentration of arsenic (14,500 µg/L) was detected in the southern portion of Parcel C (GM-14B). The detected concentrations rapidly decreased in a cross-gradient direction extending to the western boundary and in a downgradient direction to the southern portion of Parcel A. In addition, antimony was detected in seven wells at concentrations ranging from 5.8 J µg/L (MP-22D) to 4,300 µg/L (GM-14B). Similar to arsenic, the concentration of antimony was highest in the southern portion of Parcel C (4,300 µg/L in GM-14B) and gradually decreased in a cross-gradient direction extending to the western boundary (48.1 J µg/L and 16.6 µg/L in MP-18 and MP-18D, respectively) and in a downgradient direction to the southern portion of Parcel A (52.8 J µg/L and 6.1 µg/L in MP-22 and GM-2, respectively). During the second round of groundwater sampling, arsenic was again detected in 10 samples, but not in all the same wells. As in the first round, the concentration was highest in lower Parcel C and decreased in a cross-gradient direction extending to the western boundary on Parcel C and in a downgradient direction to the southern portion of Parcel A.

Three rounds of groundwater samples were analyzed for radionuclides (^{238}U, ^{226}Ra, ^{228}Ra, ^{230}Th and ^{232}Th). During the second sampling round, the concentration of ^{238}U exceeded the site-specific background concentration (2.2 pCi/L) in nine samples, ranging from 2.5 pCi/L (GM-14A) to 80 pCi/L (GM-14B). Other wells where the concentration of ^{238}U exceeded the site-specific background concentration included two wells on Parcel A, two wells on the lower portion of Parcel B and three wells on Parcel C. In the third round, the concentration of ^{238}U exceeded the site-specific background concentration in one sample from GM-14B (56.8 pCi/L).

The site-specific background concentration of ^{232}Th (0.8 pCi/L) was exceeded in eight samples. Detected concentrations ranged from 0.98 pCi/L (MP-16D) to 6.8 E pCi/L (GM-14B). Other wells where the concentration of ^{232}Th exceeded the site-specific background

concentration included three wells on Parcel A, one well on Parcel B and three wells on Parcel C. The site-specific background concentration of ^{232}Th (0.8 pCi/L) was exceeded in four samples from the third round and ranged from 1.02 pCi/L(EMW-4) to 1.25 pCi/L (GM-14B).

In the first and second rounds, fifteen samples contained concentrations of ^{226}Ra that exceeded the site-specific background (1.9 pCi/L) and 11 samples exceeded the NYSDEC standard (3 pCi/L). The radium standard, which limits the sum of ^{226}Ra and ^{228}Ra to 5 pCi/L, was exceeded in ten samples. The measured concentrations above the site-specific background ranged from 2 pCi/L (GM-13) to 11 pCi/L (MP-16D). Other wells where the concentration of ^{226}Ra exceeded the site-specific background concentration included three wells on Parcel A, three wells on Parcel B, and seven wells on Parcel C. In the third round, the concentration of radionuclides in all samples were below the site-specific background concentrations and NYSDEC standards for ^{226}Ra and only one monitoring well sample, GM-10 (6.56 pCi/L), exceeded the standard for the sum of ^{226}Ra and ^{228}Ra (5 pCi/L). The results of groundwater samples for the third round are included in Appendix B.

Surface Water

Surface water samples were collected from the ponds and wetland areas on Parcels B and C. VOCs were not detected in any of the three surface water samples on Parcel C, however, acetone (13 E µg/L), total 1,2-DCE (15 µg/L) and PCE (6 J µg/L) were detected in the pond on Parcel B. The wetland associated with the pond on Parcel B (SW-9) contained trace levels of 1,1-DCA (2 J µg/L).

SVOCs detected in surface water included bis(2-ethylhexyl)phthalate in (SW-9 (1 J µg/L) and SW-11 (4 J µg/L) and di-n-butylphthalate in (SW-11 (1 J µg/L).

One PCB compound (Aroclor-1254) was detected in SW-4 (1 E µg/L) and three pesticide compounds (4,4'-DDE, 4,4'-DDD and 4,4'-DDT) were detected in SW-8. The pesticides were detected at concentrations of 1.6 µg/L, 9.1 J µg/L and 4.6 J µg/L, respectively.

In general, some inorganics in surface water exceeded the NYSDEC Division of Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values. For example, the Mud Pond sample (SW-4) contained aluminum, cobalt, copper, iron, magnesium, manganese and selenium at concentrations that exceeded the surface

water standards. The pond on Parcel B (SW-8) contained aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium and zinc at concentrations that exceeded the surface water standards.

Uranium-238 was detected in each of the five surface water samples at concentrations ranging from less than 0.23 pCi/L (SW-9) to 4.8 pCi/L (SW-4). The Class A Surface Water Standard for ^{226}Ra is 3 pCi/L; the Class A Surface Water Standard for the sum of the ^{226}Ra and ^{228}Ra is 5 pCi/L. Radium-226 was detected in five samples at concentrations that ranged from less than 0.45 pCi/L (SW-10) to 4.5 pCi/L (SW-8). Radium-228 was detected in samples SW-4 and SW-8 at concentrations of less than 1.0 pCi/L and 2.4 pCi/L, respectively. SW-8 exceeded both the regulatory standard for ^{226}Ra and the combined standard for ^{226}Ra and ^{228}Ra. Concentrations of ^{232}Th were detected in four of the five samples, ranging in concentration from less than 0.23 pCi/L (SW-11) to less than 0.41 pCi/L (SW-4). Thorium-230 was detected in samples SW-4 and SW-8 at concentrations of 0.64 pCi/L and less than 0.46 pCi/L, respectively.

Sediment

Eight sediment samples were collected adjacent to surface water sample locations on Parcels A, B and C. Trace levels (below NYSDEC standards) of several VOCs were detected in five of the eight sediment samples. Principal VOCs detected included 2-butanone and chlorinated and aromatic hydrocarbons, however, only acetone was detected at a concentration (240 E µg/Kg) in sample SED-9 that exceeded the appropriate TAGM value (200 µg/Kg).

SVOCs were detected in each of the sediment samples except SED-10. The principal SVOCs included PAHs and phthalates. Sample SED-5 contained concentrations of benzo(a)anthracene and chrysene at 224 µg/Kg and 400 µg/Kg, respectively. Sample SED-11 contained 75 J µg/Kg benzo(a)pyrene, exceeding the NYSDEC objective of 61 µg/Kg.

PCBs were detected in three of the eight sediment samples. The PCBs detected were primarily Aroclor-1254, Aroclor-1260, and to a lesser frequency Aroclor-1248. Total PCB concentrations of 2,891 µg/Kg and 1,806 µg/Kg were detected in samples SED-2 and SED-9, respectively above the TAGM value for total PCBs of 1,000 µg/Kg. Pesticides 4,4'-DDD and 4,4'-DDT were detected in sample SED-8 at low levels (below TAGM values).

Inorganics in sediment detected above the TAGM values in each of the eight sediment samples were antimony, arsenic, calcium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, sodium and zinc.

The three sediment samples collected from the two Mud Holes (SED-2 and SED-3) and Mud Pond (SED-4) exceeded the site-specific background for each radionuclide except ^{228}Ra in SED-2. The concentration of ^{238}U in the three samples ranged from 4.5 (SED-2) to 46 pCi/g (SED-4), the concentration of ^{232}Th ranged from 2.1 pCi/g (SED-2) to 5.7 pCi/g (SED-4), and the concentration of ^{226}Ra ranged from 2.2 pCi/g (SED-2) to 5.7 pCi/g (SED-4). The concentration of each radionuclide in the two samples collected on Parcel B (SED-8 and SED-9) and one sample on the upper portion of Parcel C (SED-10) were all less than the site-specific background level. The concentrations of ^{226}Ra (2.2 pCi/g), ^{230}Th (1.3 pCi/g) and ^{232}Th (1.5 pCi/g) in SED-11 exceeded site-specific background.

Storm Sewer Sediment

Storm sewer sediment samples were collected from bottom sediments which had accumulated in four storm sewer grates on Parcel A. Trace levels (below NYSDEC standards) of several VOCs were detected in each of the four storm sewer sediment samples. Principal VOCs detected included acetone, 1,1,1-Trichloroethane and 2-hexanone, however, none of the VOCs exceeded the appropriate TAGM value.

SVOCs were detected in each of the four storm sewer sediment samples. The principal SVOCs included PAHs and phthalates. Each sample contained concentrations of benzo(b)fluoranthene (150 J µg/Kg to 13,000 µg/Kg), benzo(a)pyrene (42 J µg/Kg to 7,400 µg/Kg) and benzo(g,h,i)perylene (41 J µg/Kg to 3,600 µg/Kg). Sample SED-DP-2 contained concentrations of phenanthrene, pyrene and chrysene at 240 J µg/Kg, 240 J µg/Kg and 170 J µg/Kg, respectively. Sample SED-DP-3 contained 4,100 E µg/Kg N-nitrosodiphenylamine and 560 µg/Kg of dimethylphthalate. Sample SED-DP-5 contained 970 µg/Kg of acenaphthyene, 560 µg/Kg of dibenzofuran and 1,100 µg/Kg of fluorene.

PCBs were detected in each of the four storm sewer sediment samples. The PCBs detected were primarily Aroclor-1254 and to a lesser frequency Aroclor-1260. Total PCB concentrations in any one sample did not exceed the TAGM value for total PCBs of 1,000 µg/Kg.

Inorganics in sediment detected above the TAGM values in each of the four storm sewer sediment samples were antimony, arsenic, calcium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, sodium and zinc.

All four storm sewer sediment samples exceeded the site-specific background for each radionuclide. The concentration of ^{238}U in the four samples ranged from 1.7 pCi/g (SED-DP-29) to 29 pCi/g (SED-DP-4); the concentration of ^{232}Th ranged from 1.1 pCi/g (SED-DP-29) to 15 pCi/g (SED-DP-3); and the concentration of ^{226}Ra ranged from 1.9 pCi/g (SED-DP-29) to 6.6 pCi/g (SED-DP-3).

1.2.1.4 Fate and Transport

The fate and transport of contaminants detected including VOCs, SVOCs, PCBs/pesticides, inorganics and radionuclides may be controlled by transportation and transformation mechanisms. Transport processes include advection, dispersion, facilitated transport, volatilization and attenuation in soils. Transformation processes include biodegradation, biotransformation, bioactivation, oxidation-reduction reactions, precipitation and complexation. Site-specific geochemical or microbiological studies were not performed, therefore, conclusive statements regarding biodegradation, biotransformation, bioactivation, oxidation-reduction reactions, precipitation or complexation can not be made. Patterns of contamination may be used, however, to conjecture about some of those processes.

Several characteristics of the surface and subsurface soil favor advection, dispersion and volatilization of contaminants. For example, sand and gravel soils would allow transport of groundwater and associated contamination. The hydraulic conductivity ranges from about 10^{-2} cm/s to 10^{-7} cm/s. The coarse particle distribution may also allow volatilization of contaminants in the surface soils. Low organic matter content (0.55%) and low clay content would result in low attenuation of contaminants, as clay particles and organic matter are soil components with high sorptive capacities.

Groundwater flow is generally in the southeast direction, perpendicular to Glen Cove Creek. The hydraulic gradient is gentle, in the range of 0.031 to 0.039. The localized hydraulic gradient in the vicinity of the Mattiace site is steeper (0.075) and in the northeast direction. Groundwater flow is likely to follow preferential pathways that occur in the porous medium. Areas of high hydraulic conductivity are likely to carry the bulk of the flow. The hydraulic

conductivity is known to vary widely with the average being about 3×10^{-3} cm/s. Other paths of preferential flow known to exist are the areas adjacent to the storm sewer lines which empty into Glen Cove Creek. A number of borings in the vicinity of the storm sewers confirm the preferential transport of contaminants along the sewer lines which may have occurred through exfiltration.

VOCs in the soils may be subject to several processes (volatilization, transported by advection, dispersion, facilitated transport or biodegradation) which would result in their reduction in concentration in soil. Given that there were high concentrations of VOCs in groundwater in the vicinity of the Mattiace site (MW-10, MW-8D, MW-8S) but not in the soils, it is likely that the compounds are being transported from the Mattiace site by advection. VOCs in soils were not detected often at high concentrations except for a few specific cases. It is likely, therefore, that VOCs in soil are subject to transport and biodegradation. There may also be some sorption of VOCs to soil, especially non-polar organic compounds.

In another instance where high levels of PCE were detected (EMW-1) there were also coincident detections of TCE and DCE in lesser concentrations. Given the proximity of EMW-1 to the Crown Dykman site and the use of PCE at that site, this may suggest that natural dechlorination of the chlorinated compounds is occurring under anaerobic conditions in the water table aquifer. Further evidence of natural dechlorination is found in samples from Round 2 at GM-1, MP-2D and MP-21D.

The data regarding the nature and extent of contamination of soil and groundwater by SVOCs suggest transport and/or biodegradation of the lower molecular weight, lower ring compounds and attenuation of the higher molecular weight, higher ring compounds on soil constituents.

Analysis of soil samples resulted in the detection of higher ring PAHs (3-ring: phenanthrene; 4-ring: pyrene, fluoranthene, benzo[a]anthracene, chrysene; 5-ring: benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene). These compounds have high sorption coefficients, low solubility and are more likely to be found sorbed to soil. Among these compounds, only phenanthrene, which is slightly soluble, was detected in groundwater. Other SVOCs detected in groundwater included naphthalene, and phenols. Naphthalene has a relatively high solubility in water as do the phenols. Naphthalene and phenols also have sorption coefficients that are much lower than the high ring PAHs and they are subject to higher rates of

biodegradation due primarily to their higher solubility. Naphthalene and phenols were not detected in soils.

The observations regarding SVOCs lead to several conclusions about their likely fate and transport. It appears that naphthalene and the phenols were transported from the soils to the groundwater by advection. In addition, it is likely that they were subject to biodegradation in soils but not in groundwater to the same degree. It is possible that biodegradation occurs at a faster rate in unsaturated (but moist) soils than groundwater because oxygen does not become limited as quickly in soil as in the groundwater. It is likely, therefore, that biodegradation and advection of naphthalene and phenols in soil resulted in low concentrations being detected.

High ring PAHs are likely to become sorbed to the soil constituents to the extent that they will no longer be leached from the soil to the groundwater. The higher sorption coefficient of the PAHs and the low water solubility makes the high ring PAHs resistant to biodegradation. The higher ring PAHs are likely to remain at close to their current concentration in soil with a slow decline due to biodegradation, and without measurable impact to the groundwater.

Detection of pesticides in groundwater were limited to samples from wells in the vicinity of the Mattiace site. These pesticides were detected at the part-per-trillion concentration level in the groundwater. Given the generally low water solubility and high sorption coefficient of pesticides, and the high concentration of organic contaminants in this area, it is likely that the pesticides are coincident with the organic contaminants. Though the exact source of the contaminants is unknown, they may be trace contaminants associated with the organic contaminant plume suspected to be from the Mattiace site. It is also possible that there is a cosolvency effect from the organic compounds in the groundwater where low levels of pesticides in the saturated or unsaturated soil are extracted from a state of otherwise long term sorption. While the source may be applications decades ago, it has been removed. Prior to remediation at the Mattiace site, the USEPA divided the site into six operable units (OU). Remediation of the first operable unit (OU-1), which is completed, included the excavation of pesticide hot spots.

PCBs were detected (as total PCBs) at concentrations above the NYSDEC TAGM guidance values in four samples. PCBs were not detected in any groundwater samples. PCBs have low water solubility and are generally subject to slow rates of biodegradation. PCBs are

not likely to leach to groundwater in significant quantity. The PCBs in soil are likely to remain at present concentration with only a slow biodegradation reducing the concentration.

A wide array of inorganics were detected in numerous soil samples at concentrations above their background concentration. This may be the result of widespread placement and storage of raw and partially processed ore throughout the Li Tungsten site. Inorganics in soil are subject to a variety of transport and transformation processes. Inorganics in soil will be subject to complexation reactions, redox reactions, precipitation, attenuation on soils, advection and dispersion when dissolved in the soil solution or groundwater, and facilitated transport. In general, inorganics introduced into soil will be affected by these processes until an equilibrium condition is achieved. As soil conditions change, however, the equilibrium may change with a resultant change in the concentration of inorganics in the soil solution.

Inorganics were also widely detected in groundwater samples. The concentration of inorganics were very high in many unfiltered groundwater samples but often the filtered counterpart sample had a very low concentration of the metal or no detection. This indicates that many of the inorganics and much of the mass of the inorganics in groundwater is in the form of colloids or sorbed to particulate matter. This reinforces commonly found evidence that facilitated transport is an important mechanism for transport of inorganics.

Cobalt and nickel were also detected at relatively high concentrations in groundwater samples from wells along Glen Cove Creek. Nickel is considered to be one of the more mobile heavy metals. Under aerobic conditions and at near neutral pH precipitation reactions are discouraged. Complexation reactions occur with carbonate, sulfate and hydroxide. Carbonate and hydroxide compounds are generally insoluble, but the region in the vicinity of the saline Glen Cove Creek would have a high concentration of sulfate that would dominate complexation. Sulfate complexation reduces the sorption of nickel thus leading to greater mobility. Continued solubilization and transport of nickel is likely to occur in these areas. Cobalt is also considered a relatively mobile metal under acid conditions in soil. This may be the reason for the high concentrations of cobalt detected in these groundwater monitoring wells. Cobalt is likely to remain mobile until it encounters regions of higher pH or sorbing material.

Radionuclides of uranium, thorium and radium were widely detected in the surface soils. Tungsten ore residues containing naturally occurring radiological materials were stockpiled across the Li Tungsten site. There is also some evidence that residue material was used to

construct the berm around the former aboveground fuel oil tank on Parcel C. Radionuclides were detected in sediments and surface water samples indicating that surface runoff was a major transport mechanism, and may continue to be a significant transport mechanism of radionuclides.

Radionuclides were detected in only a few groundwater samples and many of the locations where they were detected were the same monitoring wells where significant inorganic contamination was found. These locations were in the vicinity of the former aboveground fuel oil tank and Mud Pond on Parcel C. Thorium and radium have low solubilities, so it is likely that they are transported to groundwater as colloids or as sorbed constituents on fine particles in a facilitated transport scenario. Uranium does have soluble species though the forms of uranium likely to be found in the original ore material would be insoluble. Chemical or biochemical oxidation of uranium species to a soluble U (VI) form is possible and may serve as an additional mechanism which promotes the transport of uranium.

1.2.1.5 Baseline Risk Assessment

The human health evaluation addresses the consequences of reasonable maximum exposure to radionuclides and chemicals of potential concern from hypothetical current and future exposure scenarios in the absence of remedial action. Based on the analytical results, soil data were evaluated by subdividing the Li Tungsten site into four areas, Areas A, B, B&C, and C. Sediment data were evaluated by parcel, while groundwater data were evaluated site-wide. Potentially exposed populations in the current scenario included off-site residents and trespassers, while potentially exposed populations in the future scenario included site workers (assuming development for industrial/commercial use), resident adults and children (assuming development for residential use) and construction workers. Carcinogenic risks were estimated for potential exposure to the radionuclides of potential concern, the chemicals of potential concern, and both the radionuclides and the chemicals of potential concern. Noncarcinogenic risks were estimated for potential exposure to the chemicals of potential concern only as noncarcinogenic risks do not result from exposure to the radionuclides of potential concern.

Radiological Risk

Radionuclide analyses of soil samples indicate that thorium and uranium series radionuclides are present in all areas at concentrations which exceed the range of natural background. For several current and future populations evaluated, the lifetime cancer risk estimates due to exposure to these radioactive contaminants exceed the post-remediation risk range generally deemed acceptable at CERCLA sites. As reflected in the risk calculations, the most highly contaminated soils were found in Area B&C; however, samples containing elevated radionuclide concentrations were collected from all areas (and all parcels) of the Li Tungsten site.

Radionuclide concentrations in sediments (and storm sewer sediments) were within the background range. Exposure to sediments, therefore, do not pose any above background risk to current or future populations.

It is unclear if radionuclides have migrated to groundwater. The sum of the ^{226}Ra and ^{228}Ra concentrations in several wells, including the background Konica well and background well MP-11D, ranged from 5-20 pCi/L and exceeded the 5 pCi/L maximum contaminant level (MCL) for drinking water set by the USEPA. Uranium-238 concentrations were, for the most part, less than 5 pCi/L, although three deep monitoring wells had approximately 30-80 pCi/L. Similarly, while most groundwater data for thorium were less than 1 pCi/L, three wells had ^{232}Th and ^{230}Th concentrations which ranged from 3-9 pCi/L. These fluctuations in concentrations of naturally occurring radionuclides may reflect regional variability.

Chemical Risk

Potential exposure of off-site residents to respirable particulates originating in surface soil results in hazard indices for noncancer effects in excess of the USEPA acceptable level and estimated cancer risks at the upper bound of the USEPA acceptable risk range. The predominant contributors to the hazard indices are manganese and cobalt (at annual average concentrations in air based on the maximum detected concentrations in surface soil at Areas B, B&C, and C). The predominant contributor to the cancer risks is arsenic (at an annual average concentration in air based on the maximum detected concentrations in surface soil at Areas B, B&C, and C).

Potential exposure to soil at Area A results in hazard indices for noncancer effects in excess of the USEPA acceptable level for all populations except the future scenario adolescent trespasser and estimated cancer risks that exceed the USEPA acceptable risk range for the future scenario resident adult. The predominant contributor to hazard indices and cancer risks is arsenic and, for inhalation by the future scenario construction worker, cobalt. In addition, while not evaluated quantitatively, lead was detected in two of 28 samples at a concentration greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use.

Potential exposure to soil at Area B results in hazard indices for noncancer effects in excess of the USEPA acceptable level for all populations and estimated cancer risks that exceed the USEPA acceptable risk range for the future scenario site worker, resident adult and resident child. The predominant contributor to hazard indices and cancer risks is arsenic, at the maximum detected concentration. Cobalt, antimony and nickel (at the maximum detected concentrations) and manganese contribute to a lesser extent to the hazard index for inhalation for the future scenario construction worker. In addition, while not evaluated quantitatively, lead was detected in four of 12 samples at concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use. Lead was detected in two of 12 samples at concentrations, one within and one greater than, the soil lead guidance range of 750 - 1700 mg/Kg for industrial land use.

Potential exposure to soil at Area B&C results in hazard indices for noncancer effects in excess of the USEPA acceptable level for all populations and estimated cancer risks that exceed the USEPA acceptable risk range for all populations except the future scenario construction worker. The predominant contributors to hazard indices are arsenic (at the maximum detected concentration), antimony (at the maximum detected concentration in surface soil), manganese and, for inhalation by the future scenario construction worker, cobalt. The predominant contributor to cancer risks is arsenic. In addition, while not evaluated quantitatively, lead was detected in 13 of 37 samples at concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use. Lead was detected in three of 37 samples at concentrations within and eight of 37 samples at concentrations greater than the soil lead guidance range of 750 - 1700 mg/Kg for industrial land use.

Potential exposure to soil at Area C results in hazard indices for noncancer effects in excess of the USEPA acceptable level for all populations and estimated cancer risks that exceed the USEPA acceptable risk range for the future scenario site worker, resident adult, and resident child. The predominant contributors to hazard indices are arsenic and antimony, at the maximum detected concentrations. Manganese, cobalt (at the maximum detected concentration), and silver (at the maximum detected concentration) contribute to the hazard index for inhalation by the future scenario construction worker. The predominant contributor to cancer risks is arsenic. In addition, while not evaluated quantitatively, lead was detected in nine of 15 samples at concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use. Lead was detected in five of 15 samples at concentrations within and four of 15 samples at concentrations greater than the soil lead guidance range of 750 - 1700 mg/Kg for industrial land use.

Potential exposure of an adolescent trespasser to surface water, sediment on Parcel B results in a hazard index for noncancer effects in excess of the USEPA acceptable level. The predominant contributors to the hazard index are antimony, arsenic, cadmium, aluminum and nickel at the maximum detected concentrations in surface water. While the total hazard index for dermal contact with surface water is greater than the USEPA acceptable level, the hazard quotients for the individual chemicals are all equal to (antimony) or less than the USEPA acceptable level. Potential exposure of an adolescent trespasser to surface water and sediment on Parcel C results in a hazard index for noncancer effects in excess of the USEPA acceptable level. The predominant contributor to the hazard index is arsenic at the maximum detected concentration in sediment. In addition, while not evaluated quantitatively, lead was detected in both sediment samples at concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use. Lead was detected in both sediment samples at concentrations greater than the soil lead guidance range of 750 - 1700 mg/Kg for industrial land use.

Potential exposure of the future scenario site worker, resident adult and resident child to groundwater underlying the site results in hazard indices for noncancer effects in excess of the USEPA acceptable level and estimated cancer risks that exceed the USEPA acceptable risk range. The predominant contributors to the hazard indices are 1,2-dichloroethene, arsenic,

antimony, trichloroethene and tetrachloroethene. The predominant contributors to the cancer risks are arsenic and vinyl chloride. While evaluated in the human health evaluation since groundwater is a sole source aquifer, potable use of the shallow groundwater underlying the site in the future is unlikely due to the availability of a municipal water supply. In addition, while not evaluated quantitatively, lead was detected in 46 of 60 groundwater samples in concentrations greater than the USEPA MCL action level for lead in drinking water.

Ecological Assessment

The purpose of the ecological risk assessment was to evaluate environmental samples for site-related contaminants and to estimate any potential risks these contaminants pose to the natural environment. The ecological assessment included a risk characterization of chemical contaminants in surface water, sediment and surface soil for aquatic, semi-aquatic and terrestrial receptors. Also a separate risk characterization for radionuclides occurring in surface water, sediment and surface soil, for aquatic, semi-aquatic and terrestrial receptors was performed.

Chemical stressors were identified and contaminants of potential concern (COPC) and radionuclides of potential concern (ROPC) were selected. Selection of COPC and ROPC for ecological receptors was based on screening criteria, including maximum site-specific background concentrations and ecological risk-based values derived or obtained from published sources.

Ecologically relevant exposure pathways were identified. Wildlife near the Li Tungsten site may have incidental contact with or ingest contaminants while foraging, nesting, or engaging in other activities in the terrestrial portions of the site. Chemical contaminants can also adversely affect plants and animals in surrounding habitats via the food chain. Contaminants in surface water may be taken up by aquatic life as well as semi-aquatic and terrestrial wildlife. Detrimental effects in vegetation, invertebrates, fish, small mammals, birds and carnivores were selected as the assessment endpoints for the ecological assessment. Receptor species chosen were considered representative of the local wildlife populations that would use and frequent the Li Tungsten site. The receptors chosen are as follows: aquatic invertebrates, fish, reptiles and amphibians; mallard; meadow vole; raccoon; herbaceous terrestrial vegetation; American robin; deer mouse and; red fox.

Exposure media of ecological concern include surface soils, surface water and sediment. Maximum exposure point concentrations were considered for terrestrial and semi-aquatic wildlife receptors, to provide a conservative estimate of exposure. A maximum exposure scenario was also considered for benthic invertebrates, other aquatic biota and terrestrial vegetation, because they are either immobile or have limited mobility.

Dietary exposure and exposure from ingestion of soil/sediment and water for each wildlife species were calculated using equations derived from the USEPA's Wildlife Exposure Factors Handbook (USEPA, 1993). Radiological exposure for aquatic organisms was calculated based on methodology contained in Methods for Estimating Doses to Organisms from Radioactive Materials Released into the Aquatic Environment (Baker and Solsat, 1992). Separate calculations were performed for internal and external dose rates. Estimation of radiation doses to semi-aquatic and terrestrial ecological receptors were conducted using equations adapted from the Hanford Site Ecological Risk Assessment prepared for the U.S. Department of Energy (DOE).

Toxicity reference values (TRVs) were derived for aquatic life, plants and terrestrial invertebrates based on available criteria, guidelines and toxicity data. TRVs for mammals and birds were derived based on an accepted methodology in the scientific literature. This general method is based on USEPA methodology for deriving human toxicity values from animal data. In this method, experimentally derived No Observed Adverse Effect Levels (NOAELs) for Lowest Observed Adverse Effect Levels (LOAELs) are used to estimate NOAELs for wildlife by adjusting the dose according to differences in body size. Radiation doses to aquatic organisms for each of the ROPC were compared with the benchmark doses of 1 rad/day suggested by the National Council on Radiation Protection and Measurements (NCRP) as protective of aquatic organisms and 0.1 rad/day suggested by the International Atomic Energy Agency (IAEA) as protective of terrestrial organisms.

The Hazard Quotient (HQ) method was used to characterize risks to receptor species. The HQ method characterizes possible ecological hazard as the ratio of the concentration in the environmental medium (or the total estimated exposure) to the corresponding TRV. If an HQ exceeds one, there is concern for possible adverse effects.

For the chemical risk characterization, most of the COPC in surface water had HQs that exceeded 1. In sediment, HQs for acetone, 4,4'-DDE, 4,4'-DDD, PCBs and twelve inorganic COPC were greater than 1. HQs for the mallard were greater than 1 for 4,4'-DDE, 4,4'-DDD, 4,4'-DDT and 13 inorganic COPC. HQs for the raccoon exceeded 1 for PCBs and 17 inorganic COPC. Terrestrial plant HQs were greater than 1 for 18 inorganic COPC and earthworm HQs were greater than 1 for nine inorganic COPC. For the American robin, HQs were greater than 1 for PCBs and 13 inorganic COPC. HQs for the deer mouse were greater than 1 for benzo(b)fluoranthene, PCBs and 18 inorganic COPC. HQs for the red fox were greater than 1 for benzo(b)fluoranthene, pyrene, endrin, PCBs and 18 inorganic COPC. Based on use of the 95% UCL soil concentrations, HQs for the robin exceeded 1 for twelve inorganic COPC, HQs for the mouse exceeded 1 for PCBs and 16 inorganic COPC and HQs for the fox exceeded 1 for PCBs and 17 inorganic COPC. Many of the COPC, particularly arsenic, copper, lead, nickel, selenium and zinc, exhibit high HQs for most of the receptors chosen.

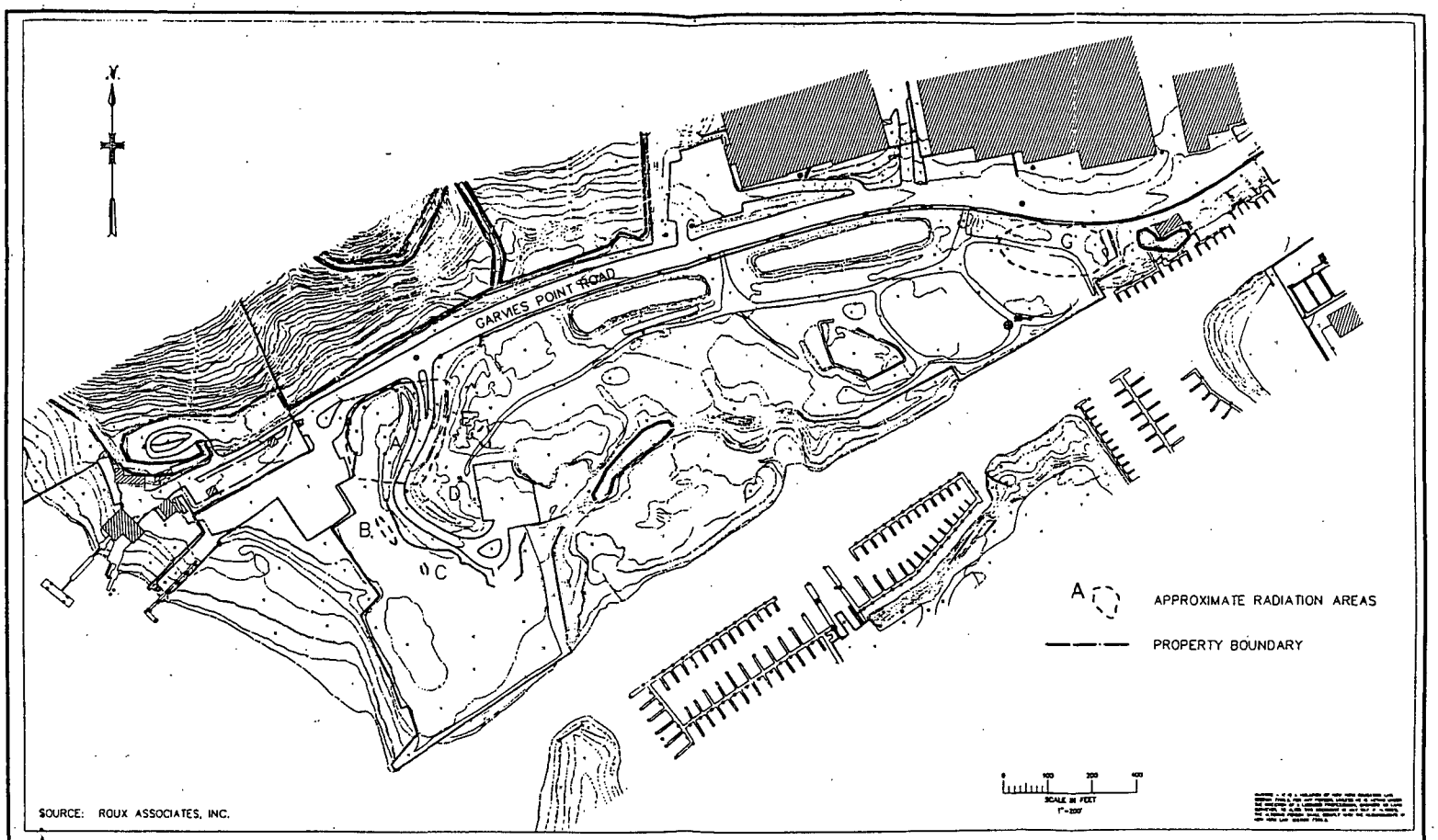
1.2.2 Captain's Cove Site

1.2.2.1 Description

The Captain's Cove site is located at the end of Garvies Point Road on the northern side of Glen Cove Creek where the creek empties into Hempstead Harbor. A regional map and site location map are presented in Figures 1-1 and 1-2, respectively. The Captain's Cove site is bordered on the west by a City beach, on the north by Garvies Point Road, on the east by the Glen Cove Anglers Club (a City-owned property) and on the south by Glen Cove Creek. The total area of the Captain's Cove site encompasses 23 acres including a four-acre wetland along Glen Cove Creek. A site plan is presented in Figure 1-4. The Li Tungsten site is located approximately 0.5 miles to the east.

1.2.2.2 History

The Captain's Cove site was formerly used as a disposal site for, among other wastes, dredge materials from Glen Cove Creek. According to historical records (Hart, 1989), dredging of Glen Cove Creek occurred in 1933-1934, 1948, 1960 and 1965. There are no available records on the disposal of approximately 195,000 cubic yards of material dredged in 1933-1934



SOURCE: ROUX ASSOCIATES, INC.

MALCOLM IRNIE		TITLE: SITE PLAN CAPTIAN'S COVE [redacted] JUNCT SITE	LI TUNGSTEN FEASIBILITY STUDY GLEN COVE, NEW YORK USEPA REGION [redacted] II ARCS CONTRACT NO. 68-W9-005[redacted] W.A. NO. 025-2L4L	PROJECT NO.: 8001202
			DATE: NOV. 1988	FIGURE NO.: [redacted]IGURE 1-4

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and 26,500 cubic yards of material dredged in 1948. Historical information indicates that in 1960, 27,100 cubic yards of material were dredged from the lower portion of Glen Cove Creek and *that* in 1965, 6,300 cubic yards of dredged material were disposed of at the Captain's Cove site.

From approximately 1956 through 1958, dumping probably occurred during the City's ownership of the Captain's Cove site. Incinerator residues, wastewater treatment plant sludges and street debris were disposed of there (Hart, 1989). During the period of time that the landfill was operational, waste from the Li Tungsten Corporation facility was also disposed of at the Captain's Cove site (Ebasco, 1995; C. Sweir - personal communication, 1997).

The parcels of real property which now comprise the Captain's Cove site were sold by the City of Glen Cove and by some private owners to Village Green Realty at Garvies Point, Inc. (Village Green Reality) via several transactions in 1983. Village Green Reality intended to develop the property into a residential condominium complex. The shell of two condominium buildings and the foundation of a third building were completed before the discovery of radiological contamination led to suspension of further development. After subsequent site investigations and the discovery of various non-radiological contamination, the Captain's Cove site was designated as a NYSDEC listed Class 2 inactive hazardous waste site. Additionally, during this period, the radiological contamination was linked to the Li Tungsten site (Ebasco, 1995).

After the Captain's Cove site was purchased by Village Green Realty, bulkheads were built along Glen Cove Creek and Hempstead Harbor. The area behind the bulkhead was backfilled with clean fill. Approximately two-thirds of the waterfront between the Captain's Cove site and Glen Cove Creek was not bulkheaded to preserve the estuarine habitat of the Captain's Cove wetlands. A stockade and chain link fence exists along the northern and western boundaries. Two unlined retention ponds were also constructed near Garvies Point Road to collect surface runoff and allow solids to settle out before the water is released to Glen Cove Creek. Large piles of liner material are stacked near the retention ponds, however, there is no evidence that the liners were ever installed. The liners were intended to prevent infiltration of storm water into the subsurface landfill materials.

Wooden and concrete piles were driven into the subsurface to provide structural support for additional planned condominium buildings. Vegetation consists mainly of grasses and weeds which are being replaced along the perimeter with deciduous trees. Existing structures on the Captain's Cove site include the burned remains of the former sales office building, the rubble and footings from the two condominium shells that were demolished by the City of Glen Cove in April 1999 and the poured foundation of a third condominium. In addition, there is an asphalt access road to the former sales office building, a parking lot and two retention ponds along Garvies Point Road. Construction materials (e.g., concrete pipe, reinforcing rod, door frames), piles of trash, fill and landscaping gravel can also be found.

1.2.2.3 Field Investigation

The purpose of the FFS at the Captain's Cove site was to investigate the horizontal and vertical extent of radiologically contaminated areas identified in previous investigations (Hart, 1989; Ebasco, 1995; NYSDEC, 1997) and provide radiological screening of samples collected in other areas of the site. The chemical contamination at the site is currently being addressed by the NYSDEC under a separate RI/FS. The NYSDEC surface radiological survey identified two principal areas with elevated surface exposure rates (Area A and Area G) and several smaller areas (Areas B, C, D, E and F). For consistency purposes, the area designations used in the NYSDEC report (NYSDEC, 1997) have been maintained throughout this Draft Final FS Report.

The FFS field investigation was conducted by Malcolm Pirnie in two phases. Phase I was conducted in September-October 1997 during the RI that was performed by Roux Associates (Roux) for the City of Glen Cove. Phase I consisted of radiological monitoring during test pit excavation and monitoring well installation, and downhole gamma logging in areas that were not previously found to contain radiological contamination. The purpose of the Phase I activities was to detect new areas (if any) of radiological contamination that may have existed at depth and, therefore, not detected during the NYSDEC survey. Phase II activities were conducted between April - June 1998 by Malcolm Pirnie in the areas of the Captain's Cove site where radiological contamination was previously identified. Phase II activities consisted of soil borings, monitoring well installation, downhole gamma logging, sediment sampling in wetland areas, surface water sampling and groundwater sampling. Samples were analyzed for TCL

organics, TAL inorganics (including cyanide) and radionuclides (^{234}U, ^{238}U, ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra and ^{228}Ra). Selected samples were also analyzed for TCLP Parameters and physical properties (grain size, moisture content, bulk density and Atterberg limits). A complete report describing the FFS investigation is presented in Appendix A.

1.2.2.4 Nature and Extent of Contamination

Surface and Subsurface Soils

VOCs were primarily limited to several samples in the northeast portion of Area A (TP-2, SH-12 and SB-21). The TAGM guidance values were exceeded for the following VOCs: acetone in two samples - TP-2 (140 E µg/Kg) and SB-12 (390 µg/Kg); 2-butanone in two samples - TP-2 (50 µg/Kg) and SB-12 (89 E µg/Kg); and chlorobenzene in two samples from SB-21 (42 E µg/Kg and 42,000 µg/Kg).

Seven SVOCs were detected at concentrations that exceeded the TAGM guidance value at six locations (TP-4, SB-12, SB-17, SB-20, SB-27 and MW-8) in Area A, four locations in Area G (SB-8, SB-22, SB-23 and MW-7) and one site-wide boring (SB-7). The TAGM guidance values were exceeded for : benzo(b)fluoranthene at two sampling depths in SB-4 (1,200 µg/Kg and 1,100 µg/Kg); benzo(a)pyrene in seven samples in Area A (SB-12, SB-13, SB-14, SB-17, SB-18, SB-19 and MW-8), four samples in Area G (SB-22, SB-23, SB-25 and MW-7) and four site-wide samples from three borings (SB-4, SB-7 and SB-8). The measured concentrations of benzo(a)anthracene exceeded TAGM guidance levels in seven samples in Area A (TP-2, SB-12, SB-13, SB-18, SB-19, SB-25 and MW-8), one sample near Area G (SB-22) and two samples from SB-4. The TAGM guidance level for chrysene (400 ug/Kg) was exceeded in a total of five samples from SB-4, SB-18, SB-22 and MW-8. The TAGM guidance level for 2-4-dimethylphenol (100 µg/Kg) was exceeded at one location (SB-4). A total of 14 other SVOCs were detected at concentrations below TAGM guidance levels.

Two samples, SB-21 (5,500 µg/Kg) and TP-6 (12,000 µg/Kg) exceeded the TAGM guidance level (1,000 ug/Kg) for total PCBs. The TAGM guidance value for one pesticide (heptachlor epoxide) was exceeded in two samples: TP-2 (34 E µg/Kg) and SB-2 (28 EN µg/Kg).

The concentrations of numerous metals exceeded their respective TAGM guidance level (or site background if a TAGM value does not exist). The concentrations of the following metals exceeded their respective TAGM guidance level (provided in parenthesis): arsenic (7.5 mg/Kg) in 23 samples; barium (300 mg/Kg) in eight samples; beryllium (3 mg/Kg) in two samples; chromium (10 mg/Kg) in 22 samples; cobalt (30 mg/Kg) in 10 samples; copper (25 mg/Kg) in 22 samples; iron (2,000 mg/Kg) in all 32 samples; lead (23 mg/Kg - site background) in 25 samples); manganese (664 mg/Kg - site background) in 12 samples; mercury (0.1 mg/Kg) in 13 samples; and selenium (2 mg/Kg) in 14 samples.

The concentration of radionuclides in test pit, soil boring and sediment samples were compared to two times the average background concentration. The analytical results from Area A and Areas G are discussed below.

Area A

Elevated concentrations (greater than 5 pCi/g) of thorium and uranium series radionuclides were found in all five test pits (TP-1, TP-2, TP-3, TP-4 and TP-7) and seven of the 15 soil/monitoring well borings (SB-5, SH-12, SB-20, SB-21, SB-25, SB-27 and MW-8). The remaining soil borings reflected radionuclide concentrations that ranged from background to less than 2.5 times background.

Maximum concentration of radionculides in test pit samples were found from 2 to 6 feet below grade level (bgl) in TP-3. Uranium series concentrations ranged from 191 to 494 pCi/g; thorium series concentrations ranged from 56 to 113 pCi/g. Other test pits had elevated radionuclide concentrations from 2 to 6 feet, with concentrations which ranged from background to 25 pCi/g.

Elevated concentrations of radionuclides were also found in soil boring samples. Maximum concentrations of 211 to 273 pCi/g uranium series and 70 to 126 pCi/g thorium series were measured at a depth of 6 to 7 feet bgl in SB-13. Several soil borings exhibited contamination at similar depths throughout Area A.

Area G

Concentrations of thorium and uranium series radionuclides greater than 5 pCi/g were found in both test pits (TP-5 and TP-6) and five of the eight soil/monitoring well borings (SB-8, SH-22, SB-23, SB-24 and SB-26). The remaining three soil borings reflected radionuclide concentrations that ranged from background to less than 2.5 times background.

In samples collected from the test pits, the highest concentration of ^{226}Ra and ^{228}Ra was found from 4 to 6 feet bgl in TP-6 and ranged from 13 to 28 pCi/g and 4 to 6 pCi/g, respectively. Slightly elevated concentrations of other uranium and thorium series radionuclides were also found at similar depths in TP-5. In the soil borings, the highest concentration of ^{226}Ra and ^{228}Ra was found from 6 to 8 feet bgl in SB-8 and measured 169 pCi/g and 49 pCi/g, respectively. Elevated concentrations of other uranium and thorium series radionuclides were also found at similar depths in other soil borings. The concentration of ^{234}U (1,041 pCi/g) measured in SB-23 was substantially elevated.

Groundwater

A total of eight VOCs were detected in CDM-2 at concentrations ranging from 13 µg/L - 610 µg/L. Trace to low concentrations of several VOCs were also detected in MW-3. Several other wells reflected trace levels of VOCs. Vinyl chloride was detected in two samples at concentrations that exceeded the MCL (2.6 µg/L in MW-3 and 190 µg/L in CDM-2). 1,2-Dichloroethene was detected in one sample above the MCL (218 µg/L in CDM-2).

The principal SVOCs that were detected included phenols, polynuclear aromatic hydrocarbons (PAHs) and phthalates, were limited to three well locations (MW-3, CDM-1 and CDM-2). Many of these SVOCs do not have MCLs or NYSDEC standards. Phenol was detected in one sample (2.1 J µg/L in CDM-1) at a concentration slightly above the MCL. No PCBs were detected in any groundwater sample and one only pesticide (endosulfan sulfate) was detected (0.17 µg/L in CDM-4).

Many inorganic compounds were detected in the groundwater samples, however, relatively few exceeded state or federal standards. Arsenic was detected in seven samples at concentrations ranging from 2.3 J µg/L (MW-2) to 10,200 µg/L (MW-8). Five of these samples exceeded the state or USEPA MCL of 50 µg/L: MW-1 (648 µg/L), MW-5 (106 µg/L), MW-6

(115 μg/L), MW-7 (195 μg/L) and MW-8 (10,200 μg/L). Antimony was detected in three samples: MW-6 (15.7 μg/L), MW-7 (14.0 J μg/L) and MW-8 (41.4 μg/L). The NYSDEC and USEPA MCL was exceeded in each of the three samples. The MCL for aluminum was exceeded at one well, MW-8 (254 μg/L). Selenium was detected in three wells at a concentration that exceeded the NYSDEC and USEPA MCL of 50 μg/L. The three wells included: MW-6 (120 μg/L), MW-8 (108 μg/L) and MW-7 (69.4 μg/L). Thallium was detected in two wells at concentrations higher than the MCL of 3 μg/L: MW-1 (7.9 J μg/L) and MW-2 (9.2 μg/L).

Iron was detected in eight wells at concentrations that exceeded the secondary MCL of 300 μg/L. The eight wells and their respective concentrations were as follows: MW-1 (25,000 μg/L), MW-2 (1,040 μg/L), MW-3 (21,500 μg/L), MW-5 (4,760 μg/L), MW-6 (474 μg/L), MW-8 (649 μg/L), CDM-1 (1,460 μg/L) and CDM-4 (11,200 μg/L). Manganese was detected in 10 wells at concentrations ranging from 37.4 μg/L (MW-8) to 5,420 μg/L (MW-6). The USEPA MCL for manganese is listed as a secondary MCL of 50 μg/L, however the NYSDEC has set a standard of 300 μg/L. Under the NYSDEC standard, the concentration of manganese exceeded the standard in eight wells: MW-1 (4,690 μg/L), MW-3 (592 μg/L), MW-5 (1,060 μg/L), MW-6 (5,420 μg/L), MW-7 (543 μg/L), CDM-1 (3,040 μg/L) and CDM-4 (728 μg/L).

There are no specific standards, either MCLs or NYSDEC water quality standards, for uranium or thorium, however, the drinking water concentration of thorium is limited by the 15 pCi/L gross alpha MCL. The USEPA and NYSDEC have established a MCL of 5 pCi/L for the sum of ^{226}Ra and ^{228}Ra. In addition, the NYSDEC limits the concentration of ^{226}Ra to 3 pCi/L. Revisions to the National Drinking Water Regulations for radionuclides (40 CFR Parts 141 and 142) were proposed but never enacted. The revisions includes 20 pCi/L for both ^{226}Ra and ^{228}Ra, 300 pCi/L for ^{222}Rn (radon), 20 μg/L (approximately 30 pCi/L) for uranium, 4 millirem effective dose equivalent/year for beta and photon emitters and 15 pCi/L for adjusted gross alpha emitters (excluding radon, uranium and radium). In the absence of element-specific MCLs, the uranium and thorium concentrations measured during groundwater sampling are compared to Li Tungsten background concentrations determined from three hydraulically upgradient monitoring wells (MP-5, MP-11D and Konica-1). In addition to a comparison to background, radium concentrations are compared to the NYSDEC standard of 3 pCi/L.

The highest concentration of uranium (7 pCi/L) and thorium (8 pCi/L) series radionuclides were measured in MW-7 and MW-2, respectively.

Surface Water

Three surface water samples were collected from each of the two retention ponds (SW-1 and SW-2) and from a topographic depression (SW-3) in the northwest portion of the Captain's Covc site. No VOCs, SVOCs, pesticides or PCBs were detected in the three surface water samples. Many of the inorganics detected in SW-3 exceeded NYS or USEPA Ambient Water Quality Criteria (AWQC) surface water standards including: aluminum (15,000 µg/L), cadmium (8.6 g/L), cobalt (43.6 µg/L), copper (333 µg/L), iron (62,000 µg/L), lead (418 µg/L), manganese (1,840 µg/L), mercury (0.55 µg/L), selenium (6.7 µg/L), silver (11.1 µg/L), vanadium (59.9 µg/L) and zinc (772 E µg/L). SW-2 exceeded surface water standards for iron (19,400 µg/L) and mercury (0.03 J µg/L). SW-1 exceeded only one surface water standard for iron (1,900 µg/L).

The Class A Surface Water Standard for ^{226}Ra is 3 pCi/L and 5 pCi/L for the sum of ^{226}Ra and ^{228}Ra. The concentration of uranium and thorium series radionuclides in all surface water samples was less than 2 pCi/L .

Sediment

Two sediment samples (SED-1 and SED-3) were collected from locations corresponding to SW-1 and SW-3 (no sediment sample was collected from SW-2). Two VOCs (acetone and 2-butanone) were detected in SW-3 at concentrations of 520 E µg/Kg and 110 E µg/Kg, respectively. The concentration of acetone exceeds NYS sediment criteria of 15 µg/Kg. No SVOCs were detected in either sample. Five pesticides were detected in SW-3: heptachlor epoxide (2.8 µg/Kg); 4,4′-DDD (7.2 µg/Kg); 4,4′-DDT (5.5 J µg/Kg); alpha-chlordane (18 E µg/Kg); and gamma-chlordane (14 E µg/Kg). No PCBs were detected in either of the two samples.

In general, inorganics detected in SW-3 were on the order of one magnitude greater than those detected in SW-1. Several sediment criteria (NYS Sediment Criteria, NOAA and Ontario) were used, where available, to evaluate sample results. The only gross exceedance of any of the standards listed above included iron (29,200 g/Kg), lead (271 E g/Kg), mercury (0.35 g/Kg),

silver (7.2 E g/Kg) and zinc (364 E g/Kg) in SED-3. The concentration of uranium and thorium series radionuclides in all surface water samples was less than 2 pCi/L.

Wetland Sediment

Five samples were collected from the wetlands (WS-1 through WS-5) and analyzed for radionuclides only. The concentration of radionuclides in the five wetland sediment samples were within the range of background.

1.2.2.5. Baseline Risk Assessment

Radiological Risk

Radionuclide analyses of soil samples showed that radionuclides of potential concern (ROPC) present at Area A and Area G are at concentrations which exceed the range of natural background. For several populations evaluated, the total excess lifetime cancer risk estimates due to exposure to these radioactive contaminants exceed the upper boundary of the risk range generally deemed acceptable at CERCLA sites. Concentrations of radionuclides in sediments from the retention ponds and the wetland area were within the range of natural background for soil. Exposure to sediments, therefore, do not pose any above-background risk to current or future populations.

Site worker, resident adult and resident child exposure to groundwater via ingestion results in total excess lifetime cancer risk estimates which are within the USEPA acceptable risk range. It is unclear if ROPC have migrated into the Upper Glacial aquifer. Radionuclide concentrations in groundwater which exceeded the MCLs were primarily due to relatively higher concentrations of ^{228}Ra. The sum of the ^{226}Ra and ^{228}Ra concentrations in groundwater from all but three samples were less than the 5 pCi/L MCL set by the USEPA. Two of these samples are background wells (Konica-1 and MP-11D), therefore, the fluctuations in concentrations of radium may reflect regional variability.

Chemical Risk

The human health evaluation addresses the consequences of reasonable maximum exposure to chemicals of potential concern (COPC) from hypothetical current and future

exposure scenarios in the absence of remedial action at the Captain's Cove site. Estimated risks that exceed the USEPA acceptable levels and the chemicals associated with those risks are discussed below by environmental medium.

Potential exposure to soil in Area A results in hazard indices for noncancer effects in excess of the USEPA acceptable level for all populations except the current/future scenario adolescent trespasser and estimated cancer risks that exceed the USEPA acceptable risk range for the future scenario resident adult and resident child. The predominant contributors to hazard indices and cancer risks are arsenic, PCBs, antimony, manganese, and additionally for the child resident, cadmium, copper and iron. While not evaluated quantitatively, lead was detected in 12 of 19 samples at a concentration greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use. Lead was detected in seven of 19 samples at concentrations greater than the soil guidance range of 750 - 1,700 mg/Kg for industrial land use.

Potential exposure to soil in Area G results in hazard indices for noncancer effects in excess of the USEPA acceptable level for the future scenario construction worker, resident adult, and resident child and estimated cancer risks that exceed the USEPA acceptable risk range for the future scenario resident adult and resident child. The predominant contributors to hazard indices and cancer risks are arsenic, PCBs, manganese, and additionally for the resident child, antimony. While not evaluated quantitatively, lead was detected in four of 10 samples at concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use and the soil lead guidance range of 750 - 1,700 mg/Kg for industrial land use.

Potential exposure of an adolescent trespasser to surface water and sediment does not result in a hazard index for noncancer effects or estimated cancer risks in excess of the USEPA acceptable levels.

Potential exposure of the future scenario site worker, resident adult and resident child to groundwater underlying the Captain's Cove site results in hazard indices for noncancer effects in excess of the USEPA acceptable level and, for the resident adult and resident child, estimated cancer risks that exceed the USEPA acceptable risk range. The predominant contributors to the hazard indices are arsenic, chloroform (for resident adult and resident child), and chlorobenzene and antimony for the resident child. The predominant contributor to the cancer risks is arsenic. While evaluated in the human health evaluation since groundwater is a sole source aquifer,

potable use of the shallow groundwater underlying the Captain's Cove site in the future is unlikely due to the availability of a municipal water supply. In addition, while not evaluated quantitatively, lead was detected in eight of the 10 groundwater samples at concentrations greater than the USEPA MCL action level of 0.015 mg/L for lead in drinking water at the tap.

1.3 ORGANIZATION OF THE FS REPORT

This Draft Final FS Report is organized into six (6) sections and two appendices as described below:

Section 1.0, **INTRODUCTION,** provides the purpose and organization of the Draft Final FS Report and summarizes the results of the Li Tungsten RI (nature and extent of contamination, contaminant fate and transport, and chemical and radiological baseline risk assessments) and the Captain's Cove investigation (nature and extent, contaminant fate and transport, and chemical and radiological baseline risk assessments). The reader should refer to the Draft Final RI Report for further details on the Li Tungsten site and Appendix A for further details on the Captain's Cove site.

Section 2.0, **IDENTIFICATION AND SCREENING OF TECHNOLOGIES,** presents the development of the remedial action objectives for the contaminated media and identifies the general response actions that will satisfy the remedial action objectives, based on allowable exposure and ARARs. Preliminary remediation goals (PRGs) are presented. Based on the general response actions, appropriate remedial technologies to remediate the contamination are identified and screened. In some cases, technology types are presented and evaluated, rather than specific technologies (or process options), to simplify the initial screening process.

Section 3.0, **DEVELOPMENT AND SCREENING OF ALTERNATIVES,** describes the rationale for combining technology/process option types into remedial alternatives. Moreover, conceptual design concepts are developed for each remedial alternative. The remedial alternatives listed at the end of this section are described and evaluated in detail in Section 4.0.

Section 4.0, **DETAILED ANALYSIS OF ALTERNATIVES,** presents a detailed description and evaluation of the remedial alternatives developed in Section 3.0 with respect

to the nine NCP criteria: 1) short-term effectiveness, 2) long-term effectiveness, 3) reduction of mobility, toxicity, and volume, 4) implementability, 5) cost, 6) compliance with ARARs, 7) overall protection, 8) state acceptance and 9) community acceptance. A comparative analysis of these alternatives is also presented in this section.

Section 5.0, **REFERENCES,** provides a listing of the references cited in this Draft Final FS Report.

Section 6.0, **GLOSSARY**, provides a glossary of abbreviations and acronyms, radiological terms, and risk assessment terms cited in this Draft Final FS Report.

APPENDICES. Results of the Captain's Cove investigation, including the risk assessment, is presented in **Appendix A**. USEPA and USACOE investigations of the Glen Cove Creek and miscellaneous sampling events are presented in **Appendix B**. Results of the third round of groundwater sampling, which were not available for presentation in the Draft FS Report (December 1998), is presented in **Appendix C**. The cost estimates for each of the remedial alternatives is presented in **Appendix D**.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 INTRODUCTION

Alternatives for remediation are developed by assembling combinations of technologies and the media to which they would be applied into alternatives that address contamination on a site-wide basis or for a specific operable unit. This process is described in this section in a series of three general steps. The first step presented in Section 2.2, remedial action objectives, describes the remedial action objectives for each of the contaminated media; describes the derivation of risk-based chemical and radiological action levels; presents a discussion of applicable and relevant and appropriate requirements (ARARs) and to be considered material (TBCs) and; selects the preliminary remediation goals (PRGs). The second step presented in Section 2.3 identifies and selects general response actions that will satisfy the remedial action objectives. Based on the general response actions that are selected, remedial technologies are identified and screened for applicability in the final step (Section 2.4).

2.2 REMEDIAL ACTION OBJECTIVES

2.2.1 Remedial Action Objectives by Media

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), NYSDEC's recommended soil cleanup objectives, site-specific risk-based levels and the most reasonably anticipated future land use for the Li Tungsten and Captain's Cove sites (i.e., commercial development).

The following remedial action objectives were established for the Li Tungsten and Captain's Cove sites:

Building Materials

- Prevent exposure to building materials contaminated with radionuclides or chemicals of concern.

- Eliminate hazards to future site workers posed by unstable structures.

- Remove any structural impediments that might interfere with pre-design sampling and implementation of technology to remediate soil and groundwater.

Soil/Sediment

- Prevent or minimize exposure to heavy metals and radionuclides of concern through inhalation, direct contact or ingestion.

- Prevent or minimize cross-media impacts from heavy metals and radionuclides of concern in soil/sediments migrating into underlying groundwater (Note: contamination of Glen Cove Creek's sediments has been addressed as part of the Mattiace Record of Decision (ROD) for OU-1 and, therefore, is not included in the remedial objectives of this Draft Final FS Report).

Groundwater/Ponded Water

- Prevent or minimize ingestion, dermal contact and inhalation of inorganic-contaminated groundwater "hot spot" areas on lower Parcel C and on Parcel A that are above State and Federal MCLs (Note: organic contamination of groundwater from the Crown Dykman State Superfund Site will be subsequently addressed by the NYSDEC and, therefore, is not included in the remedial objectives of this Draft Final FS Report).

- Restoration of groundwater quality to levels which meet State and Federal standards

- Remediation of contaminated surface water in on-site ponds to reduce risks to public health and the environment.

2.2.2 Determination of Chemical Risk-Based Action Levels

The results of the baseline risk assessments for the Li Tungsten and Captain's Cove sites (Malcolm Pirnie, 1998a; 1999) were used to derive risk-based action levels for those chemicals with the potential to cause human health risks in excess of the USEPA acceptable levels. Risk-based action levels were derived for predominant contributors to the risk estimates for future use of the underlying groundwater and for contact with surface soil, all soils (surface and subsurface), surface water and sediment under both current and future scenarios. The same exposure assumptions and parameters and toxicological criteria used in the baseline risk assessments were used in the derivations. The risk-based action levels are then compared to ARARs and TBCs identified in Section 2.2.4, to aid in evaluating remedial alternatives.

The predominant contributors to the risk estimates are those chemicals with a total pathway hazard index (i.e., the sum of the chemical-specific hazard quotients for each of the exposure routes analyzed) greater than 0.1 or estimated cancer risk greater than 1E-06. As an additional measure of caution, risk-based action levels were derived for chemicals with a total pathway hazard index greater than 0.1 with the recognition that while chemical-specific total pathway hazard indices may be less than 1.0, when the risks for multiple chemicals are added, the total hazard indices may be greater than 1.0. The chemicals that are predominant contributors to the risk estimates in the baseline risk assessments at the two sites, for each of the affected media, are presented in Table 2-1 and summarized below.

For the Li Tungsten site, risk-based action levels were derived for the following:

- eight VOCs and five inorganic chemicals in groundwater;
- two inorganic chemicals in surface water;
- three SVOCs, PCBs and eight inorganic chemicals in all soils;
- PCBs and three inorganic chemicals in surface soil; and
- one inorganic chemical in sediment.

For the Captain's Cove site, risk-based action levels were derived for the following:

TABLE 2-1

PREDOMINANT CONTRIBUTORS TO THE RISK ESTIMATES
LI TUNGSTEN AND CAPTAIN'S COVE SITES

CHEMICAL	ALL SOILS		SURFACE SOIL		SEDIMENT		GROUNDWATER		SURFACE WATER
	LT	CC	LT	CC	LT	CC	LT	CC	LT only
VOLATILE ORGANICS									
Benzene							X	X	
Chlorobenzene								X	
Chloroform								X	
1,2-Dichloroethane								X	
1,1-Dichloroethene							X		
1,2-Dichloroethene (total)							X	X	
Methylene chloride							X		
Tetrachloroethene							X	X	
1,1,1-Trichloroethane							X		
Trichloroethene							X	X	
Vinyl chloride							X	X	
SEMI -VOLATILE ORGANICS									
Benzo[a]anthracene		X							
Benzo[a]pyrene	X	X							
Benzo[b]fluoranthene	X	X							
Dibenz[a,h]anthracene	X	X							
bis(2-Chloroethyl)ether								X	
1,4-Dichlorobenzene								X	
PESTICIDES/PCBs									
PCBs (total)	X	X	X	X					
INORGANICS									
Antimony	X	X	X	X			X	X	
Arsenic	X	X	X	X	X	X	X	X	X
Barium		X							
Beryllium									X
Cadmium		X					X		
Cobalt	X	X							
Copper	X	X					X		
Iron	X	X							
Manganese	X	X	X						
Nickel	X						X		
Silver	X								

X: Predominant Contributor to Risk Estimates (total pathway cancer risk > 1E-06 and/or hazard index > 0.1)
LT = Li Tungsten Site
CC = Captain's Cove Site

- seven VOCs, two SVOCs, and two inorganic chemicals in groundwater;
- four SVOCs, PCBs and eight inorganic chemicals in all soils;
- PCBs and two inorganic chemicals in surface soil; and
- one inorganic chemical in sediment.

Risk-based action levels for groundwater and surface water are presented in Tables 2-2 and 2-3 for the Li Tungsten and Captain's Cove sites, respectively; ARARs for groundwater are also presented for comparison. Risk-based action levels for soil and sediment are presented in Tables 2-4 and 2-5 for the Li Tungsten and Captain's Cove sites, respectively; ARARs and TBCs for soil are also presented for comparison. Due to the generally high concentrations of lead in all media, it is included in Tables 2-2 through 2-5 to present ARARs and TBCs for lead. The risk-based action levels were derived, by ratio, based on the exposure point concentrations, chemical-specific risks estimated in the baseline risk assessments and target risks. For each population and each medium, the ratio of the exposure point concentration to the chemical-specific total pathway hazard index or estimated cancer risk is set equal to the ratio of some concentration, X, to the target risk (i.e., 1.0 for noncarcinogenic effects and 1E-04 and 1E-06 for carcinogenic risks). For example:

$$\frac{C}{TPR} = \frac{X}{TR}$$

where:

C = Exposure point concentration

TPR = Total pathway risk

X = Concentration protective of target risk

TR = Target risk

Solving this equation for X gives the chemical concentration in a medium that is protective for that population at that target risk level.

TABLE 2-2

RISK-BASED ACTION LEVELS
LI TUNGSTEN SITE

GROUNDWATER

Chemical	Risk-Based Action Levels								ARARs		
	Site Worker			Child Resident			Adult Resident		USEPA MCLs [1]	NYS MCLs [2]	NYSDEC WQS [3]
	HI = 1 (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	HI = 1 (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	(mg/L)	(mg/L)	(mg/L)
Benzene	N/A	0.98	0.01	N/A	0.62	0.006	0.29	0.003	0.005	0.005	0.0007
1,1-Dichloroethene	N/A	0.05	0.0005	N/A	0.01	0.0001	0.01	0.0001	0.007	0.005	0.005
1,2-Dichloroethene (total)	0.92/0.46 a	N/A	N/A	0.14/0.046 a	N/A	N/A	N/A	N/A	0.07a/0.1b	0.005	0.005 a
Methylene chloride	N/A	3.81	0.04	N/A	2.42	0.02	1.01	0.010	0.005	0.005	0.005
Tetrachloroethene	N/A	0.55	0.005	0.14/0.046 a	0.34	0.003	0.16	0.002	0.005	0.005	0.005
1,1,1-Trichloroethane	N/A	N/A	N/A	0.29	N/A	N/A	N/A	N/A	0.2	0.005	0.005
Trichloroethene	0.61/0.305 a	2.59	0.03	0.09/0.03 a,b	1.63	0.02	0.76	0.008	0.005	0.005	0.005
Vinyl chloride	N/A	0.01	0.0001	N/A	0.009	0.00009	0.004	0.00004	0.002	0.002	0.002
Antimony	0.04	N/A	N/A	0.006	N/A	N/A	N/A	N/A	0.006	NA	0.003
Arsenic	0.03	0.02	0.0002	0.005	0.01	0.0001	0.006	0.00006	0.05	0.05	0.025
Cadmium	N/A	N/A	N/A	0.008/0.004 c	N/A	N/A	N/A	N/A	0.005	0.010	0.01
Copper	N/A	N/A	N/A	0.6	N/A	N/A	N/A	N/A	1.3c	1.0a	0.2
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.015c	0.05	0.025
Nickel	N/A	N/A	N/A	0.31	N/A	N/A	N/A	N/A	0.1d	NA	NA

SURFACE WATER

Chemical	Risk-Based Action Levels		
	Trespasser		
	HI = 1 (mg/L)	1E-04 Cancer risk (mg/L)	1E-06 Cancer Risk (mg/L)
Arsenic	N/A	28	0.28
Beryllium	N/A	0.12	0.001
Lead	N/A	N/A	N/A

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General Notes: HI - Chemical-specific total pathway hazard index

N/A = Not applicable

NA = Not available

a = The second value is the risk-based action levels adjusted for liver effects

b = While trichloroethene also produces kidney effects, adjusting for liver effects is more conservative.

c = The second value is the risk-based action levels adjusted for kidney effects.

[1] USEPA Maximum Contaminant Levels; 40 CFR Part 141

Notes for [1]:

a = for cis-1,2-dichloroethene

b = for trans-1,2-dichloroethene

c = action level

d = being remanded

[2] NYS Maximum Contaminant Levels; 10 NYCRR Part 1

Notes for [2]:

a = secondary MCL

[3] NYSDEC Water Quality Standards and Guidance Values; 6 NYCRR Part 703. Standards for Class GA groundwater.

Notes for [3]:

a = for trans-1,2-dichloroethene

TABLE 2-3

RISK-BASED ACTION LEVELS
CAPTAIN'S COVE SITE

GROUNDWATER

Chemical	Risk-Based Action Levels								ARARs		
	Site Worker			Child Resident			Adult Resident		USEPA MCLs [1]	NYS MCLs [2]	NYSDEC WQS [3]
	HI = 1 (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	HI = 1 (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	1E-04 Cancer Risk (mg/L)	1E-06 Cancer Risk (mg/L)	(mg/L)	(mg/L)	(mg/L)
Benzene	N/A	N/A	N/A	N/A	N/A	N/A	0.29	0.003	0.005	0.005	0.0007
Chlorobenzene	N/A	N/A	N/A	0.07/0.014 a	N/A	N/A	N/A	N/A	NA	0.005	0.0050
Chloroform	1.02	4.66	0.05	0.001/0.0002 a	2.93	0.03	1.36	0.01	0.01a/0.08b	0.050	0.0070
1,2-Dichloroethane	N/A	0.32	0.003	0.02	0.20	0.002	0.09	0.001	0.005	0.005	0.0050
1,2-Dichloroethene (total)	N/A	N/A	N/A	0.14/0.028 a	N/A	N/A	N/A	N/A	0.07c/0.1d	0.005	0.005 a
Tetrachloroethene	N/A	0.55	0.005	0.14/0.028 a	0.34	0.003	0.16	0.002	0.005	0.005	0.005
Trichloroethene	N/A	N/A	N/A	0.09/0.018 a	N/A	N/A	0.76	0.008	0.005	0.005	0.005
Vinyl chloride	N/A	0.01	0.0001	N/A	0.009	0.00009	0.004	0.00004	0.002	0.002	0.002
bis(2-Chloroethyl)ether	N/A	0.03	0.0003	N/A	0.02	0.0002	0.008	0.00008	NA	0.005	0.001
1,4-Dichlorobenzene	N/A	1.16	0.01	N/A	0.70	0.007	0.32	0.003	0.075	0.005	0.0047 b
Antimony	0.04	N/A	N/A	0.006	N/A	N/A	N/A	N/A	0.006	NA	0.003
Arsenic	0.03	0.02	0.0002	0.005	0.01	0.0001	0.006	0.00006	0.05	0.05	0.025
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.015e	0.05	0.025

General Notes: HI - Chemical-specific total pathway hazard index
N/A = Not applicable
NA = Not available
a = The second value is the risk-based action level adjusted for liver effects
[1] USEPA Maximum Contaminant Levels; 40 CFR Part 141
Notes for [1]:
a = Current MCL
b = 1994 Proposed rule for Disinfection By-Products:Total for all tri halo-methanes combined cannot exceed the 0.08 level.
c = for cis-1,2-dichloroethene
d = for trans-1,2-dichloroethene
e = action level
[2] NYS Maximum Contaminant Levels; 10 NYCRR Part 1
[3] NYSDEC Water Quality Standards and Guidance Values; 6 NYCRR Part 703. Standards for Class GA groundwater.
Notes for [3]:
a = for trans-1,2-dichloroethene
b = for 1,2-dichlorobenzene and 1,4-dichlorobenzene

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TABLE 2-4

RISK-BASED ACTION LEVELS
LI TUNGSTEN SITE

ALL SOILS

Chemical	Risk-Based Action Levels						ARARs	To Be Considered Criteria		
	Construction Worker			Child Resident			NYSDEC TAGM 4046 levels [1] (mg/kg)	USEPA SSLs [2]		Average Site Soil Background (mg/kg)
	HI = 1 (mg/kg)	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)	HI = 1 (mg/kg	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)		Ingestion (mg/kg)	Inhalation (mg/kg)	
Benzo[a]pyrene	N/A	N/A	N/A	N/A	13	0.13	0.061 or MDL	0.09ac	NA d	NA
Benzo[b]fluoranthene	N/A	N/A	N/A	N/A	125	1.25	1.1	0.9a	NA d	NA
Dibenz[a,h]anthracene	N/A	N/A	N/A	N/A	13	0.13	0.014 or MDL	0.09ac	NA d	NA
PCBs	N/A	N/A	N/A	N/A	28	0.28	1.0/10a	1.0e	NA e	NA
Antimony	355/177.5 a	N/A	N/A	31	N/A	N/A	SB	31	NA d	1.6
Arsenic	222	2412	24	20	52	0.52	7.5 or SB	0.4a	750a	6.3
Cobalt	98/49 a	N/A	N/A	N/A	N/A	N/A	30 or SB	NA	NA	7.27
Copper	N/A	N/A	N/A	2,894	N/A	N/A	25 or SB	NA	NA	16
Iron	N/A	N/A	N/A	23,464	N/A	N/A	2,000 or SB	NA	NA	20591
Lead	N/A	N/A	N/A	N/A	N/A	N/A	SB b	f	f	24
Manganese	244	N/A	N/A	1,799	N/A	N/A	SB	NA	NA	677
Nickel	17,743	N/A	N/A	1,564	N/A	N/A	13 or SB	1,600b	13,000a	13
Silver	53,229	N/A	N/A	N/A	N/A	N/A	SB	390b	NA d	0.47

SURFACE SOIL

Chemical	Risk-Based Action Levels						ARARs	To Be Considered Criteria		
	Site Worker			Trespasser			NYSDEC TAGM 4046 levels [1] (mg/kg)	USEPA SSLs [2]		Average Site Soil Background (mg/kg)
	HI = 1 (mg/kg)	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)	HI = 1 (mg/kg	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)		Ingestion (mg/kg)	Inhalation (mg/kg)	
PCBs	5	35	0.35	N/A	272	2.72	1.0/10a	1.0e	NA e	NA
Antimony	818	N/A	N/A	702	N/A	N/A	SB	31	NA d	1.6
Arsenic	209	130	1.30	303	785	7.85	7.5 or SB	0.4a	750a	6.3
Lead	N/A	N/A	N/A	N/A	N/A	N/A	SB b	f	f	24
Manganese	47,012	N/A	N/A	40,366	N/A	N/A	SB	NA	NA	677

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TABLE 2-4 (Continued)

RISK-BASED ACTION LEVELS
LI TUNGSTEN SITE

SEDIMENT

Chemical	Risk-Based Action Levels		
	Trespasser		
	HI = 1 (mg/kg)	1E-04 Cancer risk (mg/kg)	1E-06 Cancer Risk (mg/kg)
Arsenic	303	785	7.85
Lead	N/A	N/A	N/A

General Notes:

HI - Chemical-specific total pathway hazard index

N/A = Not applicable

NA = Not available

a = The second value is the risk-based action level adjusted for circulatory system effects

[1] New York State Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels; HRW-94-4046 suburban areas or near highways are much higher and typically range from 200-500 mg/kg.

Notes for [1]:

a = 1.0 mg/kg for surface soil and 10 mg/kg for subsurface soil.

b = Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 mg/kg.

SB = Site Background

MDL = Method Detection Limit

[2] USEPA Soil Screening Levels based on residential land use; the SSLs are based on the effects (noncarcinogenic or carcinogenic) that produce the most restrictive value.

Notes for [2]:

a = Calculated values correspond to a cancer risk level of 1 in 1,000,000.

b = Calculated values correspond to a noncancer hazard quotient of 1.

c = Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).

d = No toxicity criteria available for that route of exposure.

e = A preliminary remediation goal of 1 mg/kg has been set for PCBs.

f = An interim soil lead guidance value of 400 mg/kg for residential land use and a soil lead guidance range of 750 - 1700 mg/kg for industrial land use have been set for lead.

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TABLE 2-5

RISK-BASED ACTION LEVELS
CAPTAIN'S COVE SITE

ALL SOILS

Chemical	Risk-Based Action Levels						ARARs	To Be Considered Criteria		
	Construction Worker			Child Resident			NYSDEC TAGM 4046 levels [1] (mg/kg)	USEPA SSLs [2]		Average Site Soil Background (mg/kg)
	HI = 1 (mg/kg)	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)	HI = 1 (mg/kg	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)		Ingestion (mg/kg)	Inhalation (mg/kg)	
Benzo(a)anthracene	N/A	N/A	N/A	N/A	125	1.25	0.024 or MDL	0.9a	NA d	NA
Benzo[a]pyrene	N/A	N/A	N/A	N/A	13	0.13	0.061 or MDL	0.09ac	NA d	NA
Benzo[b]fluoranthene	N/A	N/A	N/A	N/A	125	1.25	1.1	0.9a	NA d	NA
Dibenz[a,h]anthracene	N/A	N/A	N/A	N/A	13	0.13	0.014 or MDL	0.09ac	NA d	NA
PCBs	10/5 a	N/A	N/A	0.97	28	0.28	1.0/10a	1.0e	NA e	NA
Antimony	355/118 b	N/A	N/A	31	N/A	N/A	SB	31	NA d	1.6
Arsenic	222	2412	24	20	52	0.52	7.5 or SB	0.4a	750a	6.3
Barium	2,373/791 b,c	N/A	N/A	N/A	N/A	N/A	300 or SB	690,000b	1,600g	49
Cadmium	428	N/A	N/A	42	N/A	N/A	1 or SB	1,800e	8g	ND
Cobalt	99/33 b	N/A	N/A	N/A	N/A	N/A	30 or SB	NA	NA	7.27
Copper	32,825	N/A	N/A	2,894	N/A	N/A	25 or SB	NA	NA	16
Iron	266,146	N/A	N/A	23,464	N/A	N/A	2,000 or SB	NA	NA	20591
Lead	N/A	N/A	N/A	N/A	N/A	N/A	SB b	f	f	24
Manganese	244	N/A	N/A	1,799	N/A	N/A	SB	NA	NA	677

SURFACE SOIL

Chemical	Risk-Based Action Levels						ARARs	To Be Considered Criteria		
	Site Worker			Trespasser			NYSDEC TAGM 4046 levels [1] (mg/kg)	USEPA SSLs [2]		Average Site Soil Background (mg/kg)
	HI = 1 (mg/kg)	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)	HI = 1 (mg/kg	1E-04 Cancer Risk (mg/kg)	1E-06 Cancer Risk (mg/kg)		Ingestion (mg/kg)	Inhalation (mg/kg)	
PCBs	4.99	35	0.35	9.34	272	2.72	1.0/10a	1.0e	NA e	NA
Antimony	818	N/A	N/A	702	N/A	N/A	SB	31	NA d	1.6
Arsenic	209	130	1.30	303	785	7.85	7.5 or SB	0.4a	750a	6.3
Lead	N/A	N/A	N/A	N/A	N/A	N/A	SB b	f	f	24

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TABLE 2-5 (Continued)

RISK-BASED ACTION LEVELS
CAPTAIN'S COVE SITE

SEDIMENT

Chemical	Risk-Based Action Levels		
	Trespasser		
	HI = 1 (mg/kg)	1E-04 Cancer risk (mg/kg)	1E-06 Cancer Risk (mg/kg)
Arsenic	N/A	785	7.85
Lead	N/A	N/A	N/A

General Notes:

HI - Chemical-specific total pathway hazard index

N/A = Not applicable

NA = Not available

a = The second value is the risk-based action level adjusted for developmental effects

b = The second value is the risk-based action levels adjusted for circulatory effects

c = While barium also produces developmental effects, adjusting for circulatory system effects is more conservative.

[1] New York State Department of Environmental Conservation Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels; HRW-94-4046

Notes for [1]:

a = 1.0 mg/kg for surface soil and 10 mg/kg for subsurface soil.

b = Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 mg/kg. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 mg/kg.

SB = Site Background

MDL = Method Detection Limit

[2] USEPA Soil Screening Levels based on residential land use; the SSLs are based on the effects (noncarcinogenic or carcinogenic) that produce the most restrictive value.

Notes for [2]:

a = Calculated values correspond to a cancer risk level of 1 in 1,000,000.

b = Calculated values correspond to a noncancer hazard quotient of 1.

c = Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).

d = No toxicity criteria available for that route of exposure.

e = A preliminary remediation goal of 1 mg/kg has been set for PCBs.

f = An interim soil lead guidance value of 400 mg/kg for residential land use and a soil lead guidance range of 750 - 1700 mg/kg for industrial land use have been set for lead.

g = SSL for a pH of 6.8.

Generally, risk-based action levels with a target risk level of 1E-06 for individual carcinogens leads to cumulative risks within the 1E-04 to 1E-06 acceptable risk range. To be protective of cumulative risks from exposure to noncarcinogens, consideration was given to those chemicals that induce the same effect (termed toxic endpoint). The chemicals that can affect the same target organ or system (i.e., have the same toxic endpoint), based on the toxicological basis used to derive the verified reference dose (RfD) or verified reference concentration (RfC), are presented below.

Toxicological Basis	Chemical
Central Nervous System	1,1,1-Trichloroethane
	Manganese
Circulatory System	Antimony
	Barium
	Cobalt
Development	PCBs
	Barium
	Nickel
Immune System	PCBs
Kidney	Trichloroethene
	1,4-Dichlorobenzene
	Cadmium
Liver	Chlorobenzene
	Chloroform
	1,1-Dichloroethene
	1,2-Dichloroethene (total)
	Methylene chloride
	Tetrachloroethene
	Trichloroethene
	1,4-Dichlorobenzene
	Iron
Skin	Arsenic
	Silver
Gastrointestinal Tract	Copper
Lung	1,2-Dichloroethane

For each medium, if more than one chemical has the same toxic endpoint, the risk-based action levels for those chemicals were adjusted by dividing by the number of chemicals within that group. For example, the risk-based action levels derived for site worker exposure to groundwater at the Li Tungsten site for 1,2-dichloroethene (total) and trichloroethene, both liver

toxins, were divided by 2. The risk-based action levels in groundwater and all soil were adjusted as presented in Tables 2-2 through 2-5.

Exposure to surface soil via inhalation of respirable particulates by off-site residential receptors was evaluated in the baseline risk assessment for the Li Tungsten site. Due to the complexity of modeling the emission and dispersion in air of multiple chemicals from multiple area sources for evaluating risks to the off-site residents under the current scenario, risk-based action levels for this population were not specifically derived. Instead, risk-based action levels derived for soil for other populations were used to re-estimate the risks to off-site residents. The risk-based action levels were input into the exposure and risk calculations, for the predominant contributors to the risk estimates (i.e., arsenic, cobalt and manganese), by an iterative process beginning with the highest concentration. The risk-based action levels based on non-carcinogenic effects for arsenic for trespasser exposure to surface soil and for cobalt and manganese for construction worker exposure to all soils are protective of off-site resident inhalation exposure.

2.2.3 Determination of Radiological Risk-Based Action Levels

As discussed in Section 2.2.4.2, OSWER Directive No. 9200.4-25 (USEPA, 1998) established cleanup levels of 5 pCi/g plus background (i.e., approximately 6 pCi/g) for radium (sum of ^{226}Ra and ^{228}Ra) and thorium (sum of ^{230}Th and ^{232}Th) as relevant and appropriate at sites such as Li Tungsten where waste residues are similar to those present at uranium mill tailings sites. The RESRAD modeling performed as part of the radiological risk assessment during the RI, confirmed that these concentrations are protective for future occupants of the Li Tungsten site.

2.2.4 Allowable Exposure Based on ARARs

Section 121(d)(2)(A) of CERCLA incorporates into law the CERCLA Compliance Policy, which specifies that Superfund remedial actions meet any federal standards, requirements, criteria, or limitations that are determined to be ARARs. State ARARs must be met if they are more stringent than federal requirements. Furthermore, Section 121 requires the

selection of a remedial action that is protective of human health and the environment. Determining protectiveness involves a risk assessment in accordance with CERCLA guidance.

TBCs are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. As described below, TBCs will be considered along with ARARs and may be used in determining the necessary level of cleanup for protection of health and the environment.

ARARs (and TBCs necessary for protection) must be attained for hazardous substances, pollutants, or contaminants remaining on-site at the completion of the remedial action, unless waiver of an ARAR is justified. In addition, the USEPA intends that the implementation of remedial actions should also comply with ARARs (and TBCs as appropriate) to protect public health and the environment. ARARs (and TBCs necessary for protection), pertaining both to contaminant levels and to performance or design standards, should generally be attained at all points of potential exposure, or at the point specified by the ARAR itself.

This section describes federal and state environmental and public health requirements that are potential ARARs and TBCs for these sites. The information in this section is based upon CERCLA Compliance with Other Laws Manual: Interim Final (USEPA, 1988b), CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental and State Requirements (USEPA, 1989a), and USEPA's Generic Work Plan (USEPA, 1989b).

2.2.4.1 Definition of ARARs

A requirement under other environmental laws may be either "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involves a two-part analysis. First, determine if a given requirement is applicable; then if it is not applicable, determine if it is nevertheless both relevant and appropriate.

Applicable Requirements are those cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and Appropriate Requirements are those cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Other Requirements To Be Considered are federal and state guidance documents or criteria that are not generally enforceable but are advisory and do not have the status of potential ARARs. Guidance documents or advisories TBC in determining the necessary level of cleanup for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective. Three classifications of ARARs have been established and include:

- Chemical-Specific - Usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment;

- Location-Specific - Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations; and

- Action-Specific - Usually technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes.

A list of chemical-specific, location-specific and action-specific ARARs are presented in Tables 2-6, 2-7 and 2-8, respectively. As the FS progresses to remedial design/remedial action, this list of ARARs can be continually updated. ARARs are used as a guide to determine

Chemical Specific ARARs
Table 2-6

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR, Part 268.35 Waste specific prohibitions-Third Third wastes	Relevant and appropriate	Debris contaminated with any characteristic hazardous waste for which treatment standards are established are prohibited from land disposal.	Debris is defined as nonfriable inorganic solids or metal that are incapable of passing through a 9.5 mm standard sieve that require cutting, crushing and grinding in mechanical sizing equipment.
Federal	40 CFR, Part 268.40 Treatment Standards found in Table 1 in 40 CFR Part 261.24	Relevant and appropriate	Hazardous constituents in hazardous waste or in treated residue must be at or below the values found in the table ("total waste standards) for that waste and the extract of treated residue must be at or below the values found in the "waste extract standards" and the waste must be treated using specified technology.	Technology standards or an equivalent treatment technology approved by the administrator exists for wastes prior to land disposal.
Federal	40 CFR, Part 268	Relevant and appropriate	Land Disposal Restrictions (LDRs) identifies hazardous wastes that are restricted from land disposal and defines the limited circumstances under which an otherwise prohibited waste may be land disposed.	Soils and sediments removed for off-site disposal may contain inorganic contaminants at concentrations which trigger LDRs.
Federal	40 CFR, Part 262	Relevant and appropriate	Standards Applicable to generators of hazardous waste	Some remedial actions will generate hazardous waste for treatment and disposal.
Federal	40 CFR, Part 263	Relevant and appropriate	Standards applicable to transporters of hazardous waste	Some remedial actions require transportation and off-site disposal of hazardous wastes.

Chemical Specific ARARs
Table 2-6

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR, Part 264	Relevant and appropriate	Standards for owners and operators of hazardous waste treatment, storage.and disposal facilities are applicable to any on-site units that treat, store, or dispose of RCRA listed or characteristic hazardous wastes	Some remedial alternatives include options which depend on on-site disposal of inorganic contaminated waste.
Federal	OSWER Off-site Policy Directive Number 98934.11	Relevant and appropriate	This ensures that facilities authorized to CERCLA generated wastes comply with RCRA operating standards	Some remedial action alternatives include options for off-site disposal.
Federal	40 CFR Part 264	Relevant and appropriate	Offsite units that treat, store or dispose of RCRA listed or characteristic wastes. Regulations address groundwater and closure.(Subpt F & G)	Some remedial action alternatives include options which depend on on-site disposal of contaminated waste. Groundwater will require monitoring for remedial action alternatives.
Federal	40 CFR Part 265, subparts I & J	Relevant and appropriate	Defines time frame wastes may be stored on-site. The date on which the accumulation began must be clearly indicated on each container/ tank.	Some remedial action alternatives will require the temporary storage of hazardous wastes on-site prior to transfer or on-site disposal.
Federal	40 CFR 141 Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs)	Relevant and Appropriate	Provides standards for the protection of drinking water.	The promulgated values are included in the SDWA MCLs. The standards are compared with the maximum contaminant levels at the Li Tungsten and Captain's Cove Adjunct Sites.

Chemical Specific ARARs
Table 2-6

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	Application of Subtitle D to Mining Waste	To be Considered	If materials to be disposed of are determined to be a RCRA hazardous waste, they may be subject to control under Subtitle C	Some remedial actions may require fully compliance with RCRA hazardous waste disposal requirements under Subtitle C if determined to be mining wastes.
Federal	Joint NRC/EPA Guidance on Testing Requirements for Mixed Waste	To be Considered	Used to determine the wastes' RCRA hazard status and LDR sampling requirements. Mixed waste must comply with both AEA and RCRA statutes and regulations (AEA takes precedence where there is inconsistency between the two laws)	Testing requirements must be considered in developing sampling programs for mixed wastes.

Location Specific ARARs
Table 2-7

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR Part 261, RCRA Section 3001 (b) (3) (c)	Relevant and appropriate	Regulatory determination for solid waste from the extraction and beneficiation of ores and minerals	This section of RCRA requires Administrator to determine whether to promulgate regulations under Subtitle C of the Act for these wastes or to determine that such regulations are unwarranted
Federal	Wetlands	Relevant and appropriate	Functional assessment and impacts mitigation	Some remedial actions may disturb the three wetand areas identified on Parcel B and C.
Federal	Floodplains Assessment	Relevant and appropriate	Must be developed if remedial action impact flood plains.	Assessment of the remedial action's impacts on the floodplain as well as recommending appropriate measures to protect the remedy against a potential flood event
Federal	Cultural Resources	Relevant and appropriate	Determination whether the sites are sensitive for the presence of potentially significant cultural resources-	NB still working on their comments as of 1/98
Federal	Endangered Species	Relevant and appropriate	Regulations for the protection of endangered species.	No further action required as indicated by USEPA, Region II.
Federal	Coastal Zone	Relevant and appropriate	Evaluation must be conducted to evaluate any proposed remedial actions	Impacts to coastal zones must be evaluated for some remedial actions.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR, Part 268.35 Waste specific prohibitions-Third third wastes	Relevant and appropriate	Debris contaminated with any characteristic waste for which treatment standards are established are prohibited from land disposal.	Debris is defined as nonfriable inorganic solids or metal that are incapable of passing through a 9.5 mm standard sieve that require cutting, crushing and grinding in mechanical sizing equipment.
Federal	40 CFR, Part 268	Relevant and appropriate	Land Disposal Restrictions (LDRs) identifies hazardous wastes that are restricted from land disposal and defines the limited circumstances under which an otherwise prohibited waste may be land disposed.	LDRs contain requirements for testing, treatment, storage, notification, certification of compliance, variances and record keeping. Wastes may be excluded from the ban under select circumstances defined in 40 CFR Part 268
Federal	40 CFR 192	Relevant and appropriate	Standards for the disposal and control of uranium and thorium tailings. Requires excavation of soil with radium concentrations (sum of ^{228}Th and ^{232}Th) greater than 5 pCi/g over the first 15 cm below the surface and 15 pCi/g in subsequent subsurface soils (over areas >100 square meters). *Provides radon progeny standard for exposure of 0.02 WL*	These standards provide guidelines for the remediation /excavation of materials contaminated with the ROPC
Federal	40 CFR 50	Relevant and Appropriate	Defines levels of air quality to protect the public health and welfare from any known or anticipated adverse effects of a pollutant.	Provides ambient air quality standards during remediation.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR 61	Relevant and Appropriate	Provides radionuclides exposure standard of 10 mrem/yr to maximally exposed member of public	Provides emissions standards during remediation
State	Naturally Occurring Radioactive Material (NORM)	Applicable	Waste materials including soil and/or building materials are analyzed for chemically hazardous constituents (as defined by RCRA regulations)	RCRA disposal requirements would be ARARs if the waste disposed contains both chemical constituents at hazardous levels (as defined by RCRA)
State	6 NYCRR Parts 200, 201, 211, and 257	Applicable	Criteria to prevent air pollution. Requirements of owners and/or operators of air contamination sources. Provides ambient air quality standards.	Provides ambient air quality protection requiements and guidelines during remediation efforts.
State	6 NYCRR Parts 360 and 364	Applicable	Outline requirements of solid and hazardous waste mangement facilities and transporters for managing radioactive/hazardous materials.	For management of radioactive/hazardous waste generated during the remediation efforts (which includes on-site treatment).
State	New York Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (6 NYCRR 370 and 373)	Relevant and Appropriate	This regulation outlines general waste facility requirements, outline general waste analyses, security measures, inspections and training requirements.	These requirments must be considered for on-site landfill alternatives.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	49 CFR 173 Hazardous Materials Transportation Act	Applicable	Requirements for the transportation of hazardous and radioactive materials. Radioactive materials defined as: (1) Material having a specific activity greater than 0.002 micro-Curie per gram (uCi/g) (2) Low Specific Activity (LSA) material-uranium or thorium ores and nonradioactive material externally contaminated with no more than 0.1 uCi per square cm.	Some remedial actions require the off-site disposal of hazardous and radioactive materials.
Federal	49 CFR 173.411-423	Applicable	Outlines specific packing requirements for LSA materials.	For remedial action alternatives involving off-site shipment, a single shipment must not exceed 2,000 pCi/g for total radioactivity concentration.
Federal	OSHA - General Industry Standards (29 CFR 1910)	Applicable	These regulations specify the 8-hour time-weighted average concentration for worker exposure to various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120	These regulations are applicable during remedial actions during construction of facilities for soil and groundwater remediation at the Li Tungsten and Captain's Cove Adjunct sites.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	40 CFR 122.44	Relevant and Appropriate	Requires to use best available technology (BAT) to control toxic and nonconventional pollutants; use of best conventional pollutant control technology (BCT) for conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.	Remedial action alternatives require the best available technology to control toxic and nonconventional pollutants.
Federal	40 CFR 12.100 and 40 CFR 125.104	Relevant and Appropriate	Requires to develop and implement a Best Management Practices program to prevent the release of toxic constituents to surface water.	Since portions of the Li Tungsten and Captain's Cove Adjunct sites border bodies, a Best management Practice Program will need to be implemented to prevent the release of toxic constituents.
Federal	40 CFR 136.1-136.4	Relevant and Appropriate	Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided. Samples preservation procedures, container materials and maximum allowable holding times are prescribed.	Analytical samples collected and analyzed for remedial action of soils and groundwater must follow approved test methods and quality control procedures. Applicable to confimration of post-remediation sampling and long-term groundwater monitoring.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
Federal	CWA Water Quality Criteria (WQC) for Protection of Human Health and Aquatic Lifes	To Be Considered	Contaminant levels regulated by WQC are provided to protect human health for exposure from drinking water and from consuming aquatic organisms (primary fish) and from fish consumption alone.	WQC are also relevant and appropriate to evalute surface water discharge acceptability.
Federal	RCRA 3004 (f), (g), and (m) 40 CFR Parts 148 & 268.2 established under the Hazardous and Solid Waste Amendments (HSWA)	Relevant and Appropriate	Hazardous waste to be injected is subject to land ban regulations. Treated groundwater that meets the definition of hazardous waste and is to be injected also is subject to land ban regulations. Groundwater contamination with restricted RCRA hazardous waste, which is extracted must meet the best demonstrated available technology (BDAT) identified for that waste under the RCRA CDRs prior to each reinjection, in a pump-and-treat reinjection remediation system.	Groundwater remediation alternatives under consideration include options for withdrawal and reinjection of treated groundwater. Treated groundwater that meets the definition of hazardous waste and is to be injected also is subject to land ban regulations.
State	NY TOGS 2.1.2 April 1987	To be Considered	Provides standards for reinjection of treated groundwater. References the application NY effluent limitation for discharge of treated groundwater, 6 NYCRR 703.6. Groundwater to be treated to drinking water standards prior to reinjection.	Standards for pump and treat groundwater alternatives and application of NY effluent limitations for discharge of treated groundwater.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
State	NY TOGS 1.1.1 June 1998	To be Considered	Provides contaminant levels guidance for discharge of treated groundwater.	Provides discharge standards of treated groundwater.
Federal	40 CFR 144.12, 144.13, 144.16, 144.28, 144.51, 14.55, 40 CFR 144.55	Relevant and Appropriate	Provides criteria for reinjection of treated groundwater.	Criteria for remedial action alternatives involving pump and treat of groundwater at the Li Tungsten site.
Federal	40 CFR 147	Relevant and Appropriate	Provides requirements to comply with state underground injection.	On-site injection of treated groundwater must comply with state requirements.
Federal	40 CFR 148.20	To be Considered	The injection of a restricted hazardous waste from mineral processing into an injection well should submit a petition to the administrator demonstrating that there will be no migration of hazardous constituents under the injection zone.	Remedial action alternatives involving the injection of treated groundwater into injection wells will consider this criteria.
State	6 NYCRR Groundwater Quality Standards Part 703.5	Applicable	Provide quality standards for groundwater. Certain contaminant levels are specified.	Remedial action alternatives for groundwater must meet the quality standards specified under 6 NYCRR, Part 703.5.
State	New York State Air Guidelines for Control of Toxins (Air Guide-1)	Applicable	Provides NYSDEC guidelines for ambient air concentrations for individual compounds.	Provides ambient air quality guidance values during remediation.

Action Specific ARARs
Table 2-8

REGULATORY LEVEL	ARAR IDENTIFICATION	STATUS	REQUIREMENT SYNOPSIS	FS CONSIDERATION
State	NYSDEC, Division of Hazardous Waste Remediation - Technical and Administrative Guidance Memorandum (TAGM): Determination of Soil Cleanup Objectives and Cleanup Levels	To be Considered	Provides the basis and procedures to determine soil cleanup levels at State Superfund Sites	Provides soil cleanup objectives for consideration in the development of soil cleanup levels for nonradioactive contaminants.
State	NYSDEC - Technical Guidance for Screening Contaminated Sediments	To be Considered	Provides methodology used by the Division of Fish and Wildlife to establish sediment criteria to identify contaminated sediments.	Provides guidance values to identify contaminated sediments.

the appropriate extent of cleanup; to formulate and select proposed treatment technologies; and to govern the implementation/operation of the selected action. Primary consideration will be given to remedial alternatives that attain or exceed the requirements found in the ARARs. ARARs will also be discussed in Section 3.0 as they relate to the development and screening of remedial alternatives.

2.2.4.2 Preliminary Identification of Potential Radioactivity ARARs and TBCs

The radionuclides uranium and thorium and their decay products (which include radium and radon) are listed as hazardous substances under CERCLA in 40 CFR 302.4 because they are classified as hazardous substances under Section 112 of the Clean Air Act. Regulatory responsibilities for radiation protection are shared by the USEPA, Nuclear Regulatory Commission (NRC), Occupational Safety and Health Administration (OSHA), United States Department of Energy (DOE), United States Department of Transportation (DOT) and agencies within the 50 State governments.

In OSWER Directive No. 9200.4-25, Use of Soil Cleanup Criteria in 40 CFR Part 192 as Remediation Goals for CERCLA Sites, the relevance at CERCLA sites of the 40 CFR Part 192 standards which establish cleanup levels at uranium mill tailing sites is described. When thorium and/or radium contaminants at a CERCLA site are distributed in soil similar to their distribution at mill tailing (Title I) sites as described in 40 CFR Part 192,[1] the 15 pCi/g limit for radium in subsurface soils is a potentially relevant and appropriate requirement. This concentration is used to identify contaminated materials; it is not the actual clean-up level. The Directive states that the 5 pCi/g surface concentration for radium may be suitable if found to be protective; utilizing the 15 pCi/g subsurface standard in effect ensures that all contaminated soil in the subsurface is remediated to the 5 pCi/g level. Since Li Tungsten radioactive waste residues are similar to uranium mill tailings waste, the 5 pCi/g and 15 pCi/g radium standards are appropriate and relevant for use at the Li Tungsten site.

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[1]Wastes found at these sites have very little residues contaminated at concentrations between 5 pCi/g and 30 pCi/g. The 15 pCi/g subsurface radium standard is used to effectively clean Title I properties to less than 5 pCi/g.

OSWER Directive No. 9200.4-25 also addresses wastes which contain commingled radium and thorium, such as the waste residues found at the Li Tungsten site. The 40 CFR Part 192 5 pCi/g standard for radium pertains to the sum of the concentrations of ^{226}Ra and ^{228}Ra. Compliance with the standard mandates that ^{230}Th (the parent radionuclide of ^{226}Ra) and ^{232}Th (the parent radionuclide of ^{228}Ra) must be limited to the same concentrations as their radium decay products, so as to prevent future buildup (due to radioactive in-growth) of the radium isotopes to concentrations which exceed the standard. Therefore, the standards also apply to the sum of ^{230}Th and ^{232}Th.

USEPA has also adopted a policy of establishing dose-based guidance for limiting the risk to the general public from exposure to residual radioactivity. OSWER Directive No. 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (USEPA, 1997) advises USEPA staff that if a dose assessment is conducted at a site, then an effective dose equivalent of 15 millirem per year (mrem/yr) above background should generally be the maximum dose limit for humans. This dose rate would achieve a lifetime risk level of approximately 3×10^{-4}, which is a level generally considered protective and consistent with the risk reduction objectives of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(USEPA, 1990). Since annual dose equivalent (from all pathways) cannot be directly measured, dose assessment models must be utilized to relate medium-specific radionuclides of concern to annual dose under a defined, appropriate land use scenario. The 15 mrem/yr dose equivalent rate is not an ARAR, but rather a guidance level which should only be used to help establish cleanup levels for radioactive materials in the absence of ARARs.

Occupational control of radiation exposure is addressed by OSHA in 29 CFR 1910.120, Hazardous Waste Operations And Emergency Response. Radiation monitoring is required during initial investigations of hazardous waste facilities. Radioactive wastes must not be handled until the hazard to workers is assessed.

In 1993, the NYSDEC issued TAGM 4003, entitled Cleanup Guideline for Soils Contaminated with Radioactive Materials (NYSDEC, 1993). This document established State policy which limits the annual total effective dose equivalent to the maximally exposed member of the general public to 10 mrem above background (with additional consideration given to

ensure that doses are as low as reasonably achievable) from exposure to residual radioactivity in soils. This guidance is a TBC for the two sites.

Risks due to exposure to radon and radon decay products have been evaluated by the USEPA as well as many other scientific bodies. The USEPA has established indoor exposure guidelines (which are a TBC for these two sites) in the 1992 Citizen's Guide to Radon (USEPA, 1992). To mitigate the impact of radon and its decay products, new construction should adhere to relevant building codes.

The ingestion of radionuclides in drinking water has been regulated at the federal level. MCLs have been promulgated by the USEPA in 40 CFR 141.15 and 141.16. These limit the sum of ^{226}Ra and ^{228}Ra to 5 pCi/L, gross alpha activity (excluding radon and uranium isotopes) to 15 pCi/L, and beta/gamma emitters to concentrations resulting in a 4 mrem annual dose equivalent in community water systems. The MCLs for radionuclides in public drinking water systems are summarized in Table 2-9.

The discharge of radionuclides to air and water is addressed by the State of New York in 6 NYCRR Part 380-11.7 (Table II). Release limits for radium, thorium, and uranium above natural background are shown in Table 2-10. Limits for release into the sanitary sewer system contained in NYCRR Part 380-11.7 (Table III) are shown in Table 2-11. Another potential ARAR is NYS ECL Part 382, which contains the regulations pertaining to low-level radioactive waste disposal facilities.

Naturally Occurring Radioactive Material (NORM) is not considered hazardous waste under the Resource Conservation and Recovery Act (RCRA), nor does it fall into any classification categories under the Atomic Energy Act (AEA) or the Low Level Radioactive Waste Policy Act (LLRWPA). Prior to disposal, waste material will be analyzed for chemically hazardous materials as defined in RCRA regulations. RCRA disposal requirements are relevant and appropriate to commingled wastes containing both chemical and radioactive materials. Regulations under 49 CFR 171-173 govern all modes of hazardous materials transportation, including packing, repacking, handling, labeling, marking, placarding and routing. Key definitions which address DOT regulations concerning radioactive material are:

TABLE 2-9 MAXIMUM CONTAMINANT LIMITS (MCLs) FOR RADIONUCLIDES IN PUBLIC DRINKING WATER SYSTEMS	
RADIONUCLIDE	MCL (pCi/L)
Ra-226 & Ra-228	5
Gross Alpha (excluding radon and uranium)	15
Beta/gamma emitters	4*

*Beta/gamma emitters limited to concentrations resulting in a 4 mrem annual dose equivalent.

Source: 10 NYCRR Part 5-1.52; 40 CFR 141.15-.16.

TABLE 2-10

CONCENTRATION LIMITS IN AIR AND WATER ABOVE NATURAL BACKGROUND FOR RADIONUCLIDES RELEVANT TO THE LI TUNGSTEN AND CAPTAIN'S COVE SITES

RADIONUCLIDE	AVERAGE CONCENTRATION AIR ($\mu Ci/ml$)	AVERAGE CONCENTRATION WATER ($\mu Ci/ml$)
^{226}Ra	9×10^{-13}	6×10^{-8}
^{228}Ra	2×10^{-12}	6×10^{-8}
^{230}Th	2×10^{-14}	1×10^{-7}
^{232}Th	4×10^{-15}	3×10^{-8}
^{234}U	1×10^{-12}	3×10^{-7}
^{238}U	1×10^{-12}	3×10^{-7}

Source: 6 NYCRR Part 380-11.7 Table II

TABLE 2-11 RELEASE OF RADIONUCLIDES INTO THE SANITARY SEWER SYSTEM	
RADIONUCLIDE	MONTHLY AVERAGE ($\mu Ci/ml$)
^{226}Ra	6×10^{-7}
^{228}Ra	6×10^{-7}
^{230}Th	1×10^{-6}
^{232}Th	3×10^{-7}
^{234}U	3×10^{-6}
^{238}U	3×10^{-6}
U-natural[1]	3×10^{-6}

NOTES:
[1] In equilibrium with decay products.
Source: 6 NYCRR Part 380-11.7 Table III

- Radioactive material - any material having a specific activity greater than 0.002 μCi/g (49 CFR 171);

- Low Specific Activity (LSA) material - uranium or thorium ores and nonradioactive material externally contaminated with no more than 0.1 μCi per square cm. Specific packing requirements for LSA materials are presented in 49 CFR 173.425. A single shipment must not exceed 2,000 pCi/g for total radioactivity concentration. Packaging exceptions are given in 49 CFR 173.421. Limited quantities of radioactive materials are defined in 49 CFR 173.423. General design packaging requirements are outlined in 49 CFR 173.411-419.

2.2.5 Selection of Preliminary Remediation Goals

Preliminary Remediation Goals (PRGs) for soils are presented in Table 2-12. PRGs for soil were selected on a parcel-by-parcel basis using the following rationale:

- Parcel A: Apply risk-based cleanup values. The inorganic and radiological contamination in the soils is localized (organic contamination of groundwater will be addressed by the NYSDEC and is not included in the Draft Final FS Report). Risk-based chemical numbers, therefore, will be protective for commercial use of the property and the 5 pCi/g standard is protective for future site occupants.

- Parcels B and C: Apply a combination of TAGMs and cleanup levels developed for the State Superfund cleanup at Captain's Cove for chemical contaminants in the soil (including PCBs on Parcel B) and the New York State (NYS) Sediment Criteria for sediments (Parcels B and C); apply 5 pCi/g standard for radiological contamination. There is both inorganic and radiological contamination in the soils and sediments on these two parcels, therefore, the combination of TAGMs, cleanup levels developed for the State Superfund cleanup at Captain's Cove and

Table 2-12. Preliminary Remediation Goals (PRGs) for Soil.

Parameter	Parcel A Risk-Based Action Levels for Construction Worker (mg/Kg)	Parcels B, C, C′ and Captain's Cove (mg/Kg)[1]	Site Background (SB) Concentrations (mg/Kg)
Benzo(a)pyrene	8.5	1.1	NA
Benzo(b)fluoranthene	85	1.6	NA
Dibenz(a,h)anthracene	8.5	0.25	NA
PCBs	10.1	1.0	NA
Antimony	355	34.6	1.6
Arsenic	24	32.6	6.3
Barium	840	528	49
Beryllium	59	0.54	0.85
Cobalt	98	30 or SB	7.27
Copper	32,825	1,370	16
Iron	266,146	68,000	20,591
Lead	400[2]	729	24
Manganese	244[3]	SB	677
Nickel	8,872	268	13
Silver	24	12.1	0.47
Sum of ^{230}Th and ^{232}Th	5 + background[4]	5 + background[4]	2.4[4]
Sum of ^{226}Ra and ^{228}Ra	5 + background[4]	5 + background[4]	2.4[4]

NOTES:

[1] Based on a combination of NYS TAGMs and cleanup levels developed for the State Superfund cleanup at Captain's Cove.

[2] Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive No. 9355.4-12).

[3] Below site background concentration, therefore, default to site background (SB).

[4] Units of pCi/g.

NYS Sediment Criteria will be protective of the groundwater and the radiological 5 pCi/g standard is protective for future site occupants.

- Captain's Cove: Apply a combination of TAGMs and cleanup levels developed for the State Superfund cleanup at Captain's Cove for chemical contaminants in soil; apply 5 pCi/g standard for radiological contamination. There is both inorganic and radiological contamination in the soils at this location, therefore, the risk-based action levels will be protective of the groundwater and the radiological 5 pCi/g standard is protective for future site occupants.

Selection of the groundwater PRGs was based on the lowest concentration from among the following: risk-based action levels; the USEPA Maximum Contaminant Levels (MCLs) (40 CFR Part 141); the New York State MCLs (10 NYCRR Part 1) and; the NYSDEC Water Quality Standards and Guidance Values (6 NYCRR Part 703 - Standards and Guidance Values for Class GA Groundwater). The PRGs for groundwater are presented in Table 2-13.

The arsenic PRG selected was calculated to prevent an adult resident exposure which would cause an estimated cancer risk greater than 1E-04 or a total pathway hazard index greater than 1.0. All groundwater samples collected during the two rounds of sampling for copper and benzene (selected as COPCs) were below the selected PRG of 1 mg/L and 0.005 mg/L, respectively. Dissolved lead was detected at a concentration of 23.6 μg/L slightly above the PRG of 15 μg/L in the first round at MP-2D only. Groundwater at the Captain's Cove site was not contaminated with radionuclides above PRGs, therefore, no remedial alternatives were developed to address groundwater.

2.3 GENERAL RESPONSE ACTIONS

This subsection identifies remediation areas, presents the calculation of remediation volumes and presents a screening of general response actions and associated process options. The following general response actions were considered for soil/sediment and building remediation:

Table 2-13. Preliminary Remediation Goals (PRGs) for Groundwater.

Parameter	Risk-Based Action Levels for Adult Resident (mg/L)	USEPA Maximum Contaminant Levels (MCLs)[1] (mg/L or pCi/L)	New York State Maximum Contaminant Levels (MCLs)[2] (mg/L)	NYSDEC Water Quality Standards[3] (mg/L)
Benzene	-	-	0.005	
1,1-Dicholoroethene	-	-	0.005	
1,2-Dichloroethene (total)	-	-	0.005	
Methylene Chloride	-	-	0.005	
1,1,1-Trichloroethane	-	-	0.005	
Tetrachloroethene	-	-	0.005	
Vinyl Chloride	-	-	0.002	
Antimony	-	-	-	0.003
Arsenic	-	0.05	-	
Cadmium	-	0.005	-	
Copper	-	1.0	-	
Lead	-	0.015[4]	-	
Nickel	-	0.1[5]	-	
^{226}Ra and ^{228}Ra[6]	-	5[7]	-	
Gross Alpha (excluding radon and uranium)[6]	-	15[7]	-	
Beta/gamma emitters[6]	-	4[7,8]	-	-

NOTES:

[1] USEPA Maximum Contaminant Levels, 40 CFR Part 141.
[2] NYS Maximum Contaminant Levels, 10 NYCRR Part 1.
[3] New York State Department of Environmental Conservation Water Quality Standards and Guidance Values, 6 NYCRR Part 703. Standards and Guidance Values (designated "g") for Class GA groundwater.
[4] Action level.
[5] Being remanded.
[6] 10 NYCRR Part 5-1.52; 40 CFR 141.15-16.
[7] Units in picocuries per liter (pCi/L).
[8] Beta/gamma emitters limited to concentrations resulting in a 4 mrem annual dose.

- Demolition
- Containment
- Removal
- Treatment
- Transportation and Off-Site Disposal

The following general response actions were considered for groundwater/surface water remediation:

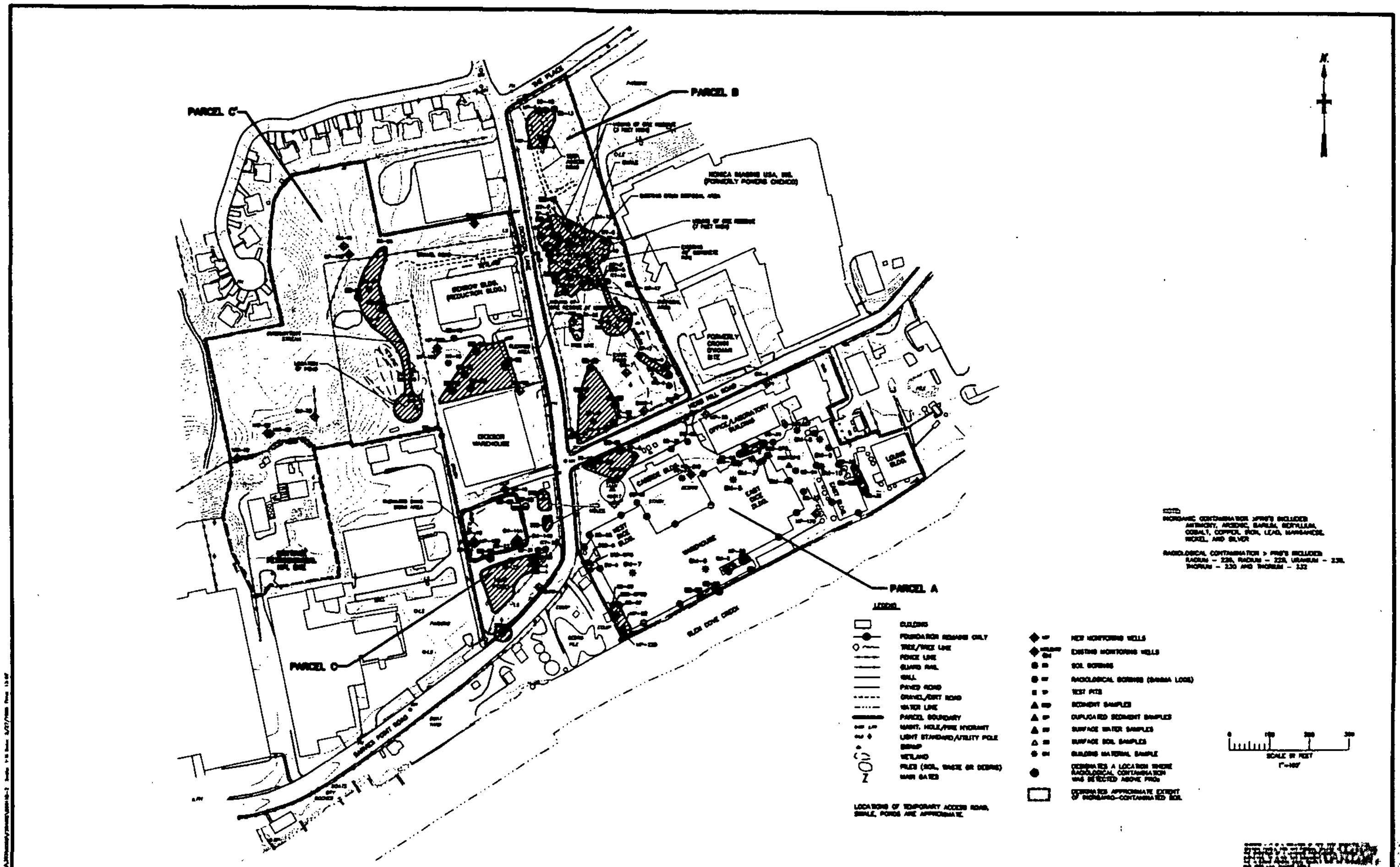
- Collection/Containment
- Treatment
- Disposal

Various process options are presented under each general response action. The intent of the initial screening was to eliminate inappropriate process options through a broad-based consideration of site characteristics and the characteristics of the remedial technologies themselves (effectiveness, implementability and cost) as presented in available documentation.

2.3.1 Soil and Sediment Remediation Areas

The sampling results were compared to the PRGs proposed in Section 2.2.5 to evaluate which soil and sediment areas require remediation. Arsenic concentrations are presented as a primary indicator for the distribution of inorganic contamination. The presence of radiological contamination and PCBs is also addressed where these contaminants exceeded their respective PRGs. Semivolatile organic contaminants were not detected above PRGs. The sections below identify proposed soil remediation areas by parcel for the Li Tungsten site and area for the Captain's Cove site, briefly discuss the areas in the context of historic site operations and environmental fate and transport, and calculate the soil volumes to be remediated. Areas where the concentration of inorganics and radionuclides in the soils exceed their respective PRGs are shown on Figure 2-1 for the Li Tungsten site and on Figure 2-2 for the Captain's Cove site.

400345

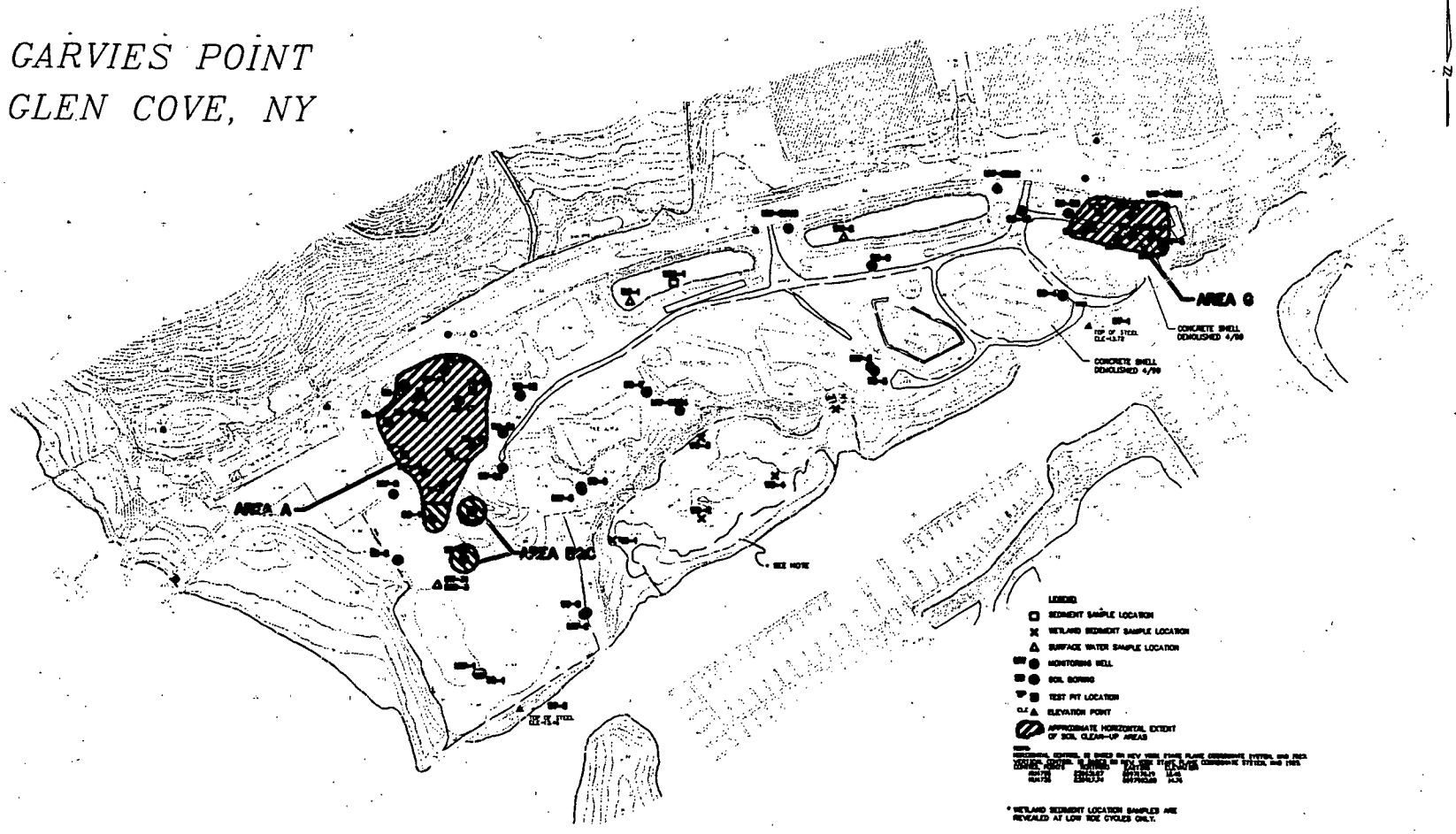


MALCOLM PIRNIE

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

SOILS GREATER THAN PRELIMINARY REMEDIATION GOALS
AS SHOWN

400346



MALCOLM PIRNIE

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

CAPTAIN'S COVE ADJUNCT SITE
SOILS GREATER THAN PRELIMINARY REMEDIATION GOALS
SCALE AS NOTED

JUNE 1999

FIGURE 2-2

2.3.1.1 Parcel A

Bulkhead

A narrow band of property is characterized by soil samples from monitoring well MP-2D and surface soil locations SS-5 and SS-7 located between the former Dice Complex and Glen Cove Creek. The arsenic PRG was exceeded in shallow soil samples from each location, with the highest concentration of 197 mg/kg detected at SS-7. In addition, the radiological PRG was exceeded at SS-5 and SS-7. The contamination may be related to activities at the former warehouse building. The estimated volume of soils requiring treatment is 300 cubic yards (cy).

Storm Sewer Alignments

Samples from borings SB-29 and SB-32 on Parcel A exceeded the arsenic PRG. SB-29 was advanced to investigate the storm sewer in the southwest corner of Parcel A, adjacent to the former West Dice Building. Arsenic was also detected above the PRG in nearby SB-7, MP-22 and MP-22D. Contamination at levels greater than the PRGs was detected as deep as 5 feet bgl at MP-22. The estimated volume of soil requiring remediation in this area is 600 cy, which includes sediment in the pipe and the pipe bedding materials along the 200 foot storm sewer alignment.

SB-32 was located alongside the storm sewer adjacent to the former East Building. Contamination above the arsenic PRG was also detected at 0-2 and 2-4 feet bgl in nearby SB-5. Samples from SB-5 also exceeded the radiological PRG. Remediation of the surrounding soil associated with this storm sewer alignment includes the SB-5 location. The estimated remediation volume in this area is 100 cy.

Northwest of Carbide Building

This area contains the sampling locations SS-1, SS-2, SS-3, SB-6 and MP-6. Soil samples from these locations exceeded PRGs for arsenic, barium, cobalt and manganese. Radiological contamination was detected above the PRG at locations SS-1 and SS-3. Contamination was detected to depths of 4 feet bgl at MP-6. The estimated volume of soil requiring remediation in this area is 700 cy.

2.3.1.2 Parcel B

Northern Portion of Parcel B

This area is represented by soil samples from locations SB-13, MP-5, TP-6 and RT-4. At SB-13, cobalt was detected slightly above its PRG in the 0-4 foot interval and manganese exceeded the PRG at 14-16 feet bgl. Cobalt was also detected above the PRG in the shallow sample from MP-5 and in the sample collected from TP-6. RT-4 exceeded the PRG for radiological contamination at 12-14 feet bgl. This approximately 4,000 square foot area requires remediation to an approximate depth of 14 feet bgl and the associated cleanup volume is approximately 2,100 cy.

Ore Stockpiles in Central Portion of Parcel B

Several stockpiles of ore material are located in the central portion of Parcel B. They range in height from 3 to 7 feet. The stockpile area is characterized by samples from soil borings SB-9, SB-10, SB-11, SB-12, SB-14, SB-15, SB-16, SB-17, TP-1, TP-3 and TP-5.

Arsenic concentrations in the shallow soil samples exceeded the PRG except at SB-10 and SB-16 (shallow soil data was rejected). However, in these two samples the detected concentrations of manganese (in SB-10) and lead (in SB-16) exceeded PRGs. In deeper samples, antimony was detected above the PRG at a depth of 8 feet bgl (SB-9), manganese was detected above the PRG at 8-10 feet bgl (SB-11), and SB-16 did not contain concentrations of site contaminants above PRGs.

Soil samples collected from RT-1, RT-2, RT-3, RT-6, RT-7, RT-8, SB-10, SB-14, SB-15, SB-17, TP-1, TP-3, TP-4 and TP-5 exceeded the PRG for radiological contamination. PCBs were detected above the PRG from 0-2 foot bgl at SB-14.

An intermittent stream crosses the eastern portion of the stockpile area and flows southward to a pond. The sediment samples collected from the stream (SED-9) and pond (SED-8) contained cobalt above the PRG. It is possible that inorganic contaminants are being transported from the stockpile area via run-off into the intermittent stream and subsequently to the pond sediments.

The approximate volume requiring remediation consists of the volume of the individual stockpiles, the soil between and beneath the stockpiles, and the affected sediments in the

intermittent stream and pond. The total volume of material in the stockpiles is estimated at 1,000 cy. The area underlying the stockpiles is approximately 23,000 square feet. The soil boring logs indicate the inorganic contamination extends to a depth of approximately 8-10 feet bgl in the stockpile area. A remediation volume of approximately 6,800 cy of soil was calculated. It was also assumed that sediments will require remediation to a depth of 2 feet in the intermittent stream (100 cy) and existing pond (300 cy), yielding an additional volume of 400 cy. Based on these assumptions, the total volume of soil and sediment requiring remediation in this area is 8,200 cy.

Lower Portion of Parcel B

The lower portion of Parcel B was characterized by soil samples from soil borings SB-18, SB-19 and SB-20; monitoring wells MP-8D and MP-9D; surface sampling locations SS-6, SS-8 and SS-9; and test pits TP-2 and TP-7.

Shallow samples from the wetland area in the southeastern corner of Parcel B (TP-7 and MP-9D) exceeded several PRGs for inorganics (including arsenic, manganese and silver). Samples collected southwest of the stockpile area (TP-2 and SS-9) were contaminated above PRGs for arsenic and manganese. These areas are downgradient of a stockpile area in the central portion of Parcel B and may have been affected by run-off from that area. The amount of soil requiring remediation (assuming a cleanup depth of 2 feet bgl) at these locations is estimated to be 200 cy.

Samples collected from the southwestern corner of Parcel B (SB-18, SB-19, SB-20, SS-6 and SS-8) contained concentrations of antimony, arsenic, cobalt, lead, manganese, nickel, and silver above the PRGs. Radiological contamination was also detected above the PRG at locations SB-19, SB-20 and SS-6. The approximate area encompassed by these sampling locations is 13,500 square feet. Assuming soil to a variable depth of 2 - 4 feet (at locations SB-19 and SB-20) below grade require treatment, the volume of soils requiring remediation is approximately 1,500 cy.

2.3.1.3 Parcel C

Surface Disposal Area West of Benbow Building

This area was characterized by soil samples from soil borings SB-26, SB-27 and SB-28, surface soil sample SS-4 and test pit TP-8. What appeared to be dark-colored ore material can be observed at the surface, spreading from a local topographic high point to the north and covering an area adjacent to and west of the former propane tank. Deep channels observed in the ground surface and site topography indicate surface water run-off flows southward from this disposal area toward the wetland northwest of the Dickson Warehouse.

Arsenic in the shallow soil samples ranged from 10.9 mg/Kg (SB-26) to 6,300 mg/Kg (SB-27). The arsenic detected in deeper soil samples included 1,290 mg/Kg from 10-12 feet bgl at boring SB-26 and 2,230 mg/Kg from 4-6 feet bgl at SB-28. These results exceed the PRG for arsenic in soil. Radiological contamination was detected above the PRG at locations SS-4 and SB-28 (including the 4-6 foot sample at SB-28).

To calculate an approximate volume requiring remediation and based on the sampling results, it was concluded that the entire visible ore disposal area was contaminated above PRGs. The disposal area comprises approximately 7,500 square feet. Soil boring logs indicate the ore residues extend as deep as 12 feet bgl. Based on these assumptions, the calculated volume of soil requiring remediation in this area is 3,300 cy.

Sediment samples from SED-10 and SED-11 contained 1,610 E mg/Kg and 2,080 E mg/Kg of arsenic respectively and exceeded the PRG. The contamination may be result of transport of ore particles via surface run-off from the upgradient disposal area. It was assumed that sediment must be remediated in the wetland area to a depth of 2 feet bgl. It is also assumed that surficial soils (to a depth of 2 feet bgl) along the surface water drainage pathway from the disposal area to the wetland will require remediation. The additional volume of soil and sediment requiring treatment is approximately 800 cy.

The total estimated volume of ore residues, soil and sediment in this area requiring remediation is 4,100 cy.

Former Staging Area South of Benbow Building

The rusted remnants of drum lids and retaining rings are visible at the surface in this area, which may have been a former material staging area for the operations conducted in the Benbow Building. The area is represented by soil samples from monitoring well MP-16S and surface soil sampling location SS-12.

The concentrations of barium, beryllium, cobalt, copper, lead and manganese in the surface soil sample from SS-12 exceeded PRGs. Detected concentrations in MP-16S did not exceeded PRGs. Radiological PRGs were exceeded in surficial samples from RT-11, RT-12, RT-13 and SS-12 and in deeper samples from RT-12 (6-8 feet bgl) and RT-14 (8-10 feet bgl).

The sampling data for the former staging area was limited. To calculate an approximate volume requiring remediation, it was concluded the area bounded by samples RT-11, RT-12, RT-13 and RT-14 was contaminated above PRGs. This area comprises approximately 17,500 square feet. It was assumed the depth of contaminated soil extended to 10 feet bgl over an area of approximately 7,500 square feet (RT-12 and RT-14) and to 2 feet bgl in the remaining 10,000 square foot area. Based on these assumptions, the calculated volume requiring remediation in this area is 3,500 cy.

Aboveground Fuel Tank Berm, Mud Holes and Mud Pond South of Dickson Warehouse

Shallow soil samples from soil borings SB-21, SB-23, SB-24 and SB-25, monitoring well MP-18 and surface soil SS-10 exceeded the PRG for arsenic. The arsenic data from SS-11 was rejected; other inorganics (such as beryllium, copper, nickel and silver) were detected above PRGs.. Deeper soil samples from soil borings SB-23 and SB-25 also exceeded the arsenic PRG. Radiological contaminants were detected at concentrations greater than the PRGs at locations RT-19, SB-25, SS-10 and SS-11.

The Mud Hole sediment samples (SED-2 and SED-3) and Mud Pond sediment sample (SED-4) exceeded the PRG for arsenic. It is likely that the berm surrounding the former aboveground fuel tank was constructed from ore residues and transport of material from the berm via surface water run-off has contaminated surrounding soils. It is assumed, therefore, the entire berm and shallow soils adjacent to it (within the bermed area and outside of the bermed area) require remediation.

The two former Mud Hole areas comprise approximately 1,600 and 900 square feet, respectively. The Mud Pond comprises an area of approximately 12,000 square feet. Assuming these areas require remediation to a depth of approximately two feet, the volume of sediment requiring treatment is approximately 1,000 cy.

The volume of the berm was calculated to be 500 cy. Assuming an 8-foot wide band of soil beneath the berm requires remediation to a depth of 6 feet bgl (based on the concentration of arsenic greater than its PRG in deeper samples from SB-23, SB-25 and MP-18 and exceedance of radiological PRG in a deep sample from RT-19), an additional 1,100 cy would require remediation. The total volume of soil within and beneath the berm to be treated is approximately 1,600 cy.

Boring SB-40 was advanced in the vicinity of the storm sewer pipe and the collected soil sample exceeded the arsenic PRG. It is assumed a 50 cy remediation volume is present comprised of the sediment in the pipe and bedding material around the pipe.

2.3.1.4 Parcel C′

There were no areas on Parcel C′ requiring soil remediation.

2.3.1.5 Dickson Warehouse

Approximately 3,131 cy of ore residues are contained in the Dickson Warehouse as estimated by the USEPA Removal Branch during the recently completed removal action.

2.3.1.6 Captain's Cove

Remediation areas at Captain's Cove were determined using a combination of available data including radionuclide concentration data, gamma logging count rate data and surface exposure rate data. Areas at the Captain's Cove site where the soils exceed the PRGs are described below and presented in Figure 2-2.

Area A

Soil boring samples (SB-11, SB-13, SB-14, SB-15, SB-16, SB-17 and SB-18) and test pit samples (TP-1, TP-2, TP-3, TP-4 and TP-7) and gamma logging data were indicative of

radionuclide concentrations which exceed PRGs. The lateral extent of contamination was approximated by utilizing gamma logging count rate data, exposure rate data and soil borings outside the boundaries of Area A (SB-12, SB-20, SB-21 and MW-8) and previously collected data (NYSDEC, 1997). An average depth of eight feet was used to estimate the volume of soil to be excavated. Actual contamination, however, was detected as deep as 10 feet in some locations. The total volume of soil to be remediated in Area A (roughly measuring 370 ft. x 180 ft. x 8 ft.) is approximately 19,700 cy. The total volume of soil containing radioactive material exceeding the PRG is approximately 12,500 cy. In certain areas, clean soil is required to be removed to access the contaminated soil exceeding the PRGs. Controlled excavation to avoid intermixing the radioactive material and the non-radioactive material will be required.

Area G

Soil boring samples (SB-8, SB-22, SB-23, SB-24 and SB-26) and test pit samples (TP-5 and TP-6) and gamma logging data were indicative of radionuclide concentrations which exceeded PRGs. Gamma logging count rate data, exposure rate data and soil borings outside the boundaries of Area G (SB-4, SB-10 and SB-28) were used to approximate the lateral extent of contamination. Recent sampling by the USEPA Removal Branch indicated that contamination does not extend beneath the former easternmost condominium shell. An average depth of 12 feet was used to estimate the volume of soil to be excavated. Actual contamination, however, was detected to the bottom of SB-23 (15 feet) and may extend deeper. The total volume of soil to be remediated in Area G (roughly measuring 220 ft. x 100 ft. x 12 ft.) is approximately 9,800 cy. The total volume of soil containing radioactive material exceeding the PRG is approximately 7,000 cy. Controlled excavation to avoid the surface clean soil which covers a small portion of this area would be required.

Areas B and C

Soil boring samples (SB-25 and SB-27) contained radionuclide concentrations which exceeded PRGs. The lateral extent of contamination around each soil boring, based on previously collected data (NYSDEC, 1997), was assumed to be localized and was approximated by including all soil within a 50 foot radius of the two borings. An average depth of 4 feet was

used to estimate the volume of soil to be excavated. The total volume of soil to be remediated in Areas B and C is approximately 1,200 cy. The total volume of soil containing radioactive material exceeding the PRG is approximately 700 cy. Controlled excavation in this area would be required.

2.3.2 Groundwater Remediation Areas

The three rounds of groundwater sampling results at the Li Tungsten site and one round of sampling at the Captain's Cove site were compared to the proposed PRGs developed in Section 2.2.5 to determine the vertical and horizontal extent of potential groundwater remediation areas. The concentration of volatile organic compounds [tetrachloroethene, trichloroethene, 1,1,1-trichloroethene, 1-2-dichlorethene (total), 1,1-dichloroethene, vinyl chloride and methylene chloride] exceeded their respective PRGs. Inorganics (arsenic, antimony, cadmium and nickel) also exceeded their respective PRGs. Radium-226 and Radium-228 exceeded the NYSDEC and USEPA standards in the first and second rounds but was below these standards in the third round using the low-flow sampling method (with the exception of one sample collected from GM-10). The following sections identify proposed groundwater remediation areas by location and contaminant. Areas on the Li Tungsten site where the groundwater exceeded the PRGs are shown in Figure 2-3; areas on the Captain's Cove site where the groundwater exceeded the PRGs are described in Section 2.3.2.7.

2.3.2.1 Parcel A/Lower Parcel B - Organics

In both sampling rounds, the PRGs for tetrachloroethene, trichloroethene, 1,2-dichlorethene (total) and vinyl chloride were exceeded in groundwater samples collected from five Parcel A monitoring wells (MP-20, GM-1, MP-6, MP-21D and MP-2D) and one Lower Parcel B monitoring well (EMW-1) as shown on Figure 2-3. The VOCs were detected in monitoring wells that are either downgradient or cross-gradient to the suspected source area, the Crown Dykman site. Organic contamination in groundwater on Parcel A/Lower Parcel B will be addressed by the NYSDEC and is not included in the Draft Final FS.

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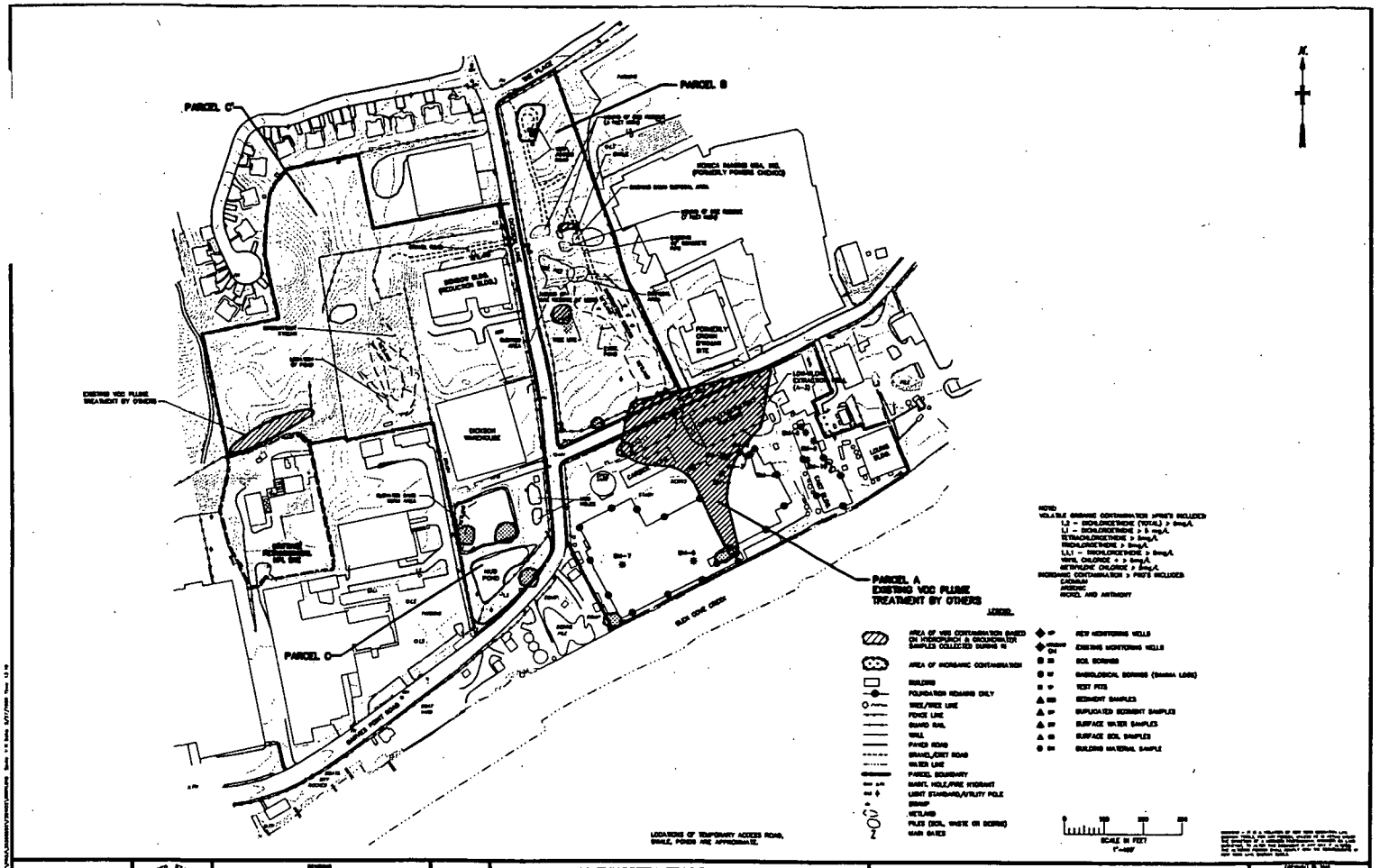


MALCOLM PIRNIE

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

GROUNDWATER GREATER THAN PRELIMINARY REMEDIATION GOALS

FIGURE 1-3

2.3.2.2 Parcel C′ - Organics

Groundwater samples collected from four Parcel C′ monitoring wells (MW-10, MW-8S, MW-8D and GM-10) exceed the PRGs for 1,2-dichlorethene (total), 1,1-dichloroethene, tetrachloroethene, 1,1,1-trichloroethene, trichloroethene and methylene chloride. The partial plume, as defined by the groundwater data form the aforementioned wells is shown in Figure 2-3. The source of the organic contamination detected on Parcel C′ appears to originate from the Mattiace site to the south. The groundwater contamination in this area is being addressed as part of the remedial action at the Mattiace site.

2.3.2.3 Parcel A - Inorganic Hot Spots

Inorganic contamination was identified at several "hot spots" on Parcel A in monitoring wells MP-22, GM-2, MP-2D and MP-6. Groundwater samples collected from MP-22, located in the southwest corner of Parcel A at the bulkhead, exceeded the PRGs for nickel, cadmium, antimony and arsenic. Groundwater samples collected from GM-2 exceeded the PRGs for nickel, antimony and arsenic. Samples from the adjacent well MP-2D, exceeded the PRGs for nickel. Groundwater samples collected from MP-6 also exceeded the PRGs for arsenic and cadmium.

2.3.2.4 Lower Parcel C - Inorganic Hot Spots

Several "hot spots" of inorganic contamination on Lower Parcel C were identified at monitoring well locations adjacent to the former 500,000-gallon aboveground tank (MP-18/18D and GM-14A/14B) and downgradient of the Mud Pond (EMW-4). Groundwater samples collected from MP-18 and MP-18D exceeded the PRG for nickel, cadmium and antimony; the arsenic PRG was exceeded in MP-18. Groundwater samples collected from GM-14A/14B exceeded the PRGs for cadmium and antimony; the PRG for arsenic was also exceeded in GM-14A.

2.3.2.5 Parcel B - Inorganic Hot Spots

Parcel B "hot spot" inorganic contamination was identified at MP-19D, where the PRG for nickel was exceeded, and GM-13, where the PRG for cadmium was exceeded.

2.3.2.6 Parcels A, B, C and C′ - Radionuclides

Parcel A groundwater samples collected from MP-22, MP-2D and GM-1 exceeded the NYSDEC standard for ^{226}Ra and the 5 pCi/L MCL for radium established by the USEPA and NYSDEC. Lower Parcel B monitoring well samples (GM-8, GM-7 and GM-9), Parcel C monitoring wells (GM-15, MP-18, MP-16D) and Parcel C′ monitoring wells (GM-11, MP-11D, GM-10 and MW-10) also exceeded the NYSDEC and USEPA MCLs. Radionculides were detected below USEPA and NYSDEC standards in all monitoring wells during the third round of sampling with one exception - the concentration of ^{226}Ra and ^{228}Ra in monitoring well GM-10 on Parcel C′).

2.3.2.7 Captain's Cove - Radionuclides

Remediation of the groundwater at the Captain's Cove site for organic and inorganic constituents will be determined as part of the RI/FS being conducted under the state Superfund program and, therefore, is not being addressed in this Draft Final FS Report. Based on the analysis of groundwater for radionuclides, the only location where a PRG was exceeded occurred in MW-2 for the combined concentration of radium and thorium.

2.3.3 Surface Water Remediation Areas

Two samples (SW-8 and SW-10) slightly exceeded PRGs for antimony, arsenic and beryllium. SW-8 was collected from the pond on Parcel B. SW-10 was collected upgradient of a drainage pond on Parcel C′. All other sample results were below the respective PRGs. PRGs for surface water include the NYSDEC standards for Class D Fresh Water, where listed or as an alternative standard, Class C, B, or A). The approximate dimensions of the pond on Parcel B is 25 ft. x 25 ft. x 4 ft; the estimated volume of water is 2,500 cubic feet or 18,700 gallons. There were no surface water remediation areas on the Captain's Cove site.

2.3.4 Building Remediation Areas

2.3.4.1 Li Tungsten

The existing structures including the Office/Laboratory Building, the Loung Building and the Carbide Building on Parcel A and the Benbow Building and Dickson Warehouse (after

removal of the ore residues) on Parcel C are either in poor structural condition or pose obstructions to future pre-design sampling or remediation activities.

2.3.4.2 Captain's Cove

Radiological contamination has been detected alongside the *north* foundation *wall* of the easternmost condominium shell. In addition, both condominium shells *posed* an obstruction to future pre-design sampling or remediation activities. In April 1999, the condominium shells were demolished by the City of Glen Cove.

2.4 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

The next step in the FS process consists of screening the remedial technologies and process options associated with each response action. The screening process will evaluate the feasibility of achieving the remedial objectives using the technologies and process options. Three criteria were used to screen the technologies and process options: effectiveness, implementability and cost. Technologies that were not retained for further consideration are <u>underlined;</u> technologies that are retained for further consideration are printed in **bold** text. Summaries of the screening of technologies and process options for soils, sediments and building materials are presented in Table 2-14; the screening of technologies and process options for surface water and groundwater is presented in Table 2-15.

2.4.1 Technologies and Process Options Applicable to Soil, Sediment and Building Materials

2.4.1.1 Containment

<u>Capping</u>

A lined landfill cell with a barrier cap could be constructed for on-site disposal of contaminated soils. Containment of the contaminated soils within a lined landfill cell, beneath a barrier cap, would reduce infiltration (and subsequent leachate generation/contaminant

TABLE 2-14
SUMMARY OF TECHNOLOGY SCREENING FOR SOIL, SEDIMENT AND BUILDING MATERIALS
LI TUNGSTEN AND CAPTAIN'S COVE SITES

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
CONTAINMENT				
• Capping - Clean Soil Cover	Does not reduce infiltration or exposure to radiological contamination.	Easily implement-ed	low	no
- Modified RCRA Cap w/ Gamma Shielding	Minimizes infiltration and radiological exposure.	Easily implemented	low	yes
• Vertical Barriers	Only in conjunction with a RCRA cap; not appropriate for in-site containment of rad-contaminated soils.	Easily implement-ed	moderate	no
REMOVAL				
• Excavation	Very effective; can be utilized in combination with other technologies.	Conventional construction method; easily implemented.	low	yes
TREATMENT				
• Vitrification	Very effective given optimal site conditions.	Difficult due to high water table.	high	no
• Volume Reduction	May not be effective due to inability to achieve PRGs.	Would require bench/pilot scale testing.	moderate to high	yes
• Stabilization/Solidification/ Chemical Fixation	Reduces leachability and mobility of metals and radionuclides.	Utilizes conventional materials and has been demonstrated.	low to moderate	yes

TABLE 2-14
SUMMARY OF TECHNOLOGY SCREENING FOR SOIL, SEDIMENT AND BUILDING MATERIALS
LI TUNGSTEN AND CAPTAIN'S COVE SITES

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
• Phytoremediation	Used effectively at Chernobyl; still in development stages; address shallow soil contamination only.	Limited given redevelopment plans.	low	no
• Electrokinetic Processing	Not effective for radionuclides of interest.	Relatively good; may be applied in-situ or ex-situ.	low to moderate	no
• Thermal Destruction	Not appropriate for radionuclides and metals.	Relatively good.	moderate to high	no
• Chemical Extraction	Very effective.	Easily implemented.	moderate	yes
<u>DEMOLITION</u>	Very effective; may require special handling of rad-comtaminated and asbestos-containing materials.	Utilizes conventional construction methods.	low	yes
<u>TRANSPORTATION/OFF-SITE DISPOSAL</u>	Very effective	Truck and rail combination easily implemented; off-site facilities available for disposal.	moderate to high	yes

TABLE 2-15
SUMMARY OF TECHNOLOGY SCREENING FOR SURFACE WATER AND GROUNDWATER
LI TUNGSTEN AND CAPTAIN'S COVE

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
<u>COLLECTION/CONTAINMENT</u>				
• Vertical High/Low Flow(HF/LF) Extraction Wells	HF limited due to low (k); would require numerous wells; LF good to capture deep "hot spot" contamination	Utilizes conventional construction methods/materials; easily implemented.	low to moderate	HF-No LF-Yes

TABLE 2-15
SUMMARY OF TECHNOLOGY SCREENING FOR SURFACE WATER AND GROUNDWATER
LI TUNGSTEN AND CAPTAIN'S COVE

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
• Continuous Interceptor Systems	Generally good for shallow groundwater; limited to a depth of 25-30 feet; results in more complete capture than extraction wells.	Utilizes conventional construction methods/materials; easily implemented.	low	yes
• Direct Pumping Methods	Very effective for surface water and g roundwater	Utilizes conventional construction methods/materials; easily implemented.	low	yes
• Hydrofracturing	Effective method to increase hydraulic conductivity.	Limited; not able to control location of fractures.	low to moderate	no
• Wellpoint Systems	Limited; high operation and maintenance requirements.	May be difficult to install utilizing direct push method due to density of site soils.	low to moderate	no
• Recirculation Wells	Effective for volatile organics in "hot spot" areas;requires sufficient vadose zone	Good; uses conventional construction methods/materials.	low to moderate	no
• Reactive Walls	Effective for organics/inorganic	Very good; uses conventional construction methods/materials.	moderate to high	yes
• Hydraulic Barriers	Recent USGS information relects limited effectiveness for some barrier; slurry walls may be more effective	Very good; uses conventional construction methods/materials.	low to moderate	yes
TREATMENT				
• Ion Exchange	Limited due to high iron content concentrations in groundwater	Very good; uses conventional construction methods/materials.	moderate to high	no

TABLE 2-15
SUMMARY OF TECHNOLOGY SCREENING FOR SURFACE WATER AND GROUNDWATER
LI TUNGSTEN AND CAPTAIN'S COVE

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
• Adsorption/Absorption	Long history of effective use for organics and inorganics	Very good; uses conventional construction methods/materials.	moderate	yes
• Membrane Treatment	Limited; prone to clogging and precipitation of salts; generates large waste stream.	Good; uses conventional construction methods/materials	low to moderate	no
• Filtration/Ultrafiltration/Microfiltration	Very good to remove suspended soilds and inorganics	Very good; uses conventional construction methods/materials.	low to moderate	yes
• Air Stripping	Effective for volatile organics with high volatility and low water solubility;	Good; uses conventional construction method/materials.	low to moderate;O&M high	yes
• Enhanced Biodegradation	Limited given site conditions; will not treat inorganics and radionuclides.	Good given optimal site conditions.	low to moderate	no
• Phytoremediation	Potentially good with shallow water table, however, requires large surface area.	Easily implemented; requires disposal of plants.	low	no
• Precipitation/Coagulation/Flocculation	Potentially good for inorganics; depends on optimum pH for various metals	Good; uses conventional construction methods/materials.	low to moderate	yes
• Neutralization	Potentially good for pH adjustment	Good; uses conventional construction methods/materials.	low	yes

TABLE 2-15
SUMMARY OF TECHNOLOGY SCREENING FOR SURFACE WATER AND GROUNDWATER
LI TUNGSTEN AND CAPTAIN'S COVE

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
DISPOSAL				
• Reinjection	Effective; currently in use at Mattiace site.	Very good; uses conventional construction methods/materials.	moderate	yes
• Discharge to On-site Recharge Basins	Poor given hydraulic conductivity and area required.	Very good; uses conventional construction methods/materials.	low	no
• Discharge to On-Site ponds/streams	Limited given insufficient capacity on-site.	Very good; uses conventional construction methods/materials.	low	no
• Discharge to Off-site POTW	Limited given site contaminants.	Very good; uses conventional construction methods/materials.	low to moderate	no
• Temporary Containment and Off-site Disposal	Very effective	Very good; uses conventional construction methods/materials or use of existing system (Mattice)	low	yes

migration), control erosion and transport via runoff, and act as a barrier to direct contact with site contaminants. The landfill cell would be constructed above the groundwater table elevation.

The capping process options included in the screening were:

- Clean Soil Cover
- Modified RCRA Cap with Gamma Shielding

The options differ in the type and function of the layers which comprise the cap. The clean soil cover would consist solely of a vegetated soil layer which would prevent direct contact and erosion/transport of existing surface soils. The clean soil cover process option was not retained for further consideration due to its inability to reduce infiltration and address potential exposure to radionuclide contamination.

The modified RCRA cap option includes a layer designed to minimize infiltration, such as a geosynthetic clay liner or low permeability soil layer. A gamma shielding layer could be employed to reduce exposure to radionuclides. The effectiveness of a **modified RCRA cap** has been demonstrated, it is an implementable technology and costs are reasonable. It was **retained** for alternative development.

Further evaluation will be conducted during the alternative development stage to assess the compatibility of remediation via on-site landfill disposal with intended site redevelopment plans. It is possible that an on-site landfill cell could be integrated into a proposed parking area associated with redevelopment plans for the site.

Vertical Barriers

Vertical barrier technology employs slurry walls or grout injection to impede the flow of groundwater through contaminated soil zones, reducing the mobilization of contaminants to downgradient and off-site receptors. Slurry walls are typically constructed by trenching and backfilling with bentonite slurry or cement-bentonite slurry. Grout injection techniques (or in-situ slurry wall construction) form a subsurface barrier wall by filling multiple, adjacent soil borings with cement, bentonite or cement-bentonite slurry.

Vertical barriers are implementable at a relatively low cost, however, they are effective only when used in conjunction with a capping option to contain contaminated soils. In consideration of the redevelopment plans for the area, in-situ containment of radiologically-

contaminated soil is not expected to be acceptable, therefore, the vertical barrier option was not retained for further evaluation.

2.4.1.2 Removal

Contaminated soil could be removed through conventional excavation and off-site disposal at an appropriate facility. Soil excavation could also be utilized in combination with potential ex-situ treatment alternatives. Excavation activities would be accompanied by air monitoring, dust suppression and soil stockpile management measures to prevent the spread of contamination. Health and safety measures would also include appropriate personal protective equipment for workers and excavation safety measures. The **removal** response action is effective, implementable and relatively low cost, therefore, it was **retained** for further evaluation.

2.4.1.3 Treatment

Vitrification

In-situ vitrification (ISV) immobilizes radioactive contaminants, inorganics and other toxic and hazardous compounds found in soil. ISV is a process that uses an electric current to melt the soil, thereby destroying organic contaminants and immobilizing metals and radionuclides in a glassy, monolithic mass. This glassy solid matrix is very resistant to weathering and leaching. The high temperature vitrification process must drive off soil moisture before the "melt" can occur. Due to the high water table conditions on the Li Tungsten site, this would significantly increase energy consumption and associated costs. ISV is not expected, therefore, to be implementable at the Li Tungsten site. In addition, it might be necessary to implement measures to limit recharge during the treatment. ISV was not retained for further evaluation.

Vitrification of the soil can also be conducted as an ex-situ process, via treatment in a cyclone furnace. Cyclone furnaces can convert contaminated soil into a vitrified slag which renders metals and radionuclides non-leachable. Costs for remediation of 20,000 tons of contaminated soil via cyclone furnace vitrification were estimated within a range of $465 to $529

per ton (USEPA, 1994). Due to the expected high cost of ex-situ vitrification (in comparison to the other process options), it was not retained.

Volume Reduction

Volume reduction technologies are used to separate contaminated soil into a large stream of clean material and a small portion of highly-contaminated residual. This can be accomplished using techniques based on particle size (e.g., sieves and screens) if it can be demonstrated that contamination is primarily associated with a particular size fraction (typically fines). This technology, referred to as **soil washing**, is implementable, cost effective and was **retained** for further evaluation. It is important to recognize, however, that bench scale testing may be required to verify the effectiveness of a particular volume reduction process option.

Volume reduction process options are also available which continuously monitor the radioactivity of a soil stream being processed and perform sorting tasks based upon collected readings [e.g., Segmented Gate System (SGS) or the Automated Conveyor Monitoring System (ACMS)]. Such a system can be configured to capture only soil fractions which exceed specific action levels. Recent discussions with vendors that offer this technology have not completely resolved the question of whether or not this technology would be effective in achieving separation at a concentration of 5 pCi/g. A treatability study during the remedial design would certainly be necessary to demonstrate its effectiveness. This technology, however, if proven to be effective in achieving the PRGs, offers significant cost benefits in reducing the volume of soil for disposal. The SGS and ACMS **volume reduction** process options, therefore, were **retained** for further evaluation.

Stabilization/Solidification/Chemical Fixation

These technologies are employed to bind hazardous constituents in a matrix which reduces their leachability and mobility. This is typically accomplished through the addition of cement (such as Portland or sulfur cement) or pozzolanic material to the contaminated soil. Chemical bonding systems which use polymers and proprietary reagents to immobilize contaminants have also been demonstrated to work effectively.

Stabilization/solidification/fixation are demonstrated processes for treatment of soils and sediments containing metal and radionuclide contaminants. The equipment and process materials are readily available at a low to moderate cost compared to other treatment process options. **Stabilization/solidification/fixation**, therefore, was **retained** for further evaluation.

Phytoremediation

Phytoremediation of contaminated soils involves the utilization of plants to extract metals and radionuclides. For example, phytoextraction of lead has been successfully demonstrated with plants accumulating large quantities of lead in their tissues (Kumar et al., 1995). Phytoremediation is a relatively new technology that shows great promise, but there are also a number of limitations. The effectiveness of the technology is limited to within a few feet of the surface, and identification of appropriate flora and their growth conditions is still in the developmental stages. Due to the developmental status of the technology, phytoremediation was not retained for further evaluation.

Electrokinetic Processing

Electrokinetic processing is a remediation technology which separates and extracts heavy metals and radionuclides from soils. The process uses direct current to electroplate contaminants onto an electrode (or capture contaminants in an electrolytic fluid) placed in the contaminated soil mass. The process may be applied in-situ or ex-situ. Electrokinetic processing may be performed as an in-situ or ex-situ process. Although bench-scale tests conducted in the early 1990's and remediation projects completed at European sites showed promise, the technology has not been demonstrated in the field to be effective in attaining the required removal efficiency to meet the PRGs for uranium, thorium and radium. A treatability study, at a minimum, would be required to demonstrate its effectiveness and possibly a research and development program would be required to improve the recovery of thorium (which has low solubility) to acceptable levels. Overall, this process option is considered too experimental. Electrokinetics, therefore, was not retained for further evaluation.

Thermal Destruction

Incineration process options are applicable for the destruction of organic contaminants. It is not effective for the treatment of the metals and radionuclides present in the soil at Li Tungsten and Captain's Cove. Thermal destruction, therefore, was not retained.

Chemical Extraction

Chemical extraction processes may use acids, proprietary solvents, resin ion exchange techniques and other methods to dissolve/separate metal and radionuclides from contaminated soil into a concentrate. Metals may be recovered from the concentrate for recycling or the concentrate may be appropriately disposed. Chemical extraction is effective, implementable and cost-effective compared to other technologies. **Chemical extraction**, therefore, was **retained** for further evaluation.

2.4.1.4 Demolition

Given the poor structural condition of the buildings, the space requirements to implement various excavation or treatment alternatives and future use of the sites, building demolition is included as part of all remedial alternatives. Demolition is a well-demonstrated technology that is effective, implementable and cost-effective. Consideration would have to be given to the potential presence of radionuclides, asbestos and lead paint. Radiologically contaminated structural materials, if any, would be transported to a licensed disposal facility; asbestos containing materials (ACM) would be transported to an appropriate disposal facility. **Demolition**, therefore, was **retained** for further evaluation.

2.4.1.5 Transportation and Off-Site Disposal

Rail, truck and barge transportation options were considered for off-site disposal of contaminated soil and/or treatment residuals/concentrates. Barge options were eliminated because, although the Li Tungsten and Captain's Cove sites are located on navigable waterways, the nearest transfer facility (Elizabeth, NJ) where the barge loads could be moved directly to rail were so close (50 miles), the transportation cost over such a short distance did not make it cost effective.

Rail options, on the other hand, include two possibilities - gondola cars and intermodal containers. Separate support and transfer facilities are necessary for either and some trucking will be necessary to move the material from the site to the respective transfer facility (Elizabeth, NJ for the intermodal containers; Wooster, MA for the gondola cars). Gondola cars have a much larger capacity (66 cubic yards or approximately 100 tons) compared to the intermodal containers (12 cubic yards or approximately 18 tons). The cost of the gondola car ($13,500/gondola car, $200/cubic yard or $135/ton) is much cheaper per unit volume or weight than the cost of intermodal transport ($4,300/container, $360/cubic yard or $240/ton). Intermodal transport, therefore, was eliminated from further consideration due to the increased cost. This transportation option (gondola railcar in combination with trucking) is effective and implementable by itself or in combination with several other remedial alternatives. Rail transportation offers reduced risks, therefore, the gondola railcar transportation option was **retained** for further consideration. Off-site facilities capable of disposing of metal and radionuclide-contaminated waste will be further evaluated according to cost and waste acceptance characteristics.

2.4.2 Technologies and Process Options Applicable to Groundwater/Surface Water

2.4.2.1 Collection/Containment

The selection of a groundwater/surface water collection/containment process option depends on the depth of contamination and the hydrologic and geologic characteristics of the aquifer. Direct pumping methods are most effective where underlying aquifers have a high degree of intergranular hydraulic conductivity. Direct pumping methods involve the active manipulation and management of groundwater to contain or remove contaminant plumes. Typically, groundwater pumping lowers the water table in the vicinity of each pumping well. As the pumping rate increases, the hydraulic gradient increases and groundwater flows towards the well. Other collection methods (e.g., passive methods) involve the natural capture of groundwater or surface water without the direct use of pumps to enhance capture radius.

The process options considered under this response action include vertical high and low flow extraction wells, continuous interceptor systems, direct pumping methods, hydrofracturing, wellpoint systems, recirculation wells, reactive walls and hydraulic barriers.

Vertical High/Low Flow Extraction Wells

Vertical high or low flow extraction wells are used singly or in series to capture and extract contaminated groundwater. High flow extraction wells can reduce the contaminant levels at a rate faster than might occur if the aquifer were left to cleanse itself naturally. However, the effectiveness of high flow extraction wells would be limited in formations where the hydraulic conductivity is low causing the capture radius to be reduced. Low-flow extraction wells may be effective in select "hot spot" point source areas or where the capture of a deeper groundwater component of flow is required. Since the aquifer permeability in the areas of contamination is low with uniform hydraulic gradients, numerous extraction wells would be required to create a sufficient capture radius. In addition, placement of high flow extraction wells in sensitive areas (i.e, adjacent to the Mattiace site in lower Parcel C) may create artificial gradients which may interfere with the on-going groundwater remediation at the Mattiace site. Based on the implementability, potential limited effectiveness and cost considerations associated with the installation of multiple extraction wells, this process option was not retained for further analysis. **Low-flow extraction wells**, however, were **retained** for further analysis.

Continuous Interceptor Systems

This process includes the use of a continuous series of parallel wells, trenches, or drains to capture plumes of contaminated groundwater in unconsolidated deposits. Continuous interceptor systems can be installed using conventional excavation techniques or using proprietary trenching machines that excavate and install drain pipe and permeable backfill material in a single operation. Conventional excavation methods are generally limited to trench depths of 25-30 feet bgl. Displaced soils can be reinstalled in the same operation with the proprietary trenching technologies, to limit disposal of contaminated soil and water.

Continuous interceptor systems can be more effective in capturing contaminated groundwater than vertical extraction systems because of the continuous nature of the system. For example, "dead zones" that may occur between vertical wells are minimized with continuous systems. Since a shallow component (less than 25 feet from the surface) of contaminated groundwater exists and the site soils can be readily excavated (sands, silts and clays), the **continuous interceptor system** process option was **retained** for further analysis.

Direct Pumping Methods

This process option includes the use of submersible pumps, sump pumps and other pumping systems to remove contaminated water from extraction wells, interceptor trenches or on-site ponds. Water collected from this operation would be temporarily contained for further on-site or off-site treatment. **Direct pumping methods** are effective, low cost and easily implemented to capture contaminated surface water and was **retained** for further analysis.

Hydrofracturing

Hydrofracturing is a specialized technique by which the permeability (and hydraulic conductivity) of low permeability formations is enhanced by creating a series of horizontal fractures in the phreatic zone near a vertical extraction well. The fractures are created by drilling a pilot hole with direct push techniques to a specified depth. The borehole wall is water jetted and a viscous mixture of a starch-based polymer, enzyme breaker, fine sand, water and sodium chloride is injected into the borehole. The highly pressurized fracture fluid follows the initial formationai notch and advances horizontally in an elliptical pattern. The fracturing fluid is propagated toward the pumping well's sand pack, moving through and around the well screen, thereby enhancing the overall permeability and connectivity of the extraction zone around the wells. Aboveground, fracture zones can be mapped by sensors which detect sodium chloride at the surface. After approximately 18 to 24 hours, the enzyme breakers degrade the starch polymer, leaving a high permeability layer of fine sand.

Hydrofracturing is effective in improving the hydraulic connectivity of low permeability aquifer materials, however, the implementability is limited by the inability to control the final locations of the fractures that are created. Hydrofracturing, therefore, was not retained for further analysis.

Wellpoint Systems

A wellpoint system is generally installed by direct push methods and consists of a series of individual well points connected to a header via a riser pipe. Well points are typically designed to dewater soils and may be effective for flows less than 255 gpm up to 22 feet below the ground. Multiple small diameter wells would be required to capture contaminated groundwater, making

implementability questionable. Continuous maintenance may be necessary to prevent clogging of the small diameter wells and would increase operation and maintenance costs. In addition, based on the variable geology and difficulty in implementation of direct push methods at the Li Tungsten site, the wellpoint system process option was not retained for further consideration.

Recirculation Wells

Recirculation wells are wells or a series of wells that have two separate screened intervals, one within the contaminated groundwater and the other in the vadose zone, just above the groundwater interface. Introduction of air within the well shaft just above the lower screened interval causes volatiles within the groundwater to be stripped from the aqueous phase while also causing the water column within the shaft to rise. The volatiles in the gaseous phase are removed via vacuum extraction and the rising column of water spills through the upper screened interval. The water then percolates through the vadose zone into the groundwater to recirculate back within the well shaft through the lower screened interval.

Recirculation wells can be installed at a relatively low cost and can be implemented to treat organics or inorganic in "hot spot" areas. The high water table and insufficient vadose zone in areas of the plume at the Li Tungsten site would make installation of the unsaturated screen difficult. Recirculation wells, therefore, were not retained for further evaluation.

Reactive Walls

A reactive wall is a permeable wall which is installed across the flow path of a contaminant plume and allows the water portion of the plume to passively move through the wall. Reactive walls allow the passage of water while prohibiting the movement of contaminants by employing agents such as zero-valent metals, chelators, sorbents and microbes. Modifications to the reactive wall process options include a funnel-and-gate system or an iron or resin treatment wall. The funnel-and-gate system for in-situ treatment uses low hydraulic conductivity cutoff walls (the funnel) with a gate that contains in-situ reactive zones. Groundwater primarily flows through high conductivity gaps (the gates). An iron treatment wall or resin wall consists of iron granules, resins, or other iron-bearing minerals and is used for the treatment of organic or inorganic contamination. As the iron is oxidized, a chlorine atom is removed from the compound

by one or more reductive dechlorination mechanisms, using electrons supplied by the oxidation of iron. The iron granules are dissolved by the process, but the metal disappears so slowly that the remediation barriers have a long life expectancy. The typical end products include non-toxic compounds. Therefore, **reactive walls** were **retained** for further evaluation.

Hydraulic Barriers

Hydraulic barriers are subsurface barriers used to contain contaminated groundwater and can be used to control plumes prior to treatment. These subsurface barriers consist of an impermeable material that prevents the flow of contaminated groundwater downgradient of the hydraulic barrier. A typical hydraulic barrier may consist of a vertically excavated trench that is filled with a slurry. The slurry hydraulically shores the trench to prevent collapse and forms a filter cake to reduce groundwater flow. Most slurry walls are constructed of a soil, bentonite, and water mixture. The bentonite slurry is used primarily for wall stabilization during trench excavation. A soil-bentonite backfill material is then placed into the trench (displacing the slurry) to create the cutoff wall. Slurry walls may be placed up to depths of 100 feet and are generally two to four feet in thickness. Other impermeable barriers may consist of synthetic geomembrane materials.

Hydraulic barriers have been used for decades and the equipment and methodology are readily available and well known. The technology is effective and implementable in containing existing contamination within a specific area, therefore, **hydraulic barriers** were **retained** for further evaluation.

2.4.2.2 Treatment

The treatment of contaminated groundwater can be accomplished with either in-situ or ex-situ treatment technologies. The process options can be physical, chemical, or biological treatments. The physical groundwater treatment process options that were screened include ion exchange, adsorption/absorption, filtration and air stripping. The chemical treatment process options include precipitation and neutralization. The biological treatment process options include enhanced biodegradation and phytoremediation.

Ion Exchange

Ion exchange is a process whereby toxic ions are removed from the aqueous phase by electrostatic exchange with inert ions (e.g., NaCl) held by the ion exchange material. Ion exchange resins consist of synthetic organic materials containing ionic functional groups to which exchangeable ions are attached. Ion exchange is used to remove metallic cations and anions, inorganic anions, organic acids, organic amines and radionuclides. Fixed bed and countercurrent systems are the most widely used ion exchange systems.

Ion exchange units are available with resins for exchanging either cations or anions. The exchange reaction is reversible and concentration-dependent; the exchange resins are regenerable for reuse. The regeneration step creates a 2 to 10% concentration contaminant waste stream that must be treated separately. Most metallic elements present as soluble species, either anionic or cationic, may be removed by ion exchange. High iron concentrations in groundwater result in rapid exhaustion of the resin and inordinately high regeneration costs. In addition, it may be difficult to achieve PRGs, therefore, ion exchange was not retained for further evaluation.

Adsorption/Absorption

Adsorption technologies are commonly used to remove organics from contaminated groundwater, however, removal of metals can also be accomplished with a number of metal-specific adsorption medias. Adsorption mechanisms are generally categorized as either physical adsorption, chemisorption, or electrostatic adsorption. Weak molecular forces, such as Van der Waals forces, provide the driving force for physical adsorption, while a chemical reaction from a chemical bond between the compound and the surface of the solid results in chemisorption. Electrostatic adsorption involves the adsorption of ions through Coulombic forces, and is normally referred to as ion exchange, which was previously discussed. The efficiency of the system depends on the strength of the molecular attraction between the adsorbent and the adsorbate, molecular weight, type of adsorbent, pH, and surface area. Most activated carbon systems use granulated activated carbon (GAC) in flow-through column reactors to treat organics. Other natural and synthetic adsorbents which treat inorganics include activated alumina, iron-bearing materials and the Forage Sponge.

Activated alumina is a filter media made by treating aluminum ore so that it becomes porous and highly adsorptive. Activated alumina will remove a variety of contaminants, including fluoride, arsenic, and selenium, however, the medium requires periodic cleaning with an appropriate regenerant such as alum or acid in order to remain effective.

The use of iron-bearing material to remove heavy metals from aqueous streams is an innovative technology that may be cost-effective compared to other adsorption medias. In this treatment process, iron fines are contacted with aqueous streams containing heavy metals for a specified period of time. Metals in aqueous solutions are removed when they adsorb to the iron oxides present in the solution. Effluent quality downgradient of iron-bearing barriers will need to be monitored to assure effluent quality standards are met.

The Forager Sponge is an open-celled cellulose sponge incorporating an amine-containing, chelating polymer that selectively adsorbs dissolved heavy metals. The polymer is intimately bonded to the cellulose so as to minimize physical separation from the supporting matrix. The functional groups in the polymer (i.e., amine and carboxyl groups) provide selective affinity for heavy metals in both cationic and anionic states, preferentially forming complexes with transition-group heavy metals. The Forager Sponge is specifically used to remove heavy metals and may be used ex-situ as well as in-situ. When used for in-situ remediation of groundwater, the sponge (which can be supplied in ½-inch cubes) is loaded into elongated fishnet enclosures that are lowered into drilled wells. The enclosures are left in place unattended for a length of time depending on the concentration of metals in the groundwater. After retrieval from the wells, the sponge is stripped of the adsorbed metals and then either reinserted for another cycle of absorption, or disposed.

Adsorption/absorption processes have a long history of use in effective treatment of hazardous waste streams and are implementable technologies with documented performance data. The target contaminant groups for adsorption/absorption processes are most organic contaminants and selected inorganic contaminants. **Adsorption/absorption** was being **retained** for further evaluation.

Filtration

Filtration/Ultrafiltration/Microfiltration are physical processes of separating and removing suspended solids from a liquid by forcing the liquid through a porous medium. Ultrafiltration/microfiltration occurs when particles are separated by forcing fluid through a semipermeable membrane. Only the particles whose sizes are smaller than the openings of the membrane are allowed to flow through. As fluid passes through the medium, the suspended particles are trapped on the surface of the medium and/or within the body of the medium. The porous medium may be a fibrous fabric (paper or cloth), a screen, or a bed of granular material. The filter medium may be pre-coated with a filtration aid such as ground cellulose or diatomaceous earth. Fluid flow through the filter medium may be performed by gravity or by pressure. Granular media filtration is typically used after gravity separation processes for additional removal of suspended solids.

Filtration is an appropriate process option to remove suspended solids prior to use of other process options (such as ion exchange or reverse osmosis) and can aid in removal of suspended solids in a pretreatment or post-treatment process. Therefore, **filtration** was **retained** for further evaluation.

Air Stripping

Air stripping is a mass transfer process in which volatile organic contaminants in groundwater are transferred to the gaseous phase. Lower solubility organics can be removed by air stripping. A packed column or tower with an air blower and counter-current flow of air to water is commonly used. The products are the stripped effluent and contaminated off-gas. Although air stripping is an easily implementable technology for volatile organics, compared to carbon adsorption, the operation and maintenance costs are higher at lower concentrations of organics. In addition, off-gases often must be collected and treated. **Air stripping** was **retained** for further evaluation.

Enhanced Biodegradation

This process option uses naturally-occurring microbial processes to break down organic contaminants to lower risk degradation products. It differs from the natural degradation process

option in that it involves enhancements (i.e., supply of nutrients, injection of oxygen) which accelerate the natural biodegradation process. This is accomplished by increasing the concentration of electron acceptors and nutrients in groundwater and comprehensively documenting the attenuating processes (for example, via groundwater monitoring of both chemical and biological parameters). Oxygen is the main electron acceptor for aerobic bioremediation and nitrate serves as an alternative electron acceptor under anoxic conditions.

Enhanced biodegradation can be effective for treating volatile organic contamination such as nonhalogenated VOCs and fuels. However factors which limit the applicability and effectiveness of this process option include subsurface conditions, bioavailability, safety precautions in handling hydrogen peroxide, and toxicity limits of microorganisms. Also, air sparging can increase the pressure in the vadose zone. This process option would be ineffective for the inorganic contamination, therefore, enhanced biodegradation was not retained for further analysis.

Phytoremediation

This process option uses hydroponically accumulating plants to remove, transfer, stabilize and destroy organic/inorganic contamination in groundwater. Phytoremediation can include enhanced rhizosphere biodegradation, hydraulic control, and phyto-degradation. Enhanced rhizosphere biodegradation takes place in the soil surrounding plant roots where natural substances released by plant roots supply nutrients to microorganisms, enhancing their ability to biodegrade organic contaminants. Hydraulic control includes trees which can act as organic pumps when their roots reach down towards the water table and establish a dense root mass that uptakes large quantities of water. Phyto-degradation is the metabolism of contaminants within plant tissues. Plants produce enzymes, such as dehalogenase and oxygenase, that assist in catalyzing degradation.

This process is implementable on a range of organic contaminants, metals and radionuclides. Phytoremediation, however, has several limitations including: shallow groundwater is necessary; high concentrations of hazardous materials can be toxic to plants; climatic or seasonal conditions may interfere or inhibit plant growth; and a large surface area is

required. Due to the limitations and developmental status of much of this technology, phytoremediation was not retained for further consideration.

Precipitation/Coagulation/Flocculation

This process option is an effective and demonstrated technology for the removal of metals from groundwater. Groundwater can be pumped from extraction wells and then treated ex-situ to precipitate metals by employing hydroxides, carbonates, or sulfides. Generally, the precipitating agent is added to water in a rapid-mixing tank along with flocculating agents such as alum, lime and/or various iron salts. The mixture then flows to a flocculation chamber that agglomerates particles, which are then separated from the liquid phase in a sedimentation chamber. Flocculation involves a gentle agitation of the coagulated solids to promote the growth of floc particles, increasing precipitation rates and removal. This process is widely used in conventional wastewater treatment systems to remove precipitated metals and suspended solids. Precipitation/coagulation/flocculation is proven technology and is effective for treating many inorganics. **Precipitation/coagulation/flocculation** was **retained** for further evaluation.

Neutralization

Neutralization or pH adjustment is a process used to adjust the pH of a waste stream to an acceptable level for discharge and disposal. Neutralization may be used as a pre/post treatment step with other treatment precesses (i.e., chemical precipitation). Adjustments can be accomplished by either adding acidic or alkaline reagents to alkaline or acidic waste streams to change the pH. **Neutralization** was **retained** for further evaluation.

2.4.2.3 Disposal

If active groundwater collection and treatment technology is selected, groundwater disposal options (either on-site or off-site) would be needed. On-site disposal process options considered include reinjection, discharge to existing streams/ponds, and the use of recharge basins. Off-site disposal options considered include discharge to the local POTW or temporary storage with off-site disposal.

Reinjection

On-site reinjection involves the discharge of treated groundwater through a series of injection wells or an infiltration gallery to recharge the aquifer from which groundwater was withdrawn. This option is usually feasible where hydraulic conductivity and transmissivity are high. Since hydraulic conductivity is generally low in the areas of contamination, reinjection facilities would need to be installed in upgradient areas where more transmissive zones are available. Potential problems with reinjection wells include clogging, dead spots, air locks, and plugging by any form of chemical precipitation. Currently, a new deep reinjection system has been constructed at the adjacent Mattiace site and will be used for reinjection of treated effluent. An option for co-operative use of this system in a collection scenario may be available. Infiltration galleries are constructed so that groundwater may percolate through the unsaturated zone in trenches over a wider area of the site than reinjection wells. The **reinjection** process option was **retained** for further evaluation.

Discharge to On-Site Recharge Basins

This option would involve the construction of recharge basins on-site to receive treated groundwater. Since recharge basins would require large areas to be constructed, recharge basins were not retained for further evaluation.

Discharge to On-Site Ponds/Streams

This option would involve the discharge of treated groundwater to on-site ponds and/or streams. This option would not be appropriate, since the intermittent streams and small existing on-site ponds and wetland areas may create adverse overland runoff conditions downgradient of discharge. Discharge to On-Site Ponds/Streams was not retained for further evaluation.

Discharge to Off-Site Publicly Owned Treatment Works (POTW)

This option would involve pumping treated groundwater directly to a POTW facility for treatment and discharge. Due to the incompatibility of conventional wastewater treatment with the chemicals of potential concern at the site, discharge to a local POTW was not retained for further evaluation.

Temporary Containment and Off-Site Disposal

This option considers temporary containment of treated water in on-site storage tanks followed by pumping for off-site treatment and disposal. Off-site disposal options may include treatment at the adjacent Mattiace site. **Temporary containment** was **retained** for further evaluation.

2.4.3 Technologies and Process Options Applicable to Institutional Controls

This section contains a screening of institutional controls that may be taken to limit or prevent human exposure to environmental contamination. These measures are intended to control or restrict property owners' activities, thus reducing the potential for human contact with contaminated media.

The following types of institutional controls will be reviewed: fencing/warning notices, requiring permits, deed restrictions, restriction of land use, community education/advisement. A summary of the screening of institutional controls is presented in Table 2-16.

2.4.3.1 Fencing/Warning Notices

The installation of fencing is common at Superfund sites undergoing remediation. Warning notices can be posted on the fences to alert unauthorized persons from entering the fenced area. Fencing and warning notices provide some means of preventing exposure to contaminated materials, but will not provide complete protection since they can be vandalized. Both of these techniques are easily implemented and can prevent some human exposure to contaminated materials, therefore, **fencing/warning notices** were **retained** for further evaluation.

2.4.3.2 Deed Restrictions/Deed Notices

Deed restrictions can be imposed by legislation or administrative court order or agreed to by the property owner. Deed restrictions recorded without acquisition of easements have been negotiated at Superfund sites where a responsible party owns the restricted party. If imposed on innocent property owners, however, they can be vulnerable to challenges.

TABLE 2-16
SUMMARY OF SCREENING OF INSTITUTIONAL CONTROLS
LI TUNGSTEN AND CAPTAIN'S COVE SITES

Technology	Effectiveness	Implementability	Cost	Retained for Further Evaluation?
FENCING/WARNING NOTICES				
• Fencing	Somewhat effective - can be vandalized	Easily implemented	low	yes
• Warning notices	Somewhat effective	Easily implemented	low	yes
DEED RESTRICTIONS/ DEED NOTICES				
• Deed restrictions	Moderately effective. Pose legal restrictions against improper use. Can be challenged by property owners.	Imposed by legislation or court order or agreed to by property owner.	moderate	yes
• Deed notices	Moderately effective. No legal restrictions, but noted on property title.	Same as for deed restrictions.	moderate	yes
LAND USE RESTRICTION/ PERMITS/ZONING ORDINANCES				
• Permitting	Moderately effective for monitoring activities, such as excavation.	Short timeframe to implement.	moderate	yes
• Zoning ordinances	Effective, if enacted.	Very difficult. Long time to implement.	moderate to high	no
• Health ordinances	Moderately effective.	Need to obtain cooperation of local (and/or county) authorities.	low to moderate	yes

Deed notices fulfill the same function as deed restrictions and are also imposed by administrative action or by agreement with the property owner. Deed notices alert anyone who researches the title to property restrictions or contamination but do not pose legal restrictions on the use of the property. Deed restrictions alert prospective buyers to the restrictions on the property because property transfers generally require a title search before the property can be insured and the transfer accomplished.

Deed restrictions and **deed notices** were **retained** for further evaluation.

2.4.3.3 Permits, Zoning Ordinances and Health Ordinances

The permitting process could be used to restrict exposure in the affected areas. Municipalities typically require individuals to acquire permits before undertaking certain activities, such as water supply or sewer connection building permits. The affected municipalities could require permits before allowing any excavation in contaminated areas. To reduce the potential to exposure from contaminated soil during excavation, a program could be developed mandating that applicants demonstrate their ability to meet certain performance standards, such as requiring that properties meet specific radon and gamma radiation standards before being sold. If issuance of a certificate of occupancy (CO) were required prior to each sale, radiation standards could be incorporated into the regular CO requirements. Permits are easy to implement and since other more permanent restrictions could take significant periods of time to put into place. **Permits** was **retained** for further evaluation.

Zoning ordinances could be used to control the exposure of property owners and workers on the sites. Typically, zoning ordinances specify permissible land uses and control development within identified districts. Enacting zoning ordinances for activities such as excavation has been controversial and may be legally challenged by property owners. Enacting zoning ordinances can be difficult to implement, and takes a long period of time, such as several years. For these reasons, zoning ordinances were not retained for further evaluation.

Health ordinances may also be a mechanism for protecting property owners and others from exposure to contaminated media. Enacting and enforcing health ordinances depends on the cooperation of local and County authorities. Since these ordinances are concerned with the protection of public health, they may be less susceptible to the same challenges as zoning

ordinances would. **Health ordinances** were **retained** as an institutional control for further consideration.

3.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section documents the development of remedial alternatives for the Li Tungsten site and the Captain's Cove site. The basis for the development of alternatives was the technology screening conducted in Section 2.0; process options determined to be applicable were carried forward and combined/expanded to address site-specific remedial objectives and concerns. The rationale associated with assembly of the soil and groundwater process options into remedial alternatives is described in this section. In addition, conceptual designs of the combined technology systems are described and evaluated.

3.1 SCREENING CRITERIA

The development of remedial alternatives from the available process options is based on a broad consideration of three factors: effectiveness, implementability and cost. Consideration of these factors during alternative development allows each possible permutation of process options to be screened, so that only the most applicable alternatives are assembled and carried forward to the detailed alternative evaluation stage. Data gathered during the field investigations and knowledge of existing site conditions is also reviewed at this stage to identify conditions that may limit or favor selected alternatives. The three factors are discussed in more detail below.

3.1.1 Effectiveness

Potential alternatives which will meet the remedial action objectives presented in Section 2.2.1 and 2.2.5 will be considered to be effective.

3.1.2 Implementability

Technical and administrative feasibility of construction, operation and maintenance are evaluated under this factor. Potential alternatives which may prove extremely difficult to implement, which will not achieve the remedial action objectives in a reasonable period of time or which have not been proven reliable will be eliminated from further consideration.

3.1.3 Cost

Conceptual estimates of cost are used to compare potential alternatives that provide similar results in terms of effectiveness and implementabilty. Both construction costs and long-term operation and maintenance costs are evaluated.

3.2 CONSIDERATIONS FOR DEVELOPMENT OF SOIL ALTERNATIVES

As discussed in Section 2.0, applicable soil and sediment remediation process options include containment, excavation, volume reduction, stabilization, electrokinetic processing, chemical extraction and transportation and off-site disposal. Each process option carried forward from Section 2.0 is discussed below in relation to the rationale for the development of remedial alternatives. The discussion concludes with the presentation of soil and sediment alternatives to be carried forward into Section 4.0 for detailed evaluation.

3.2.1 Building Demolition

Based on poor structural condition, space requirements to implement various process options and future use, building demolition is integrated into all alternatives, both at the Li Tungsten and Captain's Cove sites.

3.2.2 Containment (On-site Landfill with Modified RCRA Cap)

The containment option was only considered for an excavated waste stream. Containment of unexcavated soils/sediments by capping the entire site or capping multiple "hot spots" was not considered effective or implementable in achieving remedial action objectives. Containment of an excavated waste stream was evaluated by considering one potential waste stream that included soils/sediments that are greater than both radiological and inorganic PRGs and a second waste stream that included soils/sediments that are only greater than the inorganic PRGs. On-site containment of any radiologically contaminated soil in a specially constructed landfill using a RCRA cap with gamma shielding, while technically feasible, would face a lengthy and difficult regulatory approval process. Disposal of radioactive material on-site would

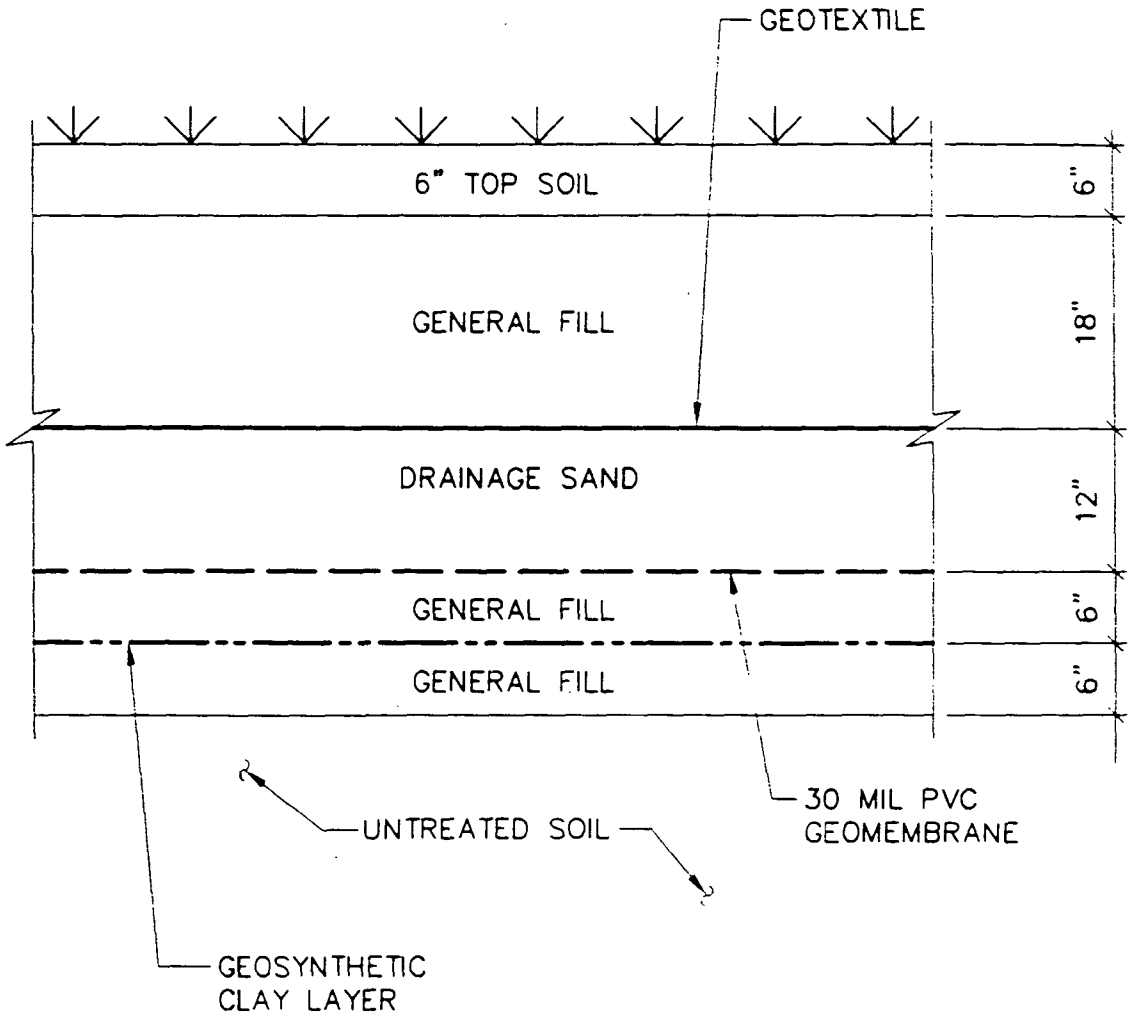
have to meet the substantive requirements of 6 NYCRR Part 380. Since Part 380 does not include shallow land burial among the authorized means of disposal for radioactive material, it would have to be demonstrated that compliance with the provisions of Part 380 would impose unreasonable economic, technological or a safety burden and that shallow land burial would have no significant impact on the public health and safety of the environment. Before on-site containment could be seriously considered, existence of the above stated conditions would have to be demonstrated. The demonstration process is likely to be very lengthy and the outcome unknown, therefore, the on-site containment was eliminated from further consideration.

Utilization of the containment option for on-site disposal of inorganic-contaminated soils was considered both effective and implementable in achieving the remedial action objectives. For this reason, containment was carried forward in the development of alternatives, but in combination other process options such as removal and stabilization, as discussed below. A schematic drawing of the modified RCRA cap is provided in Figure 3-1.

3.2.3 Removal

Removal of contaminated soils followed by transportation to an off-site disposal facility is an effective conventional remediation technology and has been successfully implemented at many sites. This process option can be carried forward for detailed analysis as a self-contained remedial alternative. Removal of contaminated soil/sediment can also be combined with other process options including ex-situ treatment (volume reduction, stabilization and chemical extraction) and containment (consolidation of the contaminated waste stream in an on-site landfill) to form additional alternatives.

There are no foreseen space constraints for the removal of soils/sediments at the Li Tungsten site. Excavation could proceed utilizing conventional cut-back and sloping techniques to provide worker protection and minimize cave-in and/or wall collapse. At the Captain's Cove site, however, there are more significant space constraints in the western portions of the site, near the proposed ferry terminal and parking area. Installation of driven sheet piles around the circumference of the areas to be excavated in the western portions of the Captain's Cove site (Area A and Areas B and C) is both implementable and effective, but at an increased cost.



NOT TO SCALE

SOURCE: USEPA, 1997
RECENT DEVELOPMENTS FOR IN-SITU
TREATMENT OF METALS CONTAMINATED SOILS

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK LAW, SECTION 7209.2.

TITLE:	DATE:	FIGURE NO.:
SCHEMATIC OF MODIFIED RCRA CAP	JUNE 1999	3-1

MALCOLM PIRNIE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

400388

3.2.4 Volume Reduction

The volume reduction process option is intended to segregate soils/sediments into a radiologically contaminated waste stream and a non-radiologically (e.g., inorganic) contaminated waste stream. Technologies to achieve the segregation include the Segmented Gate System (SGS) developed by Thermo Nutech and the Automated Conveyor Monitoring System (ACMS) developed by Canberra. Segregation of inorganic-contaminated soils using volume reduction, when combined with treatment and containment in an on-site landfill comprises an alternative for detailed analysis. A schematic of the SGS is presented in Figure 3-2.

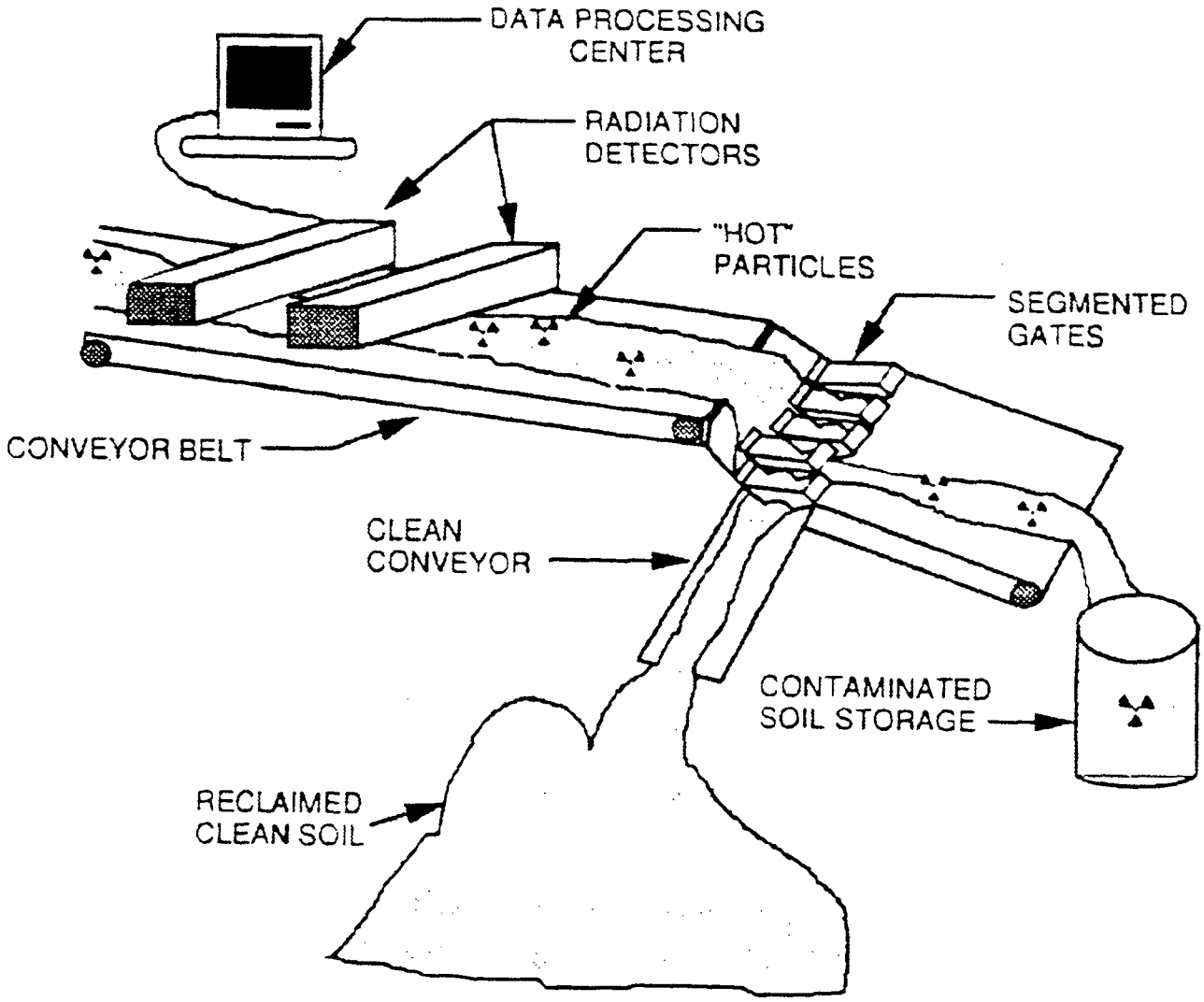
The volume reduction process option becomes less cost-effective if the non-rad waste stream has to go off-site to a hazardous waste landfill. Volume reduction becomes cost-effective if a significant percentage of the non-rad waste stream can go to a non-hazardous Subtitle D facility. Volume reduction is most cost-effective when it is combined with an on-site disposal option or a treatment process option for the inorganic-contaminated waste stream, such as those discussed in Sections 3.2.5 and 3.2.6.

3.2.5 Stabilization

Stabilization can be conducted both in-situ and ex-situ. In-situ stabilization was not considered implementable due to redevelopment plans for the area. Ex-situ stabilization/solidification/fixation, however, is effective when used in combination with other process options to facilitate alternatives with land disposal of wastes.

The concentration of inorganics in the soil and sediment may trigger Land Disposal Restrictions. For example, under 40 CFR Part 268, wastes expected to exhibit the toxicity characteristic for arsenic are prohibited from land disposal unless they meet the treatment standards in Subpart D (40 CFR 268.40). The applicable treatment standard for non-wastewaters is 5.0 mg/L arsenic via TCLP analysis. Alternatives involving on-site or off-site land disposal of a regulated soil and sediment stream may require a stabilization treatment option. Ex-situ stabilization is effective and implementable when combined with other process options.

Exhibit 2. SGS Diverts Clean Soil from Radioactively Contaminated Soil



Source: Hellier, 1996

TITLE:	DATE:	FIGURE NO.:
SCHEMATIC OF SEGMENTED GATE SYSTEM	JUNE 1999	3-2

MALCOLM PIRNIE

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

400390

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3.2.6 Chemical Extraction

The chemical extraction process option was considered to remove and concentrate both radionuclides and inorganics from an excavated soil/sediment waste stream. The concentrated waste stream would subsequently be disposed off-site. Chemical extraction processes, such as the Batch Steam Distillation and Metal Extraction treatment process developed by IT Corporation, use leachants such as hydrochloric acid to recover metals from contaminated soil and sediment. Due to the short term risks and implementability concerns associated with storage of acid for soil/sediment treatment, the incorporation of this process option into an alternative was not carried forward.

3.2.7 Transportation and Off-Site Disposal

Transportation and off-site disposal process options, will be included in alternatives which require off-site disposal for one or more waste streams. The most economical mode of transportation for the radioactive waste streams, where the distance to a licensed disposal facility may be approximately 2,600 miles, incorporates a combination of truck and rail transport. Truck transport via end-dump trucks from the site to a licensed transfer facility (e.g., Wooster, MA) for transfer to gondola cars equipped with hard lids for rail shipment directly to a licenced disposal facility (e.g., in Utah). Transportation of non-radiological waste streams are assumed to be entirely by truck.

3.2.8 Summary of Soil and Sediment Alternatives

A total of four alternatives were developed for the Li Tungsten site (LS-1 through LS-4) and the Captain's Cove site (CS-1 through CS-4). Due to the similarity in wastes present at both sites, the alternatives developed for the Li Tungsten sites also apply to the Captain's Cove site.

Based on the rationale discussed above, the following soil and sediment alternatives were developed:

- **LS-1: No Action.** Evaluation of the No Action Alternative is required under CERCLA as a baseline for comparison with other alternatives.

- **LS-2/CS-2: Excavation and Off-Site Disposal of Radioactive and Nonradioactive Metals-Contaminated Soils.** This alternative consists of building demolition to eliminated hazards posed by structural instability, hazardous construction materials (e.g., asbestos and radionuclides), facilitate pre-design sampling and implementation of future remedial action; excavation of soils and sediments contaminated at levels greater than PRGs, ex-situ stabilization (as necessary to meet LDR requirements), and off-site disposal at an appropriately licensed facility.

- **LS-3/CS-3: Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Stabilization and On-Site Containment of Other Nonradioactive Metals-Contaminated Soils at the Li Tungsten Facility.** This alternative consists of building demolition, excavation of soils and sediments contaminated at levels greater than PRGs, radioactive waste volume reduction to reduce the volume of radioactive wastes and thereby reduce off-site disposal costs at an appropriately licensed facility, ex-situ stabilization (if necessary) of residual inorganic-contaminated waste stream and disposal in a landfill with RCRA cap on the Li Tungsten site.

- **LS-4/CS-4: Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Off-Site Disposal of Other Nonradioactive Metals-Contaminated Soils.** This alternative is the same as LS-3/CS-3, except that after utilization of the radioactive waste volume reduction technology, any non-radioactive but chemically contaminated wastes would be shipped off-site for disposal instead of being contained on-site.

3.3 CONSIDERATIONS FOR THE DEVELOPMENT OF GROUNDWATER AND SURFACE WATER ALTERNATIVES

As discussed in Section 2.0, applicable groundwater and surface water remediation process options include collection/containment, treatment, and disposal. Each process option carried forward from Section 2.0 is discussed below in relation to the rationale for the development of remedial alternatives. Section 3.4 concludes with the presentation of groundwater and surface water alternatives to be carried forward for detailed evaluation. Remedial alternatives for groundwater and surface water were developed for the Li Tungsten site only. Generally, the groundwater at the Captain's Cove site did not contain radionuclides at concentrations that exceeded the PRGs, therefore, no remedial alternatives were developed.

3.3.1 Development of Collection/Containment Options

The collection/containment technologies which were retained from section 2.0 included continuous interceptor systems, low-flow extraction wells, reactive walls and slurry barriers for groundwater and direct pumping methods for surface water. These technologies are the most appropriate and cost-effective based on the volumes of contaminants to be treated and geological and hydrogeological conditions. In addition, combined with treatment systems developed in this section, these systems would be efficient and cost-effective for reducing the organic and inorganic contamination below the PRGs. Based on site conditions, two or three collection/containment process options were combined under this category to capture and/or contain the existing contamination:

- Interceptor systems with low-flow extraction wells.
- Reactive walls with slurry barriers and in-situ adsorption wells.

3.3.1.1 Interceptor Collection System with Low-Flow Extraction Wells

An interceptor collection system with low-flow extraction wells provides for the capture of both shallow and deep groundwater contamination for subsequent centralized treatment and disposal.

The interceptor collection systems are installed downgradient and within the boundaries of the existing contaminant plumes in Parcel C. The collection system is installed perpendicular to the groundwater flow path and is designed to capture the shallow groundwater contamination component directly above the Port Washington Clay confining formation. Since the Port Washington Clay is shallow in the areas of construction, excavation would be implemented using trenching machines and/or backhoes. If conventional methods (backhoes) are used, wall stabilization using wood or steel would be required to prevent cave-ins during installation. Multiple horizontal HPDE perforated piping would be installed in the interceptor trench to ensure that water arriving at the drain line would be conveyed without a buildup of pressure. In addition, the drainage design gradient would be sufficient to result in a flow velocity to prevent siltation, but will not cause turbulence.

Filters and envelopes would be installed in the trenches to prevent soil particles from entering and clogging the interceptor system. The filters would be constructed of fine mesh fabric or a geotextile. The envelope would improve groundwater flow and reduce the flow velocity into the interceptor system by creating material that is more permeable than the surrounding soils.

The pumping system of the continuous interceptor trench would be designed to remove the shallow contaminated groundwater that collects by gradient into the drainage sump. In addition, sump pumps would be installed in the drainage sump to create drawdown and accentuate the gradient of flow into the interceptor system.

Low-flow extraction wells would be used to capture the deeper component of contaminated groundwater not accessible to the interceptor system. The low-flow extraction wells would be placed downgradient or in select contaminated areas to a depth to intercept and access the deeper components of contaminant groundwater flow. The low-flow extraction wells are necessary because the clay layer varies across the site and causes locations where contamination was detected at depth. The low-flow extraction wells would be screened above the Port Washington Clay by conventional drilling mechanisms. Groundwater collected with the low-flow extraction wells would be combined at the surface with flow collected with the continuous interceptor trench for on-site or off-site treatment and disposal. Both systems would

be constructed of materials that are compatible with the COPCs.

3.3.1.2 Reactive Walls with Slurry Barriers and In-Situ Adsorption Wells

Reactive walls with slurry barriers and in-situ adsorption wells are designed to provide passive in-situ collection and containment. Combining of these three technologies would provide for the capture, containment, and in-situ treatment of both shallow and deep contaminated groundwater.

Like the interceptor systems, the reactive walls would be installed downgradient and within the boundaries of the existing contaminant plumes in Parcel C. The reactive walls are installed perpendicular to the groundwater flow path to capture the shallow groundwater contamination component directly above the Port Washington Clay confining formation. The reactive walls may be installed as a passive permeable barrier (without a slurry wall) or a funnel and gate system (with a slurry wall). As a passive permeable barrier, groundwater would pass through and be treated within the wall. Treated water would pass through the downgradient side of the wall and continue with the dominant direction of groundwater flow. In a funnel and gate system, the funnel section would consist of a soil-bentonite slurry wall. This funnel would channel contaminated groundwater toward treatment gates. The treatment gate sections consist of the treatment media in the center of the funnel. The actual funnel and gate dimensions would be based on groundwater modeling. Further design studies would be required to determine the thickness of the reactive wall that will result in the residence time necessary to degrade the organic and inorganic contamination. In addition, these tests would aid in determining the performance monitoring criteria for the reactive walls.

In-situ adsorption wells would be placed in "hot spot" inorganic contaminated areas where the deeper component of groundwater contaminant flow is not accessible to treatment by the reactive walls. The in-situ adsorption wells would be installed with conventional drilling techniques and screened above the Port Washington Clay. Packer assemblies would be used to block-off various intervals within the screened interval to collect contaminated groundwater from discreet zones.

3.3.2 Development of Treatment Options

Physical, chemical and biological treatment process options were screened in Section 2.0 to eliminate those treatment technologies which would not be appropriate based on the site contaminants and/or the ability to treat contamination in-situ or ex-situ. From the chemical treatment category, precipitation/coagulation/flocculation and neutralization were retained for further consideration.

From the category of physical treatment options, the adsorption/absorption, filtration and air stripping process options were retained for detailed analysis because of their advantage in implementation, effectiveness and cost. Air stripping is an easily implementable technology for volatile organic compounds and combined with activated carbon can extend the life of carbon, thereby decreasing the operation and maintenance costs. Although VOC contamination on Parcel A and B will be addressed by the State, air stripping will be necessary to remove the organic contamination where may co-exist in areas of inorganic contamination.

Various adsorption technologies were discussed in Section 2.0 including GAC, iron bearing materials, activated alumina and the Forager Sponge. GAC technology is easily implementable in conjunction with collection technologies for treating organic contamination. In addition, the use of iron-bearing materials to remove contaminants from aqueous streams can be used with the reactive walls. Likewise, the use of the Forager Sponge or other adsorption technology with in-situ treatment wells can be used to treat inorganic contamination. Selection of the specific adsorption media will require further treatability or pilot-scale studies. Filtration technologies are also easily implementable, however these technologies depend on active extraction of groundwater and would not be appropriate in passive technology alternatives. Filtration technologies when combined with adsorption technologies would be effective in reducing the contaminants to the PRGs.

Another treatment option is conveyance of the groundwater via force main to the treatment plant at the Mattiace site. The Mattiace treatment process consists of carbon adsorption, air stripping, sand filtration, chemical extraction and pH adjustment. Overall, the treatment process at the Mattiace site is compatible with the groundwater contaminants from Li Tungsten. The design capacity of the Mattiace site treatment plant is 30 gallons per minute

(gpm). During start-up operations, however, the yield from the extraction wells has been less than expected; the actual flow rate at the treatment plant is approximately 6-12 gpm. The added flow from the Li Tungsten site may be implementable some modifications or additions to the existing treatment plant.

On-site treatment options that were retained to be combined with other collection/containment options are as follows:

- Adsorption
- Air Stripping
- Filtration
- Chemical Extraction/pH Adjustment

Off-site treatment options that were retained to be combined with other collection/containment options include cooperative use of the existing Mattiace treatment plant and reinjection facilities.

3.3.3 Development of Disposal Options

On-site reinjection of treated groundwater or temporary containment with off-site disposal are considered effective and implementable disposal options. These options could be combined with the collection/containment and treatment options to develop a feasible alternative. If the off-site treatment option (Mattiace) is selected, disposal would be accomplished through the reinjection wells located upgradient of the Mattiace site.

Passive technologies, such as reactive walls and in-situ treatment wells, would not require groundwater disposal options because of their in-situ treatment characteristics. However, miscellaneous contaminated media (i.e., GAC or other adsorption media) generated as a result of the groundwater treatment would probably require disposal as a hazardous waste material following exhaustion.

Disposal options that were retained to be combined with other collection/containment and treatment options are as follows:

- Reinjection (on-site)
- Reinjection (off-site at Mattiace)

3.3.4 Summary of Groundwater and Surface Water Alternatives

Based on the rationale discussed in Sections 3.3.1 through 3.3.3, the following groundwater and surface water alternatives were developed:

- **LW-1: No Action.** Evaluation of the No Action Alternative is required under CERCLA and as a baseline for comparison with the other alternatives.

- **LW-2: Interceptor Trench/Extraction Wells with On-Site Treatment and Disposal.** This alternative uses a combination of interceptor trenches and low-flow extraction wells to capture shallow and deep contaminated groundwater in the Upper Glacial Aquifer above the Port Washington Clay. On-site treatment consists of adsorption, air stripping, filtration, chemical precipitation/pH adjustment with on-site reinjection and disposal.

- **LW-3: Interceptor Trench/Extraction Wells with Off-Site Treatment and Reinjection at the Nearby Mattiace Superfund Site Treatment Facility.** This alternative uses similar collection/containment options as LW-2, however, contaminated groundwater is pumped via a force main off-site to the Mattiace site for treatment and disposal (reinjection).

- **LW-4: Reactive Walls with Slurry Walls and In-Well Adsorption Treatment.** This alternative is a passive containment/collection and treatment alternative. It combines the installation of reactive walls containing zero-valence metals or other adsorption media to treat the inorganic contamination. In addition, in-well adsorption wells would be used to treat the deeper inorganic "hot spots".

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 EVALUATION CRITERIA

This section presents a detailed evaluation of the soil, sediment, ore residues and groundwater/surface water alternatives developed in Sections 2 and 3. The alternatives are evaluated using criteria established in the NCP as described in this chapter. Each alternative is evaluated in detail considering seven of the nine criteria stipulated in the NCP.

The first two criteria are the "threshold" factors that must be met for an alternative to be considered for implementation:

- Overall protection of human health and the environment.
- Compliance with ARARs of federal and state environmental and public health laws.

Five "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between the remedial alternatives. Alternatives that satisfy the threshold criteria are evaluated further using the following five criteria:

- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of contaminated media.
- Short-term effectiveness.
- Implementability.
- Cost.

The remaining two criteria, state acceptance and community acceptance, are "modifying" factors. A more detailed description of the criteria is provided below:

Overall Protection of Human Health and the Environment

This criterion relates to whether the alternative provides adequate protection of human health and the environment and describes how risks posed by each potential exposure pathway,

based on a reasonable maximum exposure scenario, are eliminated, reduced or controlled through treatment, engineering controls or institutional controls. This criterion evaluates the long-term benefits to public health and the environment in contrast to any short-term or long-term risks posed by the implementation of the alternative.

Compliance with ARARs

Remedial alternatives are evaluated to determine whether they attain ARARs and TBC material under Federal or State environmental statutes and requirements or provide grounds for invoking a waiver. The chemical-specific, location-specific and action-specific ARARs and TBCs are presented in Tables 2-6 through 2-8.

Long-Term Effectiveness and Permanence:

This criterion evaluates the long-term effectiveness and permanence each alternative affords, along with the degree of certainty that the alternative will prove effective. The magnitude of residual risk remaining from untreated waste or treatment residuals is considered. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility and tendency to bioaccumulate. The adequacy and reliability of controls necessary to manage treatment residuals and untreated waste are also considered. This criterion addresses the uncertainties associated with land disposal for providing long-term protection from residuals, the potential need to replace technical components for the alternative and potential exposure pathways should the remedial action need replacement.

Reduction in Toxicity, Mobility, or Volume

This criterion addresses the degree to which the alternatives employ treatment technologies that reduce toxicity, mobility or volume. The treatment employed by the alternative is assessed as to the amount of hazardous contaminants destroyed or treated, the degree of expected reduction in toxicity, mobility or volume of the waste, the degree to which the treatment is irreversible, the type and quantity of residuals that will remain after treatment and the degree to which the treatment reduces the inherent hazards at the site.

Short-Term Effectiveness

This criterion assesses the short-term effectiveness of the alternative. This criterion analyzes the short-term risks that may be posed to the community during implementation of the alternative, potential impacts on workers and the environment during remedial action, and the effectiveness and reliability of protective measures. The amount of time until remedial action objectives are achieved is also evaluated.

Implementability

This criterion assesses each alternative for ease or difficulty of implementation. This assessment includes: technical feasibility, administrative feasibility, reliability, the ability to monitor the effectiveness of the remedy, the availability of services and materials necessary to implement the alternative, ability to construct and operate, the ease of undertaking additional measures (if necessary), ability to obtain approvals from other agencies, the availability of necessary equipment and specialists, and the timing of new technologies.

Cost

This criterion includes a calculation of the estimated present worth for each alternative. Costs that are considered in the evaluation include both direct and indirect capital costs, operation and maintenance (O&M) costs and net present worth costs.

State Acceptance

This criterion relates to the State perception of the selected remedy and its acceptability as the method of remediation. State acceptance is usually assessed in the Record of Decision (ROD) following review of State comments on the Draft Final FS Report. State acceptance indicates whether the state concurs with, opposes or has no comment on the selected remedy.

Community Acceptance

This criterion relates to the public perception of the selected remedy and its acceptability

as the method of remediation. Community acceptance is usually assessed in the ROD following a review of public comments received on the Draft FS Report.

4.2 SOIL AND SEDIMENT ALTERNATIVES

4.2.1 Alternative LS-1/CS-1: No Action

4.2.1.1 Description

Consideration of the no action alternative is required by the NCP and CERCLA as a baseline for comparison with the other alternatives. The no action remedial alternative does not include any remedial measures that address the problem of contamination at the site. Because thorium-contaminated material would be left on-site as part of this alternative, these sites would be subject to 5-year reviews as required by Section 121 of Superfund Amendments and Reauthorization Act of 1986 (SARA). The site would be reviewed to determine exposures to potentially affected populations, the effectiveness of engineering controls would be assessed and a report summarizing the review would be prepared.

4.2.1.2 Assessment

Overall Protection of Human Health and the Environment: The no action alternative would not contribute to protection of human health and the environment beyond deterring entry to the fenced sites and thereby preventing direct contact with the ore residues, soils and sediments.

Compliance with ARARs: On-site soil contains metal and/or radionuclide contaminants at concentrations greater than New York State TAGM objectives for soil cleanup, the cleanup levels developed for the State Superfund cleanup at Captain's Cove and the risk-based PRGs presented in Section 2.2.5. The no action alternative, therefore, does not comply with applicable TBCs.

Long-Term Effectiveness and Permanence: Would not provide any long-term effectiveness or permanence in protecting human health or the environment. The effectiveness

of the alternative may decrease in the long term due to the continuing presence of residual risk.

Reduction of Toxicity, Mobility or Volume: Alternatives LS-1 and CS-1 do not reduce toxicity, mobility or volume of contaminated soil. No containment, removal or treatment is associated with these alternatives.

Short-Term Effectiveness: The alternative does not result in any adverse short-term impacts.

Implementability: This alternative is readily implemented and would not take any time to complete.

Cost: There are no capital costs or O&M costs associated with Alternatives LS-1 and CS-1.

State Acceptance: State acceptance of the No Action alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of the No Action alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.2.2 Alternative LS-2/CS-2: Excavation and Off-Site Disposal of Radioactive and Nonradioactive Metals-Contaminated Soils

4.2.2.1 Description

Under this alternative, all structures on the Li Tungsten site would be demolished to eliminate hazards posed by structural instability, hazardous materials of construction (e.g., asbestos, radionuclides), as well as to facilitate pre-design sampling and implementation of future remedial actions. This action would include demolition of the Dickson Warehouse and the Benbow Building on Parcel C and the Carbide Building, the Loung Building and the Office/Laboratory Building on Parcel A.

Additionally, soil, sediment and ore residues contaminated above PRGs would be excavated and disposed off-site. Radioactive wastes on the Li Tungsten site would require excavation to an average depth of four feet (maximum of six feet on Parcel C). On the Captain's Cove site, excavation would range between four and 12 feet in Areas A, G and B/C. Radioactive wastes would be disposed as naturally occurring radioactive material (NORM) at an off-site licensed disposal facility that is capable of appropriately managing this type of material. Inorganic-contaminated wastes would be disposed at an appropriate off-site landfill. Nonradioactive metals-contaminated soil at the Li Tungsten site is typically co-located with radioactive wastes and will require excavation to depths greater than four feet in several areas (e.g., 10 feet in a few areas of Parcel C) because of the tendency of these inorganics to leach into the groundwater. If necessary, excavated soils would be chemically fixated at the disposal facility to achieve Land Ban compliance, due to the presence of inorganic contamination.

Soil excavation would be preceded by site preparation measures including building demolition, the removal of discarded drums present at the surface on Parcel B and management of the existing storm sewer system. Potential contaminated ore or soils associated with the discarded drums would also be disposed off-site. The existing storm sewers would be pressure-washed and the effluent and sediments collected for off-site disposal. Storm sewer bedding material would be characterized where encountered during excavation activities to evaluate the necessity for off-site disposal.

Deed restrictions would be placed on the Li Tungsten site to prevent the property from being used for residential purposes and the installation of potable water supply wells. Five year reviews would also be required because this alternative does not allow unrestricted use of the property.

4.2.2.2 Assessment

Overall Protection of Human Health and the Environment: Protection of human health and the environment is achieved by removing the contaminated soils, sediments and ore residues above the PRGs for off-site treatment and disposal. The uncontrolled nature of the contamination at the site will be eliminated by transferring the contaminated media to appropriate disposal facilities.

Compliance with ARARs: Removal of the soil would reduce contaminant concentrations at the Li Tungsten and Captain's Cove sites below the PRGs presented in Section 2.2.5. The alternative may have to comply with land disposal restrictions for off-site disposal of any excavated wastes with metals contamination above LDR levels. Off-site transportation of radioactive materials which exceed a concentration of 2,000 pCi/g would be regulated by 49 CFR 173. The excavation and disposal of PCB-contaminated soils would be governed by the requirements of Toxic Substances Control Act (TSCA). Excavated soils with greater than 50 mg/Kg of total PCBs would require appropriate off-site treatment and disposal.

Excavation activities will utilize New York State's Air Guide-1 to ensure that there are no adverse air/particulate impacts to the surrounding community resulting from the excavation and handling of contaminated soils.

Long-Term Effectiveness and Permanence: Long-term risks would be eliminated and permanence would be achieved due to the removal of contamination. Long-term management, maintenance or monitoring would not be required. Long-term effectiveness for the removed soil would be based on the maintenance of engineering controls at the off-site disposal facility.

Reduction of Toxicity, Mobility or Volume: The toxicity, mobility and volume of contaminants would be reduced by the excavation and off-site disposal of radioactive and metals-contaminated wastes.

Short-Term Effectiveness: Potential short-term impacts are associated with this alternative due to direct contact with the soil by workers and through the potential for the generation of dust during construction. It requires monitoring and control to protect the community and workers from the potential short-term adverse risks associated with the remedial actions.

Potential risks to the community include exposure to dust and radionuclides emitted from excavation areas and stockpiled soils awaiting transportation. Temporary structures, plastic covers/tarps and temporary erosion control barriers could be used to minimize dust generation and off-site migration. Air monitoring would be employed to evaluate if controls are adequate.

Equipment decontamination will be performed before construction equipment is removed from the site.

A short-term risk is associated with transportation of radioactive soils from the source location to the off-site facility. PPE and monitoring would be used to protect workers from dermal contact, inhalation and ingestion of contaminated soils and dust. Excavation safety measures would be enforced to reduce physical hazards. Vehicle traffic associated with this alternative could impact the local roadway system and nearby residents through increased noise level and traffic.

Implementability: The implementability of this alternative would be a function of the acceptability of transportation of low-level radioactive wastes to an off-site disposal location and the efficiency of the volume reduction/separation technology. The wastes would be securely loaded and trucked to an appropriate rail spur where the wastes would then be shipped by rail to the disposal location. Institutional controls through deed restrictions would be placed on the Li Tungsten and Captain's Cove properties to prevent residential development and are easily implementable. Conventional equipment and labor required to excavate the soils for treatment is readily available and easily implementable.

Assuming the acceptability of transportation of low-level radioactive wastes to an off-site disposal location, LS-2 could be implemented in five months; CS-2 could be implemented in three months.

Cost: The capital cost of Alternative LS-2 is $16,754,00; there are no associated O&M costs. The capital cost of Alternative CS-2 is $15,465,000. Details of the cost estimate are presented in Appendix D.

State Acceptance: State acceptance of the alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of the alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.2.3 Alternative LS-3 and CS-3: Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Stabilization and On-Site Containment of Other Nonradioactive Metals-Contaminated Soils at the Li Tungsten Facility

4.2.3.1 Description

This alternative is the same as LS-2, except that a radioactive materials separation technology/strategy would be used to further reduce the volume of radioactive wastes after excavation, to reduce the cost of off-site disposal. On-site containment would be utilized for disposal of non-radioactive metals-contaminated soils.

Under this alternative, excavated soils, sediments and ore residues would be addressed via a volume reduction technology (e.g., SGS or ACMS) and/or a volume reduction strategy (e.g., precision excavation). Precision excavation could be used in combination with either of the separation technologies or by itself if either of the separation technologies do not prove effective (testing would be conducted during remedial design). On both properties, radionuclide-contaminated soils are present at relatively discrete layers. Soil excavation, conducted in carefully controlled lifts, would minimize the potential mixing of radioactive and non-radioactive soil. Non-radioactive soil layers, therefore, could be immediately segregated for on-site disposal, as appropriate. This excavation procedure is applicable to both properties, but is particularly applicable to the Captain's Cove site where radioactive wastes may be present only at specific depth intervals. Overall, for cost estimating purposes, the efficiency of the volume reduction technology/strategy is 50%. The radionuclide-contaminated fraction would be subsequently disposed off-site as NORM at an appropriate facility. The residual nonradioactive metals-contaminated soil stream would be disposed in the on-site landfill.

The existing storm sewers would be pressure-washed and the effluent and sediments disposed off-site. Sediments removed from contaminated wetland areas, the Mud Pond and mud holes would be dewatered and handled in the same manner as the excavated soils.

On-site landfill construction would be preceded by site preparation measures including building demolition and the excavation of soil at concentrations greater than the PRGs in the construction area. The landfill would be situated in an area, where subsurface excavation, construction and utility installation would not be required, such as the middle portion of Parcel

B.

4.2.3.2 Assessment

Overall Protection of Human Health and the Environment: The containment alternative would protect human health and the environment by reducing the potential for migration of the contaminants and preventing direct contact with contaminated soils. The potential for direct contact with radioactive soils is eliminated via their disposal and management at an appropriate, off-site facility. Protection from direct contact with the nonradioactive metals-contaminated soils would be achieved by stabilization (if necessary) and containment in an on-site containment cell.

Compliance with ARARs: The construction of the containment cell would be subject to 6 NYCRR Parts 360 and 364 which outline the requirements of solid and hazardous waste management facilities and transporters for managing radioactive and hazardous materials. Off-site transportation of radioactive materials which exceed a concentration of 2,000 pCi/g would be regulated by 49 CFR 173. The excavation and disposal of PCB-contaminated soils would be governed by the requirements of TSCA. Excavated soils with greater than 50 mg/Kg of total PCBs would require appropriate off-site treatment and disposal.

Long-Term Effectiveness and Permanence: A properly designed on-site containment cell with institutional controls and long-term maintenance would provide long-term effectiveness and permanence. The existence of a containment cell in a populated area, however, could possibly result in some compromises to long-term effectiveness of this alternative. Long-term monitoring of groundwater and surface water would allow an assessment of the containment system's long-term efficacy.

Reduction of Toxicity, Mobility or Volume: Reduces the toxicity, mobility and volume of the radiological contaminants. The toxicity and mobility of the nonradioactive metals-contaminated soils would be contained on-site by stabilization to prevent leaching. The volume of the radioactive soils would be reduced through the use of a physical separation

technology/strategy. The percent volume reduction that can be achieved is uncertain until testing can be performed during remedial design.

Short-Term Effectiveness: Potential short-term impacts are associated with this alternative due to direct contact with the soil by workers and through the potential for the generation of dust during construction. It requires monitoring and control to protect the community and workers from the potential short-term adverse risks associated with the remedial actions.

In addition, this alternative would involve additional handling during on-site radioactive materials separation and would also result in additional handling of materials during fixation of the metals-contaminated wastes and their disposition in the on-site cell. Proper protective equipment, air monitoring during construction and soil handling procedures would minimize the short-term risks to workers and the surrounding community. Vehicle traffic associated with this alternative could impact the local roadway system and nearby residents through increased noise level and traffic.

Implementability: The implementability of this alternative would be a function of the acceptability of transportation of low-level radioactive wastes to an off-site disposal location and the efficiency of the volume reduction/separation technology. The wastes would be securely loaded and trucked to an appropriate rail spur where the wastes would then be shipped by rail to the disposal location. Institutional controls through deed restrictions would be placed on the Li Tungsten site to prevent residential development and are easily implementable. Conventional equipment and labor required to excavate the soils for treatment is readily available and easily implementable.

Assuming the acceptability of transportation of low-level radioactive wastes to an off-site disposal location and a 50% efficiency in the volume reduction/separation technology, LS-3 could be implemented in 13 months; CS-3 could be implemented in 11 months.

Cost: The capital and annual O& M costs of Alternative LS-3 are $12,579,000 and $60,000, respectively. The total present worth of Alternative LS-3 is $14,379,000. The capital

and annual O&M costs of Alternative CS-3 are $10,432,000 and $60,000, respectively. The total present worth of Alternative CS-3 is $11,787,000. Details of the cost estimate are presented in Appendix D.

State Acceptance: State acceptance of this alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.2.4 Alternative LS-4 and CS-4: Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Off-Site Disposal of Other Nonradioactive Metals-Contaminated Soils

4.2.4.1 Description

This alternative is the same as LS-3, except that after utilization of a radioactive materials separation technology/strategy, any nonradioactive but metals-contaminated waste soils would be shipped off-site for disposal instead of being contained on-site. These wastes would be disposed of at an off-site Subtitle D facility, unless they were determined to be hazardous pursuant to RCRA, in which case they would be disposed of off-site at a RCRA Subtitle C facility. Overall, for cost estimating purposes, the efficiency of the volume reduction technology/strategy is 50%.

Specifically, this alternative would involve demolition of all structures to eliminate hazards posed by structural instability, hazardous materials of construction (e.g., asbestos, radionuclides), as well as to facilitate pre-design sampling and implementation of future remedial actions. This action would include demolition of the Dickson Warehouse and the Benbow Building on Parcel C and the Carbide Building, the Loung Building and the Office/Laboratory Building on Parcel A.

Additionally, soil, sediment and ore residues (including those currently staged in the Dickson Warehouse) contaminated above PRGs would be excavated in the various contaminated areas of the site. Excavation would be conducted as described for Alternative LS-3/CS-3.

Radioactive wastes require excavation to an average depth of four feet (maximum depth of 4-6 feet on Parcel C). Metals-contaminated soils, while typically co-located with the radioactive wastes, will require excavation to depths greater than four feet in several areas because of the tendency of these inorganics to leach into the subsurface. Excavations to depths as much as 10 feet would be required in a few areas of Parcel C to achieve the chemical PRGs for these contaminated soils.

Excavated soils would be treated via a volume reduction technology to reduce the volume of the radioactive waste stream that would require off-site disposal. The "concentrated" radioactive waste stream would be disposed of as NORM at an off-site licensed facility. Some or all of the remaining "non-radioactive"waste stream is anticipated to contain other wastes above the PRGs. These wastes would be disposed of at an off-site subtitle D facility, unless they are confirmed RCRA hazardous, in which case they would be disposed of at a subtitle C facility.

The storm sewer system would be cleaned via pressure washing. The effluent would be captured and disposed off-site. Captured sediments would also be disposed off-site.

4.2.4.2 Assessment

Overall Protection of Human Health and the Environment: Protection of human health and the environment is achieved by removing the contaminated soils, sediments and ore residues above the PRGs for off-site treatment and disposal. The uncontrolled nature of the contamination at the site will be eliminated by transferring the contaminated media to appropriate disposal facilities.

Compliance with ARARs: Removal of the soil would reduce contaminant concentrations at the Li Tungsten and Captain's Cove sites below the PRGs presented in Section 2.2.5. The alternative may have to comply with land disposal restrictions for off-site disposal of any excavated wastes with metals contamination above LDR levels. Off-site transportation of radioactive materials which exceed a concentration of 2,000 pCi/g would be regulated by 49 CFR 173. The excavation and disposal of PCB-contaminated soils would be governed by the requirements of TSCA. Excavated soils with greater than 50 mg/Kg of total PCBs would require appropriate off-site treatment and disposal.

Excavation activities will utilize New York State's Air Guide-1 to ensure that there are no adverse air/particulate impacts to the surrounding community resulting from the excavation and handling of contaminated soils.

Long-Term Effectiveness and Permanence: Long-term risks would be eliminated and permanence would be achieved due to the removal of contamination to an off-site disposal facility designed for long-term containment. Long-term management, maintenance or monitoring would not be required. Long-term effectiveness for the removed soil would be based on the maintenance of engineering controls at the off-site disposal facility.

Reduction of Toxicity, Mobility or Volume: The toxicity, mobility and volume of contaminants at the site would be reduced by the excavation and off-site disposal of radioactive and metals-contaminated wastes. The volume of the radioactive soils would be reduced through the use of a physical separation technology/strategy. The percent volume reduction that can be achieved is uncertain until testing can be performed during remedial design.

Short-Term Effectiveness: Potential short-term impacts are associated with this alternative due to direct contact with the soil by workers and through the potential for the generation of dust during construction. It requires monitoring and control to protect the community and workers from the potential short-term adverse risks associated with the remedial actions.

Potential risks to the community include exposure to dust and radionuclides emitted from excavation areas and stockpiled soils awaiting transportation. Temporary structures, plastic covers/tarps and temporary erosion control barriers could be used to minimize dust generation and off-site migration. Air monitoring would be employed to evaluate if controls are adequate. Equipment decontamination will be performed before construction equipment is removed from the site.

A short-term risk is associated with transportation of radioactive soils from the source location to the off-site facility. PPE and monitoring would be used to protect workers from dermal contact, inhalation and ingestion of contaminated soils and dust. Excavation safety

measures would be enforced to reduce physical hazards. Vehicle traffic associated with this alternative could impact the local roadway system and nearby residents through increased noise level and traffic.

Implementability: The implementability of this alternative would be a function of the acceptability of transportation of low-level radioactive wastes to an off-site disposal location and the efficiency of the volume reduction/separation technology. The wastes would be securely loaded and trucked to an appropriate rail spur where the wastes would then be shipped by rail to the disposal location. Institutional controls through deed restrictions would be placed on the Li Tungsten site to prevent residential development and are easily implementable. Conventional equipment and labor required to excavate the soils for treatment is readily available and easily implementable.

Assuming the acceptability of transportation of low-level radioactive wastes to an off-site disposal location and a 50% efficiency in the volume reduction/separation technology, LS-4 could be implemented in nine months; CS-4 could be implemented in seven months.

Cost: The capital cost of Alternative LS-4 is $14,455,000. There are no O&M costs for Alternative LS-4. The capital cost of Alternative CS-4 is $13,597,000. There are no O&M costs for Alternative CS-4. Details of the cost estimate are presented in Appendix D.

State Acceptance: State acceptance of the alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.3 GROUNDWATER/SURFACE WATER ALTERNATIVES

4.3.1 Alternative LW-1: No Action

4.3.1.1 Description

This alternative for groundwater is required by the NCP and CERCLA as a baseline for comparison with the other groundwater alternatives. The no action remedial alternative does not include any remedial measures that address the existing groundwater contamination at the site. This alternative would serve as a long-term groundwater monitoring mechanism for the Li Tungsten site.

To demonstrate the effectiveness of this alternative, initial quarterly and thereafter, semi-annually sampling would be performed to compare the effectiveness of the natural flushing mechanisms against baseline aquifer conditions. New monitoring wells would also be added to the existing monitoring well networks to increase the network's coverage in areas of known contamination. Five year reviews would be conducted to evaluate any changes in groundwater on-site above health-based levels, and their potential effects on the public health and the environment. In addition, this alternative may be implemented prior to remedial action on the source area soils (if selected) to establish baseline conditions and to monitor groundwater during and after soils remedial action.

The no action alternative alternative may be implemented separately or in combination for the inorganic and/or radiological contamination in groundwater. Organic contamination will be addressed separately by the State. In evaluating whether the no action alternative is applicable for radiological contamination, the following information must be considered:

- Three rounds of groundwater samples were collected for radionuclides between November 1996 and October 1998 using both the traditional purge and sampling method and the new low-flow sampling method. In the third round, ^{226}Ra and ^{228}Ra were detected below the PRGs using the low-flow sampling method with the exception of one sample collected from GM-10. The reduced concentrations of radionuclides observed in the 3rd round may be more representative of groundwater conditions because the low-flow method minimizes disturbance (or

interference of suspended soil particles) of sediment from the bottom of the well.

- Ra-226 and Ra-228 in groundwater samples collected from background monitoring wells located in Parcel B and C′ (MP-5 and MP-11D) were detected at concentrations which exceeded the NYSDEC and USEPA MCLs of 5 pCi/L (6.4 pCi/L and 5.2 pCi/L, respectively).

- Radionuclides which exceeded the NYSDEC and USEPA MCLs in the first and second rounds were detected in groundwater samples collected from deep background monitoring wells in non-contaminated areas (i.e. MP-11D, GM-10, MW-10), which may indicate that regional concentrations of radionuclides are also high.

- The direct ingestion pathway for radiological groundwater contamination is unlikely because no potable uses of groundwater exist at the site (the municipal water supply for the City of Glen Cove is derived from 3 municipal wells screened within the Magothy Formation located more than 1 mile east and south-east from the site).

- Dermal contact with groundwater may be limited by placing deed restrictions on the future use of groundwater. If implemented, dermal contact may be limited to future site workers, but can be minimized with proper PPE.

- Thorium and radium are virtually insoluble (uranium does have soluble species and the forms of uranium likely to be found in the original ore material would be insoluble).

- If removal remedies are selected for contaminated source soils, the future potential for transport of radionuclides to groundwater as colloid particles may be minimized.

- A confining unit (the Port Washington Clay) has been observed to be continuous across the site at various depths and hydraulically separates the Upper Glacial Aquifer from the Lloyd Aquifer.

4.3.1.2 Assessment

Overall Protection of Human Health and the Environment: This alternative would not protect human health and the environment as no active remedial measures or institutional controls are included in this alternative. If the sources of contamination are removed, the natural flushing mechanisms of the aquifer may remove the non-recalcitrant contaminants from the pore water and may reduce some of the toxicity and volume of contamination in the groundwater. This may reduce the overall health risk. Continuous discharge toward the Glen Cove Creek or other downgradient areas may eventually reduce concentrations of non-calcitrant contaminants in the groundwater. However, reduction of the recalcitrant compounds may not occur and in that case, this alternative would not reduce the toxicity or volume of contamination in the groundwater.

Compliance with ARARs: This alternative would not actively address the concentrations of arsenic, antimony and other heavy metals in groundwater that are presently in excess of MCLs promulgated under the Safe Drinking Water Act (40 CFR Part 141), the New York State MCLs (10 NYCRR Part 5), or New York State Water Quality Standards (6 NYCRR Part 703). It is anticipated, however, that soils remediation could result in MCLs being achieved in the near future.

Long-Term Effectiveness and Permanence: This alternative would not actively remove groundwater contaminants except by the natural movement of groundwater which would dilute the remaining contaminated levels and would eventually flush the inorganics into Glen Cove Creek, where they would continue to be dispersed. Given the relatively sporadic inorganic contamination that currently exists in the aquifer, it is anticipated that this mechanism when combined with the soil remediation should effectively provide long term protection from

groundwater contamination. The monitoring program will be designed to determine if LW-1 is effective.

Reduction of Toxicity, Mobility or Volume: This alternative would not reduce the toxicity, mobility or volume of contaminated groundwater through treatment. The natural flushing mechanisms may gradually reduce the volume and toxicity of some contamination in the pore water. However, this alternative would not reduce the mobility of the contaminants of concern.

Short-Term Effectiveness: This alternative does not include any remediation and, therefore, would not pose any adverse short-term impacts to the community or to workers. There is no short-term threat to the public health since the groundwater is not currently being used for ingestion by the public and a community water system is in place. Since this alternative involves minimal new construction (such as the installation of additional monitoring wells), there would be minimal risks to workers or the community resulting from implementation of the alternative.

Implementability: The installation of additional monitoring wells and implementation of a long-term groundwater monitoring plan is technically feasible. Annual inspections and quarterly sampling would require administrative and regulatory attention.

Cost: The capital and average annual O&M costs associated with Alternative LW-1 are $0 and $32,000, respectively. The total present worth of LW-1 is $722,000. A detailed breakdown of component costs are provided in Appendix D.

State Acceptance: State acceptance of this alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.3.2 Alternative No. LW-2: Interceptor Trench/Extraction Wells with On-Site Treatment and Disposal

4.3.2.1 Description

Alternative No. LW-2 uses a combination of an interceptor trench and low-flow extraction wells to capture groundwater contaminated with heavy metals for on-site treatment consisting of chemical precipitation/settling and on-site reinjection to groundwater. To capture the shallow inorganic contaminated groundwater (less than 20 feet), one interceptor trench, located in Lower Parcel C, would be installed. The trench in Lower Parcel C would measure approximately 350 feet long. Multi-tiered horizontal HPDE perforated piping containing filters and envelopes would be installed perpendicular and downgradient to the groundwater flow direction in Lower Parcel C. The design of the interceptor trench will depend upon potential impacts from at least a 100 year storm generated tidal surge. Tidal fluctuations will be measured during full tidal cycles during pre-design activities to determine the specific placement and orientation of the trench. Low-flow extraction wells would then be installed in areas of the plume or "hot spots" to capture isolated pockets of groundwater contamination not accessible to the interceptor trench. Shallow contaminated groundwater from the interceptor trench and wells would be collected through the horizontal piping and channeled via gravity flow to collection sump areas. Contaminated groundwater at the sump areas would be pumped periodically at approximately 10 gallons per minute to an on-site treatment facility. At the treatment facility, the groundwater would be treated to State and Federal MCLs and groundwater standards through chemical precipitation, clarification and pH adjustment. Treated groundwater would then be conveyed to upgradient on-site reinjection galleries. A conceptual design for Alternative LW-2 is presented in Figure 4-1.

A long-term sampling program would be developed to monitor groundwater quality. New monitoring wells would be added to the existing monitoring network to increase the network's area of coverage.

4.3.2.2 Assessment

Overall Protection of Human Health and the Environment: The overall protection of human health and the environment would be enhanced by direct removal of inorganic

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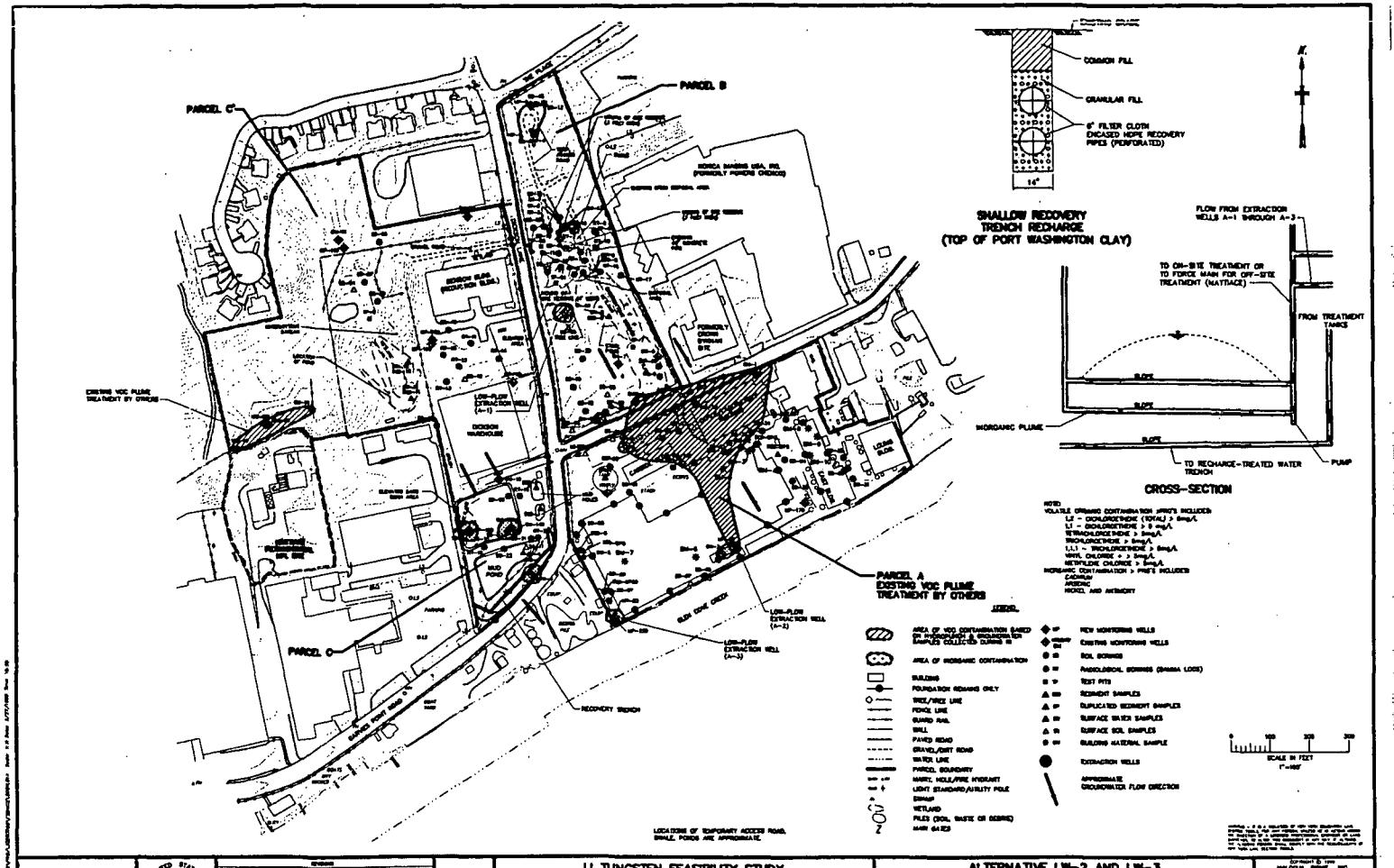

MALCOLM PIRNIE

U TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT 68-W9-0051; W.A. NO. 025-2L4L

ALTERNATIVE LW-2 AND LW-3
INTERCEPTOR TRENCH W/LOW-FLOW EXTRACTION WELLS & ON/OFF-SITE TREATMENT
AS SHOWN

COPYRIGHT © 1990 MALCOLM PIRNIE, INC.
DATE JUNE 1990
FIGURE 4-1
SHEET ___ OF ___
CAD REF. NO. 20071.01.4

contaminants for on-site treatment and disposal. Inorganic contaminants may be prevented from entering Glen Cove Creek or other downgradient areas with the use of direct capture mechanisms. The remedial goal of this alternative is to restore groundwater quality in order to meet State and Federal MCLs. Even without deed restrictions or other institutional controls, however, human health impacts through potable water consumption would continue to be a remote hypothetical risk; the likelihood of drawing potable water from the Upper Glacial aquifer is very remote because of the high level of dissolved solids in the aquifer from saltwater intrusion, as well as the availability of the City public water supply.

Compliance with ARARs: This alternative uses treatment technologies capable of removing the inorganics of concern to meet the State and Federal standards. Off-site disposal of any sludges or treatment residues generated as a result of groundwater treatment processes would be required to be sent to an appropriate off-site treatment/disposal facility

Long-Term Effectiveness and Permanence: Removal of the source of groundwater contamination under any of the soil alternatives would improve the long term effectiveness and permanence of this groundwater alternative. In addition, this alternative would be effective over the long term in permanently removing inorganic contaminants from groundwater.

Reduction of Toxicity, Mobility or Volume: This alternatives would reduce the toxicity, mobility, and volume of contaminated groundwater through chemical precipitation of heavy metals, clarification and pH adjustment.

Short-Term Effectiveness: This alternative would require trenching in the vicinity of Garvies Point Road and Herb Hill Road to accommodate the installation of different subsurface features (i.e., wells, drains, force main, slurry wall). Potential short term impacts would be associated with the direct contact with soil by workers and through the potential for generation of dust during construction. Such impacts would be minimized through worker health and safety protective measures and dust suppression techniques such as covering waste piles and water spraying during dust-generating activities. Potential short-term impacts would result from the

direct contact of groundwater by workers, however, impacts would be minimized through worker health and safety protective measures.

Implementability: This alternative is considered technically and administratively implementable. In addition, it would be able to achieve MCLs in the treated effluent with the proposed treatment methods, although reliance on standard proven technology improves the degree of implementability. Off-site property easements or permits to construct should also be relatively easy to obtain.

Cost: The capital and annual O&M costs associated with Alternative LW-2 are $351,000 and $84,000, respectively. The total present worth of LW-2 is $2,247,000. A detailed breakdown of component costs are provided in Appendix D.

State Acceptance: State acceptance of this alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.3.3 Alternative No. LW-3: Interceptor Trench/Extraction Wells with Off-Site Treatment and Reinjection at the Nearby Mattiace Site Treatment Facility

4.3.3.1 Description

This alternative is similar to Alternative No. LW-2 in that it uses a combination of an interceptor trench and low-flow extraction wells to capture shallow and deep contaminated groundwater (above the Port Washington Clay). Instead of on-site treatment, however, the contaminated groundwater is pumped off-site to the groundwater treatment plant at the Mattiace site. The contaminated groundwater would be conveyed via an underground pumping station and force main from the Li Tungsten site to the Mattiace site. The flow from the Li Tungsten site (estimated at approximately 10 gallons per minute), when combined with flow from the Mattiace extraction wells, would be approximately 20 gallons per minute. Treatment would

consist of chemical precipitation, clarification and pH adjustment. Some modifications to the existing Mattiace plant and/or operating procedures might be necessary to accept the waste stream from the Li Tungsten site. For example, because the Li Tungsten waste influent is predominantly heavy metals, an additional metals clarifier might have to be added. Chemical feed rates for metals treatment would also change, and the amount of sludge generated by the facility would increase, requiring more frequent sludge hauling.

A long-term sampling program would be developed to monitor groundwater quality with new monitoring wells added to the existing monitoring well network to increase the network's area of coverage. A conceptual design for Alternative LW-3 is presented in Figure 4-1.

4.3.3.2 Assessment

Overall Protection of Human Health and the Environment: This alternative would protect human health and the environment because the groundwater contaminated with inorganics on the Li Tungsten Facility would be intercepted and prevented from discharging to Glen Cove Creek. The remedial goal is to restore groundwater quality to meet State and Federal MCLs. However, even without deed restrictions or other institutional controls, human health impacts through potable water consumption would continue to be a remote hypothetical risk; the likelihood of drawing potable water from the Upper Glacial aquifer is very remote because of the high level of dissolved solids in the aquifer from saltwater intrusion, as well as the availability of the City public water supply.

Compliance with ARARs: This alternative uses treatment technologies capable of removing the inorganics of concern to meet the State and Federal standards. Off-site disposal of any sludges or treatment residues generated as a result of groundwater treatment processes would be required to be sent to an appropriate off-site treatment/disposal facility

Long-Term Effectiveness and Permanence: Removal of the source of groundwater contamination under any of the soil alternatives would improve the long term effectiveness and permanence of this groundwater alternative. In addition, this alternative would be effective over the long term in permanently removing inorganic contaminants from groundwater.

Reduction of Toxicity, Mobility or Volume: This alternatives would reduce the toxicity, mobility, and volume of contaminated groundwater through chemical precipitation of heavy metals, clarification and pH adjustment.

Short-Term Effectiveness: This alternative would require trenching in the vicinity of Garvies Point Road and Herb Hill Road to accommodate the installation of different subsurface features (i.e., wells, drains, force main, slurry wall). Potential short term impacts would be associated with the direct contact with soil by workers and through the potential for generation of dust during construction. Such impacts would be minimized through worker health and safety protective measures and dust suppression techniques such as covering waste piles and water spraying during dust-generating activities.

This alternative would have the most impact on the local community as it would require that a forcemain be installed below grade for approximately 700 feet from the groundwater collection point to the treatment facility at the Mattiace site. Potential short-term impacts would result from the direct contact of groundwater by workers, however, impacts would be minimized through worker health and safety protective measures.

Implementability: This alternative is considered technically and administratively implementable. In addition, it would be able to achieve MCLs in the treated effluent with the proposed treatment methods, although reliance on standard proven technology improves the degree of implementability. Off-site property easements or permits to construct should also be relatively easy to obtain.

Cost: The capital and annual O&M costs associated with Alternative LW-3 are $208,000 and $47,000. The total present worth of LW-3 is $1,269,000. A detailed breakdown of component costs are provided in Appendix D.

State Acceptance: State acceptance of this alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.3.4 Alternative No. LW-4: Reactive Walls with Slurry Walls and In-Well Adsorption Treatment

4.3.4.1 Description

Alternative No. LW-4 consists of the installation of a reactive wall in Lower Parcel C, directly downgradient of the existing inorganic contamination. The reactive wall would be installed to a depth to the top of the Port Washington Clay, approximately 30 below ground level. The reactive wall, designed as a funnel and gate system, consists of a passive permeable barrier in which groundwater would pass through. Treatment occurs within the wall. The funnel, consisting of a soil-bentonite slurry wall, would be designed to channel contaminated groundwater toward the treatment gates. The treatment gate(s) contain zero-valence metals or other adsorption media to treat the inorganic contamination in both locations. Collection galleries consisting of pea gravel are installed adjacent to the wall. Treated water is conveyed with a distribution pipe through the wall to the distribution trench, located downgradient of the slurry wall. The design of the reactive wall will depend upon potential impacts from at least a 100 year storm generated tidal surge. Tidal fluctuations will be measured during full tidal cycles during pre-design activities to determine the specific placement and orientation of the reactive wall.

"Hot spot" inorganic contamination areas would be treated via in-well adsorption using adsorption media consisting of open-celled cellulose sponges incorporating an amine-containing chelating polymer that selectively adsorbs dissolved heavy metals. Locations of inorganic "hot spots" are depicted in Figure 2-3. Adsorption treatment media is added into each well and allowed residence time under advective groundwater forces. The adsorption media is retrieved periodically and disposed of while new media is reinserted for additional cycles of absorption.

A long-term sampling program would be developed to monitor groundwater quality. New monitoring wells would be added to the existing monitoring well network to increase the network's area of coverage. A conceptual design for Alternative LW-4 is presented in Figure 4-2.

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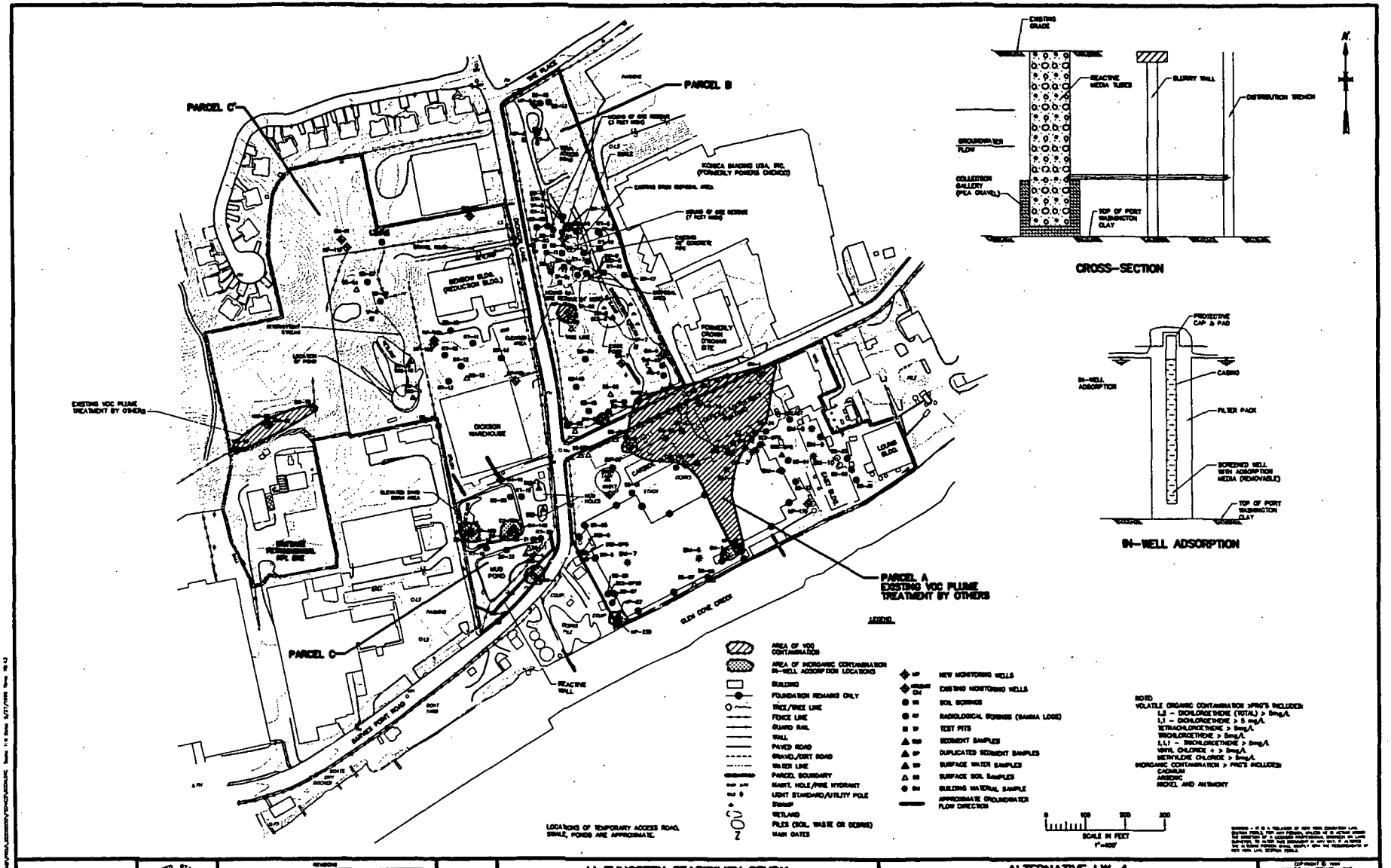

CROSS-SECTION

IN-WELL ADSORPTION

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DR. JG
CK. LM/PJT
APR.

LI TUNGSTEN FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

ALTERNATIVE LW-4
REACTIVE WALLS WITH SLURRY WALLS AND IN-WELL ADSORPTION
AS SHOWN

COPYRIGHT © 1996 MALCOLM PIRNIE, INC.
DATE JUNE 1996
FIGURE
SHEET
CAD REF. NO. 8007L01C

4.3.4.2 Assessment

Overall Protection of Human Health and the Environment: This alternative would protect human health and the environment because the groundwater contaminated with inorganics on the Li Tungsten Facility would be intercepted and prevented from discharging to Glen Cove Creek. The remedial goal is to restore groundwater quality to meet State and Federal MCLs. However, even without deed restrictions or other institutional controls, human health impacts through potable water consumption would continue to be a remote hypothetical risk: the likelihood of drawing potable water from the Upper Glacial aquifer is very remote because of the high level of dissolved solids in the aquifer from saltwater intrusion, as well as the availability of the City public water supply.

Compliance with ARARs: This alternative uses treatment technologies capable of removing the inorganics of concern to meet the State and Federal standards. Off-site disposal of any sludges or treatment residues generated as a result of groundwater treatment processes would be required to be sent to an appropriate off-site treatment/disposal facility

Long-Term Effectiveness and Permanence: Removal of the source of groundwater contamination under any of the soil alternatives would improve the long term effectiveness and permanence of this groundwater alternative. In addition, this alternative would be effective over the long term in permanently removing inorganic contaminants from groundwater.

Reduction of Toxicity, Mobility or Volume: This alternatives would reduce the toxicity, mobility, and volume of contaminated groundwater through the use of adsorptive treatment media to adsorb dissolved heavy metals.

Short-Term Effectiveness: This alternative would require trenching in the vicinity of Garvies Point Road and Herb Hill Road to accommodate the installation of different subsurface features (i.e., wells, drains, force main, slurry wall). Potential short term impacts would be associated with the direct contact with soil by workers and through the potential for generation

of dust during construction. Such impacts would be minimized through worker health and safety protective measures and dust suppression techniques such as covering waste piles and water spraying during dust-generating activities. Potential short-term impacts would result from the direct contact of groundwater by workers, however, impacts would be minimized through worker health and safety protective measures.

Implementability: This alternative is considered technically and administratively implementable. In addition, it would be able to achieve MCLs in the treated effluent with the proposed treatment methods. Off-site property easements or permits to construct should also be relatively easy to obtain.

Cost: The capital and annual O&M costs associated with Alternative LW-4 are $644,000 and $29,000. The total present worth of Alternative LW-4 is $1,299,000. A detailed breakdown of component costs are provided in Appendix D.

State Acceptance: State acceptance of this alternative will be determined upon NYSDEC review and acceptance of the Draft Final FS Report.

Community Acceptance: Community acceptance of this alternative will be determined upon the review and acceptance of the Draft Final FS Report.

4.4 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section discusses the key factors and difference among the remedial alternatives relative to each of the evaluation criteria. Table 4-1 and 4-2 presents a summary of comparison among the alternatives for soil/sediment and groundwater/surface water, respectively.

4.4.1 Soil/Sediment

Overall Protection of Human Health and the Environment

Alternatives LS-1 and CS-1, the No-Action Alternatives, would not protect human health or the environment beyond discouraging entry to the presently fenced site.

COMPARATIVE EVALUATION OF SOIL AND SEDIMENT ALTERNATIVES
LI TUNGSTEN (LS) AND CAPTAIN'S COVE (CC) SITES

CRITERIA	LS-1 NO ACTION	LS-2 EXCAVATION AND OFF-SITE DISPOSAL OR RADIOACTIVE AND NONRADIOACTIVE METALS-CONTAMINATED SOILS	LS-3 EXCAVATION WITH RADIOACTIVE WASTE VOLUME REDUCTION, OFF-SITE RADIOACTIVE WASTE DISPOSAL AND STABILIZATION AND ON-SITE CONTAINMENT OF OTHER NONRADIOACTIVE METALS-CONTAMINATED SOILS	LS-4 EXCAVATION WITH RADIOACTIVE WASTE VOLUME REDUCTION, OFF-SITE RADIOACTIVE WASTE DISPOSAL AND OFF-SITE DISPOSAL OF OTHER NONRADIOACTIVE METALS-CONTAMINATED SOILS	CS-1 NO ACTION	CS-2 EXCAVATION AND OFF-SITE DISPOSAL OR RADIOACTIVE AND NONRADIOACTIVE METALS-CONTAMINATED SOILS	CS-3 EXCAVATION WITH RADIOACTIVE WASTE VOLUME REDUCTION, OFF-SITE RADIOACTIVE WASTE DISPOSAL AND STABILIZATION AND ON-SITE CONTAINMENT OF OTHER NONRADIOACTIVE METALS-CONTAMINATED SOILS	CS-4 EXCAVATION WITH RADIOACTIVE WASTE VOLUME REDUCTION, OFF-SITE RADIOACTIVE WASTE DISPOSAL AND OFF-SITE DISPOSAL OF OTHER NONRADIOACTIVE METALS-CONTAMINATED SOILS
OVERALL PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT	Not protective beyond discouraging entry to the presently fenced site	Very protective of human health and the environment – removal of contaminated soils, sediments and ore residues above PRGs from site	Protective of human health/environment by removal/off-site disposal of radioactive soils. Achieves protectiveness from metals contaminated soils (fixation and on site containment).	Very protective of human health and the environment – removal of contaminated soils, sediments and ore residues above PRGs from site.	Not protective beyond discouraging entry to the presently fenced site	Very protective of human health and the environment – removal of contaminated soils, sediments and ore residues above PRGs from site.	Protective of human health and the environment by removal/off-site disposal of radioactive wastes. Would achieve protectiveness from metals-contaminated soils by fixation and on site containment.	Very protective of human health and the environment – removal of contaminated soils, sediments and ore residues above PRGs from site.
COMPLIANCE WITH ARARs/TBCs	Does not comply with ARARs	Off site disposal subject to LDR. Transport of radioactive materials exceeding 2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation and handling of contaminated materials	Containment cell subject to 6 NYCRR Parts 360 and 364. Transport of radioactive materials >2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation/ handling of contaminated materials.	Off site disposal subject to LDR. Transport of radioactive materials >2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation/ handling of contaminated materials.	Does not comply with ARARs.	Off-site disposal subject to LDR. Transport of radioactive materials >2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation/handling of contaminated materials.	Containment cell would be subject to 6 NYCRR Parts 360 and 364. Transport of radioactive materials >2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation/ handling of contaminated materials	Off-site disposal subject to LDR. Transport of radioactive materials >2,000 pCi/g would be regulated by 49 CFR Part 173. PCB wastes subject to TSCA. NYS's Air Guide-1 will ensure no adverse air/particulate impacts to community during excavation/ handling of contaminated materials.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Would not provide any long term effectiveness or permanence in protecting human health and the environment. Receptors may be exposed to contaminated media in absence of remedial measures	Would provide long term effectiveness and permanence with removal of radioactive and nonradioactive metals-contaminated soils above PRGs	Would provide long-term effectiveness and permanence through a properly designed containment cell, institutional controls and long term maintenance.	Would provide long-term effectiveness and permanence with removal of radioactive and nonradioactive metals-contaminated soils above PRGs	No long-term effectiveness or permanence in protecting human health and the environment. Receptors may be exposed to contaminated media in absence of remedial measures.	Would provide long-term effectiveness and permanence with removal of radioactive and nonradioactive metals-contaminated soils above PRGs.	Would provide long term effectiveness and permanence with removal of radioactive and nonradioactive metals-contaminated soils above PRGs	Would provide long-term effectiveness and permanence with removal of radioactive and nonradioactive metals-contaminated soils above PRGs
REDUCTION IN TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility or volume	Would reduce the toxicity, mobility and volume of radioactive and nonradioactive metals contaminated soils	Would reduce the toxicity, mobility and possibly volume of radioactive contaminants and reduce the toxicity and mobility of nonradioactive metals-contaminated soils (stabilization).	Would reduce the toxicity, mobility and volume of radioactive and nonradioactive metals contaminated soils at the site.	No reduction in toxicity, mobility or volume.	Would reduce the toxicity, mobility and volume of radioactive and nonradioactive metals contaminated soils at the site.	Would reduce the toxicity, mobility and possibly volume of radioactive contaminants and reduce the toxicity and mobility of nonradioactive metals contaminated soils (stabilization)	Would reduce the toxicity, mobility and volume of radioactive and nonradioactive metals contaminated soils at the site
SHORT-TERM EFFECTIVENESS	Would not result in any adverse short term impacts	Short term impacts due to direct contact with soil and dust to workers excavating and handling radioactive materials. Vehicle traffic would increase noise level on local roadways.	Same as LS-2. Short-term impacts resulting from handling radioactive soils (volume reduction) and metals-contaminated soils (stabilization). Vehicle traffic would increase noise level on local roadways.	Same as LS-2. Short-term impacts resulting from handling radioactive materials (volume reduction). Vehicle traffic would increase noise level on local roadways.	Would not result in any adverse short-term impacts.	Short-term impacts due to direct contact with soil and dust to workers excavating and handling radioactive materials. Vehicle traffic would increase noise level on local roadways.	Same as LS-2. Short term impacts resulting from handling radioactive materials during volume reduction. Vehicle traffic would increase noise level on local roadways	Same as LS-2 with additional short-term impacts resulting from handling radioactive materials during volume reduction. Vehicle traffic would increase noise level on local roadways.
IMPLEMENTABILITY	Easily implemented	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Would require institutional controls through deed restrictions to prohibit residential development	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Volume reduction technology requires treatability study. Would require institutional controls through deed restrictions against residential development.	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Volume reduction technology requires treatability study. Would require institutional controls through deed restrictions against residential development.	Easily implemented.	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Would require institutional controls through deed restrictions against residential development.	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Volume reduction technology requires treatability study. Would require institutional controls through deed restrictions against residential development.	Based on the acceptability of transportation of low-level radioactive wastes to an off site disposal location. Volume reduction technology requires treatability study. Would require institutional controls through deed restrictions against residential development.
COST	$0	$16,754,000	$14,379,000	$14,455,000	$0	$15,465,000	$11,787,000	$13,597,000
STATE ACCEPTANCE	Not applicable at this time	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.
COMMUNITY ACCEPTANCE	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.

LS - Li Tungsten Soil Alternative
CS - Captain's Cove Soil Alternative
Cost is initial capital cost plus present worth of Long Term Monitoring O&M Costs

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TABLE 4-2
COMPARATIVE EVALUATION OF GROUNDWATER AND SURFACE WATER ALTERNATIVES
LI TUNGSTEN (LI) AND CAPTAIN'S COVE (CC) SITES

CRITERIA	LW-1 NO ACTION	LW-2 INTERCEPTOR TRENCH/EXTRACTION WELLS WITH ON-SITE TREATMENT AND DISPOSAL	LW-3 INTERCEPTOR TRENCH/EXTRACTION WELLS WITH OFF-SITE TREATMENT REINJECTION AT THE NEARBY MATTIACE SUPERFUND SITE TREATMENT FACILITY	LW-4 REACTIVE WALLS WITH SLURRY WALLS AND IN-WELL ADSORPTION TREATMENT
OVERALL PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT	No protection of human health and the environment.	Protective of human health and the environment.	Protective of human health and the environment.	Protective of human health and the environment.
COMPLIANCE WITH ARARs/TBCs	Does not comply with ARARs.	Uses treatment technologies capable to removing inorganics of concern to meet applicable standards.	Uses treatment technologies capable to removing inorganics of concern to meet applicable standards.	Uses treatment technologies capable to removing inorganics of concern to meet applicable standards.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Not effective.	Effective long-term and permanent.	Effective long-term and permanent.	Less effective lon-term and permanent; relies on natural flushing mechanisms
REDUCTION IN TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility or volume.	Most effective in reducing the toxicity and volume by direct capture, extraction, and treatment; Mobility may be reduced by direct capture	Most effective in reducing the toxicity and volume by direct capture, extraction, and off-site treatment; Mobility may be reduced by direct capture.	Effective in reducing toxicity and volume of contaminants by treating in-situ, mobility may not be reduced.
SHORT-TERM EFFECTIVENESS	No short-term effectiveness	Low risks to workers performing capital construction and sludge disposal with proper monitoring and PPE.	Low risks to workers performing capital construction and sludge disposal with proper monitoring and PPE.	Low risks to worker performing capital construction and media handling with proper monitoring and PPE.
IMPLEMENTABILITY	Easily implemented.	Utilizes conventional or specialized technologies and materials for construction.	Utilizes conventional or specialized technologies and materials for construction.	Utilizes more specialized construction techniques.
COST[1]	$722,000	$2,247,000	$1,269,000	$1,299,000
STATE ACCEPTANCE	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.
COMMUNITY ACCEPTANCE	Not applicable at this time.	Not applicable at this time.	Not applicable at this time.	Not applicable at this time

LW = Li Tungsten Groundwater/Surface Water Alternative
[1]Cost is initial capital cost plus present worth of Long-Term Monitoring/O&M Costs.

All remaining soil alternatives would protect human health and the environment by reducing the existing exposures to radiological and chemical site contaminants to below soil/sediment cleanup levels. Alternatives LS-2 and CS-2 and Alternative LS-4 and CS-4, would achieve protection of human health and the environment by removing the contaminated soils, sediments and ore residues above cleanup levels for off-site treatment and disposal. Alternatives LS-3 and CS-3 would achieve similar protection vis-a-vis the radionuclides of concern by removing them off-site and would achieve protectiveness from the metals contaminants by fixating and containing them on-site and thereby reduce or eliminate the various exposure pathways and potential for cross-media impacts to groundwater that presently exists.

Compliance with ARARs

Alternatives LS-2 and CS-2, and LS-4 and CS-4 may have to comply with land disposal restrictions (LDR - 40 CFR Part 268) for the off-site disposal of any excavated wastes contaminated with certain heavy metals above LDR levels. This ARAR also describes minimum technology requirements needed to construct the on-site cell in Alternative LS-3 and CS-3.. The construction of the containment cell in Alternative LS-3 and CS-3 would be subject to 6 NYCRR Parts 360 and 364 which outline requirements of solid and hazardous waste management facilities and transporters for managing radioactive and hazardous materials. Off-site transportation of radioactive materials under Alternatives LS-2 and CS-2, LS-3 and CS-3, and LS-4 and CS-4 which exceed a concentration of 2,000 pCi/g would be regulated by 49 CFR 173. Since Alternatives LS-2 and CS-2, LS-3 and CS-3, and LS-4 and CS-4 would involve the excavation of some PCB-contaminated soils, their disposition would be governed by TSCA requirements.

All excavation alternatives will utilize New York State's Air Guide -1 to ensure that there are no adverse air/particulate impacts to the surrounding community as a result of excavation and handling of contaminated soils.

Long-Term Effectiveness and Permanence

Alternatives LS-1 and CS-1 would not provide any long-term effectiveness or permanence in protecting human health and the environment. All of the other soil alternatives

would permanently protect public health and the environment over the long term because the radioactive wastes would be excavated and removed to an off-site facility licensed to manage this type of material. Implementation of Alternatives LS-2 and CS-2 and Alternatives LS-4 and CS-4 would permanently protect public health and the environment at the site over the long term because the nonradioactive, metals-contaminated soils at the site would be removed to an off-site disposal location designed for long-term containment. Alternatives LS-3 and CS-3 would similarly provide for long-term effectiveness and permanence through a properly designed on-site containment cell which would require institutional controls and long-term maintenance to provide permanent protection to public health and the environment.

Reduction of Toxicity, Mobility or Volume

Alternatives LS-1 and CS-1 would not reduce the toxicity, mobility or volume of any contaminants at the site. Alternatives LS-2 and CS-2 and Alternatives LS-4 and CS-4 would reduce the toxicity, mobility, and volume of contaminants at the site through excavation and off-site disposal of the radioactive and metals-contaminated wastes. Alternatives LS-3 and CS-3 would reduce the toxicity, mobility, and volume of the radiological contaminants in the same manner. Alternatives LS-3 and CS-3 would reduce the toxicity and mobility of the metals-contaminated soils that would be contained on-site by chemically fixating the metals to prevent them from leaching. Alternatives LS-3 and CS-3 and LS-4 and CS-4 may reduce the volume of the radioactive materials through the use of a separation technology, however, the percent volume reduction is uncertain and would be the result of a physical separation process rather than treatment.

Short-Term Effectiveness

The No-Action Alternatives LS-1 and CS-1 would not result in any adverse short-term impacts. Potential short-term impacts would be associated with Alternatives LS-2 and CS-2, LS-3 and CS-3 and LS-4 and CS-4 due to the direct contact with soil by workers and through the potential for generation of dust during construction. Such impacts would be minimized through worker health and safety protective measures and dust suppression techniques such as covering waste piles and water spraying during dust-generating activities. Alternatives LS-3 and CS-3

and LS-4 and CS-4 would involve additional handling during on-Site radioactive materials separation and Alternatives LS-3 and CS-3 would also result in increased handling of materials during fixation of the metals-contaminated wastes and their disposition in the on-site cell. The vehicle traffic associated with all alternatives other than no action could impact the local roadway system and nearby residents through increased noise level and traffic. Proper protective equipment, air monitoring during construction, and soil handling procedures would minimize the short-term risks to workers and the surrounding community.

Implementability

The implementability of Alternatives LS-2 and CS-2, LS-3 and CS-3 and LS-4 and CS-4 would likely be a function of the acceptability of transportation of low-level radioactive wastes to an off-Site disposal location. These wastes would be securely loaded and trucked to an appropriate rail spur, where the wastes would then be shipped by rail to the ultimate disposal location. The implementability of Alternatives LS-3 and CS-3, and LS-4 and CS-4 would also depend on the efficiency of the separation technology/strategy selected for separation of radionuclide-contaminated soil from other excavated soils. Institutional controls through deed restrictions on the residential development of both Li Tungsten and Captain's Cove required for all the action alternatives should be readily implementable.

Cost

A detailed breakdown of component costs are provided in Appendix D.

4.4.2 Groundwater/Surface Water

Overall Protection of Human Health and the Environment

The Alternative LW-1, No-Action, would not provide any protection of human health and the environment as no active remedial measures or institutional controls are included in this alternative. It should be noted that remediation of contaminated soil is expected to greatly decrease the degree of leaching of contaminants from the soil into the groundwater, and would therefore significantly reduce the magnitude and duration of any potential impacts on human health and the environment from groundwater. Alternatives LW-2, LW-3 and LW-4 would

protect human health and the environment because the groundwater contaminated with inorganics on the Li Tungsten facility would be intercepted and prevented from discharging to Glen Cove Creek. The remedial goal of these alternatives is to restore groundwater quality in order to meet State and Federal MCLs. However, even without deed restrictions or other institutional controls, human health impacts through potable water consumption would continue to be a remote hypothetical risk; the likelihood of drawing potable water from the Upper Glacial aquifer is very remote because of the high level of dissolved solids in the aquifer from saltwater intrusion, as well as the availability of the City public water supply.

Compliance with ARARs

Alternative LW-1 would not actively address the concentrations of arsenic, antimony, and other heavy metals in groundwater that are presently in excess of MCLs promulgated under the Federal Safe Drinking Water Act (40 CFR Part 141), the New York State MCLs (10 NYCRR Part 5), or New York State Water Quality Standards (6 NYCRR Part 703); although it is anticipated that soils remediation could result in MCLs being achieved in the near future. Alternatives LW-2, LW-3, and LW-4 all use treatment technologies capable of removing the inorganics of concern to the standards. Off-site disposal of any sludges or treatment residues generated as a result of groundwater treatment processes included as part of Alternatives LW-2, LW-3, and LW-4 would be required to be sent to an appropriate off-Site treatment/disposal facility.

Long-Term Effectiveness

Removal of the source of groundwater contamination under any of the soil alternatives would improve the long term effectiveness and permanence of all of the groundwater alternatives. Alternative LW-1 would not actively remove groundwater contaminants except by the natural movement of groundwater which would dilute the remaining contaminated levels and would eventually flush the inorganics into Glen Cove Creek, where they would continue to be dispersed. Given the relatively sporadic inorganic contamination that currently exists in the aquifer, it is anticipated that this mechanism when combined with the soil remediation should effectively provide long term protection from groundwater contamination. The monitoring

program will be designed to determine if LW-1 is effective.

Alternatives LW-1, LW-2, LW-3, and LW-4 would all be similarly effective over the long term in permanently removing inorganic contaminants from groundwater.

Reduction of Toxicity, Mobility or Volume

Alternative LW-1 would not reduce the toxicity, mobility, or volume of contaminated groundwater through treatment. Using different technologies, Alternatives LW-2 and LW-3 would reduce the toxicity, mobility, and volume of contaminated groundwater through chemical precipitation of heavy metals, clarification and pH adjustment. Alternative LW-4 would rely on an adsorptive treatment media to adsorb dissolved heavy metals.

Short-Term Effectiveness

Alternative LW-1 would not include any remediation and, therefore, would not pose any short-term impacts to the community or to workers. Alternatives LW-2, LW-3, and LW-4 would all require trenching in the vicinity of Garvies Point Road and Herb Hill Road to accommodate the installation of different subsurface features (i.e., wells, drains, force main, slurry wall). Potential short term impacts would be associated with the direct contact with soil by workers and through the potential for generation of dust during construction. Such impacts would be minimized through worker health and safety protective measures and dust suppression techniques such as covering waste piles and water spraying during dust-generating activities. Alternative LW-3 would have the most impact on the local community as it would require that a forcemain be installed below grade for approximately 700 feet from the groundwater collection point to the treatment facility at the Mattiace site.

Potential short-term impacts would be associated with the three treatment alternatives as a result of the direct contact of groundwater by workers. However, impacts would be minimized through worker health and safety protective measures.

Implementability

All of the alternatives are considered technically and administratively implementable. Alternatives LW-2, LW-3, and LW-4 all would be able to achieve MCLs in the treated effluent

with the proposed treatment methods, although LW-2 and LW-3's reliance on standard proven technology improves their degree of implementability. Off-site property easements or permits to construct should also be relatively easy to obtain for all three alternatives.

Cost

A detailed breakdown of component costs are provided in Appendix D.

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6.0 GLOSSARY

6.1 Abbreviations and Acronyms

ABBREVIATION/ACRONYM	
AEA	Atomic Energy Act
ACM	Asbestos Containing Material
ACMS	Automated Conveyor Monitoring System
APT	Ammonium Paratungstate
ARARs	Applicable or Relevant and Appropriate Requirements
ARCS	Alternative Remedial Contracting Strategy
AWQC	Ambient Water Quality Criteria
bg	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
Ci	Curie
CLP	Contract Laboratory Program
cm	Centimeter
CO	Certificate of Occupancy
COPC	Chemical of Potential Concern
cy	Cubic Yard
DCA	Dichloroethane
DCE	Dichloroethene
DOE	Department of Energy
DOT	Department of Transportation
E	Estimated value for laboratory data
EMW	Monitoring well designation
FFS	Focussed Feasibility Study

FS	Feasibility Study
FSP	Field Sampling Plan
GAC	Granular Activated Charcoal
GM	Geraghty and Miller (monitoring well designation)
gpm	Gallons per minute
Hart	Fred C. Hart Associates, Inc.
HASP	Health and Safety Plan
HQ	Hazard Quotient
Hqs	Hazard Quotients
IAEA	International Atomic Energy Agency
IRA	Interim Remedial Action
ISV	In-Situ Vitrification
LLRWPA	Low Level Radioactive Waste Policy Act
LOAELs	Lowest Observed Adverse Effect Levels
LSA	Low Specific Activity
MCLs	Maximum Contaminant Levels
mg/Kg	Milligram per Kilogram
MP	Malcolm Pirnie (monitoring well designation)
MPI	Malcolm Pirnie, Inc.
mrem	millirem
mR/h	milliRoentgen per hour
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NOAA	National Oceanic and Atmospheric Administration
NOAELs	No Observed Adverse Effect Levels
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NUS	Halliburton-NUS, Inc.

NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSWQS	New York State Water Quality Standards and Guidance Values
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operating Unit
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
pCi/g	picoCurie per gram
pCi/L	picoCurie per Liter
PIC	Pressurized Ion Chamber
POTW	Publicly-Owned Treatment Works
PPE	Personal Protection Equipment
PRG	Preliminary Remediation Goal
QAPjP	Quality Assurance Project Plan
R	Roentgen
Ra	Radium
RAGS	USEPA Risk Assessment Guidance Documents
RCRA	Resource Conservation and Recovery Act
rem	rem
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROPC	Radionuclide of Potential Concern
Roux	Roux Associates
SARA	Superfund Amendments and Reauthorization Act of 1986

SGS	Segmented Gate System
SPDES	State Pollution Discharge Elimination System
SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Chemical
TAGM	Technical Assistance Guidance Manual
TAL	Target Analyte List
TBC	"To Be Considered" Material
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
Th	Thorium
TRC	TRC Corporation
TRVs	Toxic Reference Values
µg/Kg	microgram per Kilogram
µg/L	microgram per Liter
µR/h	microRoentgen per hour
U	Uranium
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

6.2 Radiological Terms

Action level:

A derived, media-specific concentration or activity level for a hazardous substance that (1) is based on a primary dose or risk limit and (2) triggers a response, such as further investigation or cleanup, if exceeded. See *investigation level.*

Activity:

See *radioactivity.*

ALARA (acronym for As Low As Reasonably Achievable):

A basic concept of radiation protection which specifies that exposure to ionizing radiation and releases of radioactive materials should be reduced as far below regulatory

limits as is reasonably achievable considering economic, technological, and societal factors, among others. Reducing exposure at a site to *ALARA* strikes a balance between what is possible through additional remediation and the use of additional resources to achieve a lower level. A determination of *ALARA* is a site-specific analysis that is open to interpretation, because it depends on approaches or circumstances that may differ between regulatory agencies. An *ALARA* recommendation should not be interpreted as a set limit or level. An example of one approach to performing a site-specific *ALARA* analysis can be found in Appendix G of the NRC draft report NUREG-1500 (Daily, et al., 1994).

Alpha particle:

A positively charged particle emitted by some radioactive materials undergoing *radioactive decay*.

Background radiation:

Radiation from cosmic sources; *naturally occurring radioactive material*, including radon (except as a decay product of *source* or *special nuclear material)*; and global fallout as it exists in the environment from the testing of nuclear explosive devices or from nuclear accidents like Chernobyl which contribute to *background radiation* and are not under the control of the licensee. *Background radiation* does not include radiation from *source*, *byproduct*, or *special nuclear materials* regulated by the NRC.

Becquerel (Bq):

The International System (SI) unit of activity equal to one nuclear transformation (disintegration) per second. 1 *Bq* = 2.7×10^{-11} *Curies (Ci)* = 27.03 picocuries (pCi).

Beta particle:

An electron emitted from the nucleus during *radioactive decay*.

Biased sample or measurement:

See *judgement sample* or *measurement*.

Chain of custody:

An unbroken trail of accountability--supported by documentation and signatures--that ensures the physical security of samples, data, and records.

Cleanup:

Actions taken to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release of a hazardous substance to the environment. Cleanup is sometimes used interchangeably with the terms *remedial action*, response action, or *removal action*.

Confidence interval:

A range of values for which there is a specified probability (e.g., 80%, 90%, 95%) that this set contains the true value of an estimated parameter.

Contamination:

The presence of *residual radioactivity* in excess of levels which are acceptable for release of a *site* or facility for *unrestricted use*.

Core sample:

A soil sample taken by core drilling.

Corrective action:

An action taken to deal with a release or threat of release of a hazardous substance that could adversely affect humans or the environment or both. Corrective action is sometimes used interchangeably with the terms *remedial action*, response action, or *cleanup*.

Curie (Ci):

The customary unit of radioactivity. One *curie* (Ci) is equal to 37 billion disintegrations per second (3.7×10^{10} dps = 3.7×10^{10} *Bq*), which is approximately equal to the decay of one gram of ^{226}Ra. Fractions of a *curie*, e.g. picocurie (pCi) or 10^{-12} Ci and microcurie (μCi) or 10^{-6} Ci, are levels typically encountered in *decommissioning*.

Decay:

See *radioactive decay*.

Decontamination:

The removal of radiological contaminants from, or their neutralization on, a person, object or area to within levels established by governing regulatory agencies. *Decontamination* is sometimes used interchangeably with *remediation*, remedial action, and *cleanup*.

Direct measurement:

Radioactivity measurement obtained by placing the detector against the surface or in the media being surveyed. The resulting radioactivity level is read out directly.

Dose commitment:

The dose that an organ or tissue would receive during a specified period of time (e.g., 50 or 70 years) as a result of intake (as by ingestion or inhalation) or one or more radionuclides from a given release.

Dose equivalent (dose):

A quantity that expresses all radiations on a common scale for calculating the effective absorbed dose. This quantity is the product of absorbed dose (rads) multiplied by a quality factor and any other modifying factors. Dose is measured in *Sv* or *rem*.

Duplicate:

One of two independent samples collected in such a manner that they are equally representative of the parameter(s) of interest at a given point in space and time.

Exposure pathway:

The route by which radioactivity travels through the environment to eventually cause a radiation exposure to a person or group.

Exposure rate:

The amount of ionization produced per unit time in air by X-rays or gamma rays. The unit of exposure rate is roentgens/hour (R/h); for decommissioning activities the typical units are microroentgens per hour (μR/h), i.e. 10^{-6} R/h.

External radiation:

Radiation from a source outside the body.

Gamma (γ) radiation:

Penetrating high-energy, short-wavelength electromagnetic radiation (similar to X-rays) emitted during *radioactive decay*. Gamma rays are very penetrating and require dense materials (such as lead or uranium) for shielding.

Indistinguishable from background:

The term indistinguishable form background means that the detectable concentration distribution of a radionuclide is not statistically different form the background concentration distribution of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

Infiltration rate:

The rate at which a quantity of a hazardous substance moves from one environmental medium to another--e.g., the rate at which a quantity of a radionuclide moves from a source into and through a volume of soil or solution.

Inventory:

Total residual quantity of formerly licensed radioactive material at a site.

Investigation level:

A radionuclide specific level of radioactivity that results in additional investigation when it is exceeded. See *action level.*

Lower limit of detection (L_D):

The smallest amount of radiation or radioactivity that statistically yields a net result above the method background. The critical detection level, L_c, is the lower bound on the 95% detection interval defined for L_D and is the level at which there is a 5% chance of

calling a background value "greater than background". This value should be used when actually counting samples or making direct radiation measurements. Any response above this level should be considered as above background; i.e., a net positive result. This will ensure 95% detection capability for L_D. A 95% confidence interval should be calculated for all responses greater than L_c.

Minimum detectable concentration (MDC):

The minimum detectable concentration (MDC) is the *a priori* activity level that a specific instrument and technique can be expected to detect 95% of the time. When stating the detection capability of an instrument, this value should be used. The *MDC* is the detection limit, L_D, multiplied by an appropriate conversion factor to give units of activity.

Missing or unusable data:

Data (measurements) that are mislabeled, lost, or do not meet quality control standards. *Less-than data* are not considered to be missing or unusable data. See *R*.

Naturally occurring radionuclides:

Radionuclides and their associated progeny produced during the formation of the earth or by interactions of terrestrial matter with cosmic rays.

Precision:

A measure of mutual agreement among individual measurements, usually under prescribed similar conditions, expressed generally in terms of the *arithmetic standard deviation*.

Qualified data:

Any data modified or adjusted as part of statistical or mathematical evaluation, data *validation*, or data *verification* operations.

Quality:

The totality of features and characteristics of a product or service that bear on its ability to meet the stated or implied needs and expectations of the user.

Quality assurance (QA):

An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Project Plan (QAPP):

A formal document describing in comprehensive detail the necessary *QA*, *QC*, and other technical activities that must be implemented to ensure that the results of the work performed satisfies the stated performance criteria.

Quality control (QC):

The overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the client. *QC* includes operational techniques and activities that are used to fulfill requirements for *quality*.

R:

The rate of missing or unusable measurements expected to occur for samples collected in *reference areas or survey units*. See *missing* or *unusable data*. See n_r. (Not to be confused with the symbol of the radiation exposure unit Roentgen.)

Radioactive decay:

The spontaneous transformation of an unstable atom into one or more different nuclides accompanied by either the emission of energy and/or particles from the nucleus, nuclear capture or ejection of orbital electrons, or fission. Unstable atoms decay into a more stable state, eventually reaching a form that does not decay further or has a very long *half-life*.

Radioactivity:

The mean number of nuclear transformations occurring in a given quantity of radioactive material per unit time. The International System (SI) unit of radioactivity is the *Becquerel (Bq)*. The customary unit is the *Curie (Ci)*.

Radiological survey:

Measurements of radiation levels associated with a *site* together with appropriate documentation and data evaluation.

Radionuclide:

An unstable nuclide that undergoes *radioactive decay*.

Rem (radiation equivalent man):

The conventional unit of *dose equivalent*. The corresponding International System (SI) unit is the *Sievert* (Sv): 1 Sv + 100 rem.

Remediation:

The process and associated activities resulting in removal of contamination from a site. Remediation is sometimes used interchangeably with the terms remedial action, response action, or *decontamination*.

Replicate:

A repeated analysis of the same sample or repeated measurement at the same location.

Representative measurement:

A measurement that is selected using a procedure in such a way that it, in combination with other representative measurements, will give an accurate representation of the phenomenon being studied.

Representativeness:

A measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Reproducibility:

A measure of precision, usually expressed as a variance, that measures the variability among measurement results of the same sample or location by different analysts.

Residual radioactivity:

Radioactivity in structures, materials, soils, groundwater, and other media at a site resulting form activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radioactivity. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with the provisions of 10 CFR Part 20.

Restoration:

Actions to return a remediated area to a usable state following decontamination.

Sample:

A part or selection from a medium located in a *survey unit* or *reference area* that represents the quality or quantity of a given parameter or nature of the whole area or unit; a portion serving as a specimen.

Scanning:

An evaluation technique performed by moving a detection device over a surface at a specified speed and distance above the surface to detect elevated levels of radiation.

Sievert (Sv):

The special name for the International System (SI) unit of *dose equivalent*. 1 Sv = 100 *rem* = 1 Joule per kilogram.

Site:

Any installation, facility, or discrete, physically separate parcel of land, or any building or structure or portion thereof, that is being considered for release.

Soil:

The top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter. A particular kind of earth or ground -- e.g., sandy soil.

Soil activity (soil concentration):

The level of radioactivity present in soil and expressed in units of activity per soil mass (typically Bq/kg or pCi/g).

Split:

A sample that has been homogenized and divided into two or more aliquots for subsequent analysis.

Subsurface soil sample:

A soil sample taken deeper than 15 cm below the soil surface.

Surface contamination:

Residual radioactivity found on building or equipment surfaces and expressed in units of activity per surface area (Bq/m^2 or $dpm/100\ cm^2$).

Surface soil sample:

A soil sample taken form the first 15 cm of surface soil.

Survey:

A systematic evaluation and documentation of radiological measurements with a correctly calibrated instrument or instruments that meet the sensitivity required by the objective of the evaluation.

Survey plan:

A plan for determining the radiological characteristics of a *site.*

Survey unit:

A geographical area of specified size and shape at a remediated site for which a separate decision will be made whether the unit attains the site-specific reference-based cleanup standard for the designated pollution parameter. *Survey units* are generally formed by grouping contiguous site areas with a similar use history and the same classification of contamination potential. Survey units are established to facilitate the survey process and the statistical analysis of survey data.

Working level:

A special unit of radon exposure defined as any combination of short-lived radon daughters in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy. This value is approximately equal to the alpha energy released from the decay of progeny in equilibrium with 100 pCi of ^{222}Ra.

Validation:

Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. In design and development,

validation concerns the process of examining a product or result to determine conformance to user needs.

Verification:

Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, validation concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity.

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: Grain Size, Bulk Density, Specific Gravity and Total Solids

LABORATORY: Soil Technology, Bainbridge Island, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

	Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Detection Limit (dry wt)
Grain Size	ASTM D-2217 and D-422	N/A	N/A	≤20%	1.0%
Bulk Density	ASTM D-854	N/A	N/A	≤20%	N/A
Specific Gravity	EM 1110-2-1906	N/A	N/A	≤20%	N/A
Total Solids	Plumb 1981	N/A	N/A	N/A	1.0%

SAMPLE CUSTODY A total of 15 samples were received on 11/1/95 and were logged into Battelle's log-in system. Eleven samples were analyzed for conventionals; the composite samples were not analyzed for conventional parameters. Samples for conventionals analyses were kept cold (~4°C) until analyses.

METHOD Grain size was measured for four fractions using a combination of sieve and pipette techniques, following ASTM method D-2217 and D-422 for wet sieving. Bulk density was measured in accordance with ASTM method D-854. Specific Gravity was measured in accordance with USACE Method EM 1110-2-1906. Total solids was measured gravimetrically following Plumb (1981).

HOLDING TIMES Samples were analyzed within the 6 month holding time.

DETECTION LIMITS Target detection limits of 1.0% by weight for each fraction were met for all samples.

METHOD BLANKS Not applicable.

MATRIX SPIKES Not applicable.

QA/QC SUMMARY GRAIN SIZE, BULK DENSITY, SPECIFIC GRAVITY and TOTAL SOLIDS
(continued)

REPLICATES One sample was analyzed in triplicate for grain size and percent solids. Precision was measured by calculating the relative standard deviation (RSD) among triplicate results. The RSD's ranged from 1% to 28%, indicating acceptable precision. One sample was also analyzed in triplicate for bulk density and specific gravity. The RSDs for bulk density were 1% while the RPD for specific gravity was 0%, indicating acceptable precision of the methods.

SRMs Not applicable.

REFERENCES

ASTM D-2217. Standard Method for Wet Preparation of Soil Samples for Particle-size Analysis and Determination of Soil Constants.

ASTM D-422. Standard Method for Particle-Size Analysis of Soils.

ASTM D-854. Standard Method for Specific Gravity

EM 1110-2-1906. USACE (United States Army Corps of Engineers). 1970. Engineering and Design Laboratory Soils Testing.

Plumb R.H. 1981. Procedure for Handling and Chemical Analysis of Sediment and Water Samples. Tech. Rep. EPA/CE-81-1. Prepared for Great Lakes Laboratory, State University College at Buffalo, Buffalo, NY, for the Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

RINE SCIENCES LABORATORY
Bay Road
382

GLENCOVE - Navy
Apparent Sediment Grain Size Distribution (1)

Sponsor ID	% Gravel >2.0mm	% Sand 2.0-.063mm	% Silt 63-.004mm	% Clay <.004mm	% Solids (2)
SITE 1	10	85	3	2	82
SITE 2	49	48	2	1	90
SITE 3	35	62	2	1	86
SITE 4	23	37	20	20	57
SITE 4	25	37	18	20	56
SITE 4	14	43	22	21	57
SITE 5	21	46	19	14	57
SITE 6	34	33	20	13	51
SITE 7	23	64	7	6	77
SITE 8	7	45	29	19	55
SITE 9	1	64	23	12	63
SITE 10	1	37	41	21	44
UPLAND-1	5	54	38	3	85

LYSIS

SITE 4	23	37	20	20	57
SITE 4	25	37	18	20	56
SITE 4	14	43	22	21	57
	28%	**9%**	**10%**	**3%**	**1%**

:ded

measured according to Plumb. 1981. EPA/CE-81-1.

400453

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GLENCOVE - Navy
Apparent Sediment Grain Size Distribution (1)

MSL Code	Rep	Sponsor ID	% Gravel >2.0mm	% Sand 2.0-.063mm	% Silt 63-.004mm	% Clay <.004mm	% Solids (2)
912GLEN*1		SITE 1	10	85	3	2	82
912GLEN*2		SITE 2	49	48	2	1	90
912GLEN*3		SITE 3	35	62	2	1	86
912GLEN*4	1	SITE 4	23	37	20	20	57
912GLEN*4	2	SITE 4	25	37	18	20	56
912GLEN*4	3	SITE 4	14	43	22	21	57
912GLEN*5		SITE 5	21	46	19	14	57
912GLEN*6		SITE 6	34	33	20	13	51
912GLEN*7		SITE 7	23	64	7	6	77
912GLEN*8		SITE 8	7	45	29	19	55
912GLEN*9		SITE 9	1	64	23	12	63
912GLEN*10		SITE 10	1	37	41	21	44
912GLEN*15		UPLAND-1	5	54	38	3	85

REPLICATE ANALYSIS

912GLEN*4	1	SITE 4	23	37	20	20	57
912GLEN*4	2	SITE 4	25	37	18	20	56
912GLEN*4	3	SITE 4	14	43	22	21	57
RSD			**28%**	**9%**	**10%**	**3%**	**1%**

(1) Organics included

(2) Percent solids measured according to Plumb. 1981. EPA/CE-81-1.

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GLENCOVE - Navy
Specific Gravity and Remolded Bulk Density Determinations

MSL Code	Rep	Sponsor ID	Specific Gravity (1)	Remolded Unit Weight (2) Wet (pcf)	Remolded Unit Weight (2) Dry (pcf)
912GLEN*11		GC-1	2.65	138	117
912GLEN*12		GC-2	2.67	96	52
912GLEN*13	1	GC-3	2.58	94	48
912GLEN*13	2	GC-3	2.58	93	48
912GLEN*13	3	GC-3	2.59	95	49
912GLEN*15		UPLAND-1	2.62	68	58

REPLICATE ANALYSIS

912GLEN*13	1	GC-3	2.58	94	48
912GLEN*13	2	GC-3	2.58	93	48
912GLEN*13	3	GC-3	2.59	95	49
RSD			**0%**	**1%**	**1%**

(1) Specific Gravity measured according to ASTM D854 methodology.
(2) Army Corps of Engineers methodology; Manual EM 1110-2-1906, Appendix II.

400455

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: Total Organic Carbon (TOC)

LABORATORY: Analytical Resources, Inc., Seattle, WA.

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Range of Recovery	SRM Accuracy	Relative Precision	Detection Limit (dry wt)
Plumb, 1981	N/A	≤20%	≤10%	0.1%

METHOD TOC was analyzed in accordance with EPA (1986). Analysis was performed by combustion and quantitation of evolved carbon dioxide using a LECO analyzer.

HOLDING TIMES Samples were analyzed within the 6 month holding time.

DETECTION LIMITS Target detection limits of 0.1% was met for all samples.

METHOD BLANKS Thirty-four method blanks were analyzed with the sediment samples. TOC levels detected in blanks ranged from 0.001% to 0.008% which were less than the established detection limit.

MATRIX SPIKES Not applicable.

REPLICATES One sample was analyzed in duplicate. Precision was measured by calculating the relative percent difference (RPD) between the replicate results. The RPD was 4% indicating acceptable precision of the method.

SRMs Standard reference material MESS-1, obtained from the National Research Council of Canada, was analyzed at least once per batch of sediment samples. Although MESS-1 is not certified for TOC, accuracy was measured by calculating the percent difference (PD) from the in-house consensus value. The PD value was 13%. Another SRM, NBS2704 was also analyzed for TOC. This SRM is certifed and the PD was 1%.

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(CF#912GLEN)

GLEN COVE - NAVY
TOTAL ORGANIC CARBON IN SEDIMENT SAMPLES

MSL Code	Sponsor ID	Analytical Replicate	Total Organic Carbon (% - dry wt.)
912GLEN*1	SITE 1	1	0.57
912GLEN*1	SITE 1	2	0.55
912GLEN*2	SITE 2		0.40
912GLEN*3	SITE 3		0.34
912GLEN*4	SITE 4		2.5
912GLEN*5	SITE 5		2.4
912GLEN*6	SITE 6		4.6
912GLEN*7	SITE 7		2.1
912GLEN*8	SITE 8		3.1
912GLEN*9	SITE 9		2.8
912GLEN*10	SITE 10		4.2
912GLEN*11	GC-1		0.44
912GLEN*12	GC-2		2.7
912GLEN*13	GC-3		3.9
912GLEN*15	UPLAND-1		3.1
Blank			<0.020U
MATRIX SPIKE RESULTS			
Amount Spiked			0.46
912GLEN*1	SITE 1	(mean)	0.56
912GLEN*1 + Spike		1	0.99
Amount Recovered			0.43
Percent Recovery			93%
Amount Spiked			0.63
912GLEN*1	SITE 1	(mean)	0.56
912GLEN*1 + Spike		2	1.20
Amount Recovered			0.64
Percent Recovery			102%
STANDARD REFERENCE MATERIAL			
MESS-1			2.93
	consensus value		2.6
	range		±0.2
	percent difference		13%
NBS#2704			3.33
	certified value		3.35
	percent difference		1%
REPLICATE ANALYSIS			
912GLEN*1	SITE 1	1	0.57
912GLEN*1	SITE 1	2	0.55
	RPD%		4%

U Not detected at or above MDL

400457

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: Semivolatiles; Phthalates and 4-Methylphenol

LABORATORY: Analytical Resources Inc., Seattle, WA.

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	MS Recovery	Surrogate Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (dry wt)
GC/MS	50-120%	30-150%	≤30%	≤30%	phenol 10 ng/g Phthalate 100 ng/g

SAMPLE CUSTODY

A total of 15 samples were received on 11/1/95 and were logged into Battelle's log-in system. Only 4 samples were received in containers for organics analyses (3 on-site sediment composite samples and one background, upland soil). Samples for organic analyses were frozen (-20 deg C) and sent to Analytical Resources Inc., in Seattle for analysis of phthalates and 4-methylphenol.

METHOD

Sediment samples were extracted following EPA Method 3550B (ultrasonication). Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) following EPA method 8270 (EPA 1986).

HOLDING TIMES

Samples were extracted on 11/16/95. All extracts were analyzed by GC/MS on 12/8/95.

DETECTION LIMITS

Detection limits reported are based on an MDL study determined by multiplying the standard deviation of 7 spiked replicates of a background sediment sample by the student t value. A MDL verification was performed consisting of 4 spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the 4 replicate spike results by 3.5. All MDL verification results were below the target detection limit.

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GLENCOVE - Navy
SEMI-VOLATILE ORGANICS
Sediment Analyses

(CF#912)

MSL Code	Blank	GLEN*11	GLEN*12	GLEN*12 (Dup)	GLEN*12 (Trip)	Relative Standard Deviation	GLEN*13	GLEN*15
Sponsor Code		GC-1	GC-2	GC-2	GC-2		GC-3	UPLANDS-1
Matrix	Seds	Seds	Seds	Seds	Seds		Seds	Seds
% Moisture	NA	8.87	48.2	48.2	48.2		33.2	15.7
Units	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	%	µg/Kg	µg/Kg
Batch	1	2	1	1	1		1	1
4-Methylphenol	5.0 U	9.9 U	19 U	19 U	19 U	NA	99	20 U
Butylbenzylphthalate	5.0 U	9.9 U	26 M	71	20 M	71%	300	71
bis(2-Ethylhexyl)phthalate	6.4	110	1800 D	1900 D	2200 D	11%	15000 D	230
Surragate Recovery (%)								
d5-Phenol	38.1	37.1	47.3	43.1	40.4		52.4	41.3
2-Fluorophenol	30.1	30.6	42.7	41.6	41.8		59.7	33.3
2,4,6-Tribromophenol	28.5	57.8	61.3	57.7	52.9		53.4	61.4
d4-2-Chlorophenol	40.6	38.2	52.6	49.2	47.4		60.6	44.8

D Diluted value used
M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match
NA Not applicable/available
U Not detected at or above the MDL shown

400459

Battelle
Pacific Northwest Laboratories

Project No. _____

Internal Distribution

Date February 7, 1996 · File/LB

To Greg Durell: BOS

From Lisa Lefkovitz

Subject Spex jars for St. John's Metals Samples

Enclosed in the two coolers being shipped today are 150 clean, tared spex jars to be used for tissue samples for metals analyses on the St. John's River project. Please note that these jars are tared and **no additional labels, tape etc. should be placed on the jars!** If there are any questions, please call me at 360-681-3626.

An additional 50, or so, jars will be shipped later in project.

400460

NY4-SEDIMENT MDL (ng/g DRY WT.)								
Extracted 5/3/95, analyzed on HP5970b 5/16/95								
Spike Sol'n:	pp-445							
Spike amt (µl):	400							
Name	MDL-blk	MDL-1	MDL-2	MDL-3	MDL-4	AVG	STD DEV	MDL
1,4-DICHLORO	nd	nd	nd	nd	nd			
NAPHTHALENE	2.37	17.32	17.84	18.74	17.02	17.73	0.75	2.64
ACENAPHTHYLE	nd	15.82	15.64	15.75	15.71	15.73	0.08	0.26
ACENAPHTHENE	nd	16.62	17.17	16.86	16.87	16.88	0.23	0.79
FLUORENE	nd	14.83	17.46	16.67	15.49	16.11	1.18	4.12
DIBENZOTHIOP	1.55	nd	nd	nd	nd			
PHENANTHRENE	nd	17.94	20.17	17.27	19.35	18.68	1.32	4.61
ANTHRACENE	nd	13.08	13.86	12.24	12.93	13.03	0.66	2.33
FLUORANTHENE	4.12	18.76	21.24	18.69	20.02	19.68	1.21	4.23
PYRENE	2.20	18.15	19.59	17.14	18.98	18.47	1.06	3.72
BENZO(A)ANTH	3.84	16.18	17.20	15.23	15.89	16.13	0.82	2.87
CHRYSENE	1.27	15.45	16.63	15.65	15.51	15.81	0.55	1.94
BENZO(B)FLUO	4.18	22.15	23.94	23.31	24.11	23.38	0.89	3.11
BENZO(K)FLUO	nd	19.25	20.40	20.60	21.09	20.34	0.78	2.73
BENZO(E)PYRE	1.60	21.07	22.15	22.81	23.55	22.40	1.05	3.68
BENZO(A)PYRE	nd	16.34	17.87	17.00	18.07	17.32	0.80	2.81
PERYLENE	nd	13.24	13.14	12.54	13.64	13.14	0.45	1.59
INDENO(123-C	2.22	16.11	16.94	16.04	15.85	16.24	0.48	1.69
DIBENZO(A,H)	nd	12.69	13.46	12.84	12.30	12.82	0.48	1.69
BENZO(G,H,I)	2.23	15.78	16.76	16.32	16.84	16.43	0.49	1.70

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GLENCOVE - Navy

PAH in Sediment Samples

MSL ID Client ID	Blank	(BSA) BLK SPK A	Spike Conc.	Percent Recovery	(BSB) BLK SPK B	Spike Conc.	Percent Recovery	SRM 1941a	*certified value*	Percent Difference
Matrix	SED	SED			SED			SED		
Analytical Replicate	1	1			2			1		
Wet Wt.	19.7	19.7			19.7			15.0		
Units	*ng/g*	*ng/g*	*ng/g*	%	*ng/g*	*ng/g*	%	*ng/g*	*ng/g*	%
Percent Dry Wt (%)	80.4	80.4			80.4			100		
Batch	1	1			1			1		
1,4-Dichlorobenzene	1.78 U	1.78 U	NS	NA	1.78 U	NS	NA	110	NA	NA
Naphthalene	1.78 U	37.5	31.5	119%	37.7	31.5	120%	918	1010	9%
Acenaphthylene	1.89 U	29.1	31.5	92%	29.1	31.5	92%	55.5	NA	NA
Acenaphthene	1.69 U	29.0	31.5	92%	30.1	31.5	96%	41.9	NA	NA
Fluorene	3.37 U	29.5	31.5	94%	30.7	31.5	97%	79.6	97.3	18%
Phenanthrene	3.99 U	26.9	31.5	85%	27.2	31.5	86%	454	489	7%
Anthracene	4.85 U	28.3	31.5	90%	28.3	31.5	90%	169	184	8%
Fluoranthene	1.83 U	24.8	31.5	79%	24.5	31.5	78%	894	981	9%
Pyrene	1.36 U	24.5	31.5	78%	24.5	31.5	78%	695	811	14%
Benzo(a)anthracene	1.78 •	28.7	31.5	85%	28.8	31.5	86%	413	427	3%
Chrysene	0.74 U	29.5	31.5	94%	30.0	31.5	95%	560 (1)	380	47% #
Benzo(b)fluoranthene	1.40 U	38.9	31.5	123% &	38.8	31.5	123% &	945 (2)	740	28%
Benzo(k)fluoranthene	2.37 U	37.6	31.5	119%	38.1	31.5	121% &	339	361	6%
Benzo(e)pyrene	1.55 U	1.55 U	NS	NA	1.55 U	NS	NA	552	553	0%
Indeno(123-cd)pyrene	0.85 U	26.2	31.5	83%	26.7	31.5	85%	455	501	9%
Dibenzo(a,h)anthracene	1.07 U	26.4	31.5	84%	26.9	31.5	85%	114 (3)	73.9	54% #
Benzo(g,h,i)perylene	0.77 U	21.8	31.5	69%	22.2	31.5	70%	433	525	17%

400462

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GLENCOVE - Navy
PAH in Sediment Samples

MSL ID Client ID	Blank	*(BSA)* BLK SPK A	Spike Conc.	Percent Recovery	*(BSB)* BLK SPK B	Spike Conc.	Percent Recovery	SRM 1941a	*certified value*	Percent Difference
Matrix	SED	SED			SED			SED		
Analytical Replicate	1	1			2			1		
Wet Wt.	19.7	19.7			19.7			15.0		
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	ng/g	ng/g	%
Percent Dry Wt (%)	80.4	80.4			80.4			100		
Batch	1	1			1			1		
Surrogate Recoveries (%)										
d4 1,4-Dichlorobenzene	46	81			76					
d8 Naphthalene	56	85			80					
d10 Acenaphthene	78	92			87					
d12 Chrysene	105	103			103					
d14 Dibenzo(a,h,i)Anthracene	81	86			88					

U = Not detected at or above MDL.
B = Analyte detected in sample is < 5x blank value
NA = Not applicable.
* = Ion ratio out or confirmation ion not detected.
& = Outside Spike recovery range (50-120%).
# = Outside QC range (<30%)
@ = Outside Surrogate Recovery limits (30-150%)
(1) = Concentration is the sum of chrysene and triphenylene
(2) = Concentration is the sum of benzo(b)fluoranthene and benzo(j)fluoranthene
(3) = Concentration is the sum of dibenzo(a,c)anthracene and dibenzo(a,h)anthracene

400463

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GLENCOVE - Navy

PAH in Sediment Samples

MSL ID	912-11 R-1	*Dup* 912-11 R-2	*Trip* 912-11 R-3	*RSD%*	912-13	*(MS)* 912-13 SPK	Spike Conc.	Percent Recovery	912-12	912-15
Client ID	GC-1	GC-1	GC-1		GC-3	GC-3			GC-2	UPLAND-1
Matrix	SED	SED	SED			SED			SED	SED
Analytical Replicate	1	2	3			1			1	1
Wet Wt.	20.3	20.3	20.0		20.9	20.8			20.0	20.1
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	ng/g	%	ng/g	ng/g
Percent Dry Wt (%)	91.1	91.1	91.1		66.8	66.8			51.8	84.3
Batch		1	1		1	1			1	1
1,4-Dichlorobenzene	9.11 •	2.40	2.67	80% #	179	180	NS	NA	71.5	1.67 U
Naphthalene	13.4	4.45	4.76	67% #	117	148	35.0	89%	110	10.1
Acenaphthylene	3.16 •	2.35 •	2.14 •	21%	38.5	69.1	35.0	87%	65.3 a	3.69
Acenaphthene	9.14	1.97	3.69	76% #	91.9 a	120	35.0	80%	36.3 a	3.60
Fluorene	15.2	2.97	4.22	90% #	80.6 a	119	35.0	110%	55.0 a	3.58
Phenanthrene	95.7	11.5	21.6	107% #	382 a	450	35.0	194% &	281 a	38.8
Anthracene	27.0	5.19	7.64	90% #	142 a	190	35.0	137% &	121 a	6.40
Fluoranthene	135	31.8	43.4	81% #	1230 a	1250	35.0	57%	953 a	89.8
Pyrene	117	41.7	51.1	59% #	1160 a	1160	35.0	0% &	1190 a	74.8
Benzo(a)anthracene	58.1	15.6	22.5	71% #	495 a	543	35.0	137% &	439 a	42.7
Chrysene	54.1	19.1	24.7	58% #	589 a	618	35.0	83%	499 a	55.9
Benzo(b)fluoranthene	83.8	34.9	44.2	48% #	740	757	35.0	49% &	786	89.6
Benzo(k)fluoranthene	29.2	12.1	15.6	48% #	283	315	35.0	91%	274	28.9
Benzo(e)pyrene	41.1	21.5	22.5	39% #	439	430	NS	NA	473	45.2
Indeno(123-cd)pyrene	33.3	14.1	16.8	49% #	364	387	35.0	66%	357	38.6
Dibenzo(a,h)anthracene	8.04	4.78	4.05	38% #	84.6 a	114	35.0	84%	83.9 a	8.80
Benzo(g,h,i)perylene	29.0	15.0	15.4	40% #	358	375	35.0	49% &	364	34.7

400464

BATTELLE MARINE SCIENCES
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GLENCOVE - Navy
PAH in Sediment Samples

MSL ID	912-11 R-1	*Dup* 912-11 R-2	*Trip* 912-11 R-3	*RSD%*	912-13	*(MS)* 912-13 SPK	Spike	Percent	912-12	912-15
Client ID	GC-1	GC-1	GC-1		GC-3	GC-3	Conc.	Recovery	GC-2	UPLAND-1
Matrix	SED	SED	SED			SED			SED	SED
Analytical Replicate	1	2	3			1			1	1
Wet Wt.	20.3	20.3	20.0		20.9	20.8			20.0	20.1
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	ng/g	%	ng/g	ng/g
Percent Dry Wt (%)	91.1	91.1	91.1		66.8	66.8			51.8	84.3
Batch		1	1		1	1			1	1
Surrogate Recoveries (%)										
d4 1,4-Dichlorobenzene	25 @	65	58		38	52			62	69
d8 Naphthalene	37	73	64		60	73			77	76
d10 Acenaphthene	69	88	78		87	95			94	85
d12 Chrysene	105	110	98		95	103			91	103
d14 Dibenzo(a,h,i)Anthracene	104	107	95		102	111			114	103

U = Not detected at or above MDL.
B = Analyte detected in sample is < 5x bla
NA = Not applicable.
* = Ion ratio out or confirmation ion not detected.
& = Outside Spike recovery range (50-120
# = Outside QC range (<30%)
@ = Outside Surrogate Recovery limits (30
(1) = Concentration is the sum of chrysene
(2) = Concentration is the sum of benzo(b)f
(3) = Concentration is the sum of dibenzo(

400465

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: Polynuclear Aromatic Hydrocarbons (PAH) and 1,4-Dichlorobenzene

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	MS Recovery	Surrogate Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (dry wt)
GC/MS/SIM	50-120%	30-150%	≤30%	≤30%	10 ng/g

SAMPLE CUSTODY

A total of 15 samples were received on 11/1/95 and were logged into Battelle's log-in system. Only 4 samples were received in containers for organics analyses (3 on-site sediment composite samples and one background, upland soil). The remaining samples were split for additional physical analyses. Samples for organic analyses were frozen (-20 deg C) until extraction.

METHOD

Sediment samples were extracted with methylene chloride using a roller under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (Krahn et al. 1988). Samples were then cleaned using Silica/Alumina (5% deactivated) chromatography followed by HPLC cleanup.

Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) in the selected ion mode (SIM) following a procedure based on EPA method 8270 (EPA 1986).

HOLDING TIMES

Samples were extracted on 11/21/95. All extracts were analyzed by GC/MS/SIM on 12/5/95.

DETECTION LIMITS

Target detection limits of 10 ng/g dry wt. were met for all PAH compounds. Method detection limits (MDLs) were determined by multiplying the standard deviation of 7 spiked replicates of a background clam sample by the student t value. A MDL verification was performed within the last 6 months on sediments from New York Harbor, consisting of 4 spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the 4 replicate spike results by 3.5. All MDL verification results were below the target detection limit.

QA/QC SUMMARY/PAHs (continued)

METHOD BLANKS

One method blank was extracted with the extraction batch. Only benzo(a)anthracene was detected in the blank. All blank levels were less than the target MDL of 10 ng/g dry wt and all sample concentrations were well above 5 times the blank concentration therefore, no data were flagged. No data were blank corrected

SURROGATES

Five isotopically labelled compounds were added prior to extraction to assess the efficiency of the method. These were d8-Naphthalene, d10-Acenaphthene, d12-Chrysene, d14-Dibenzo(a,h)anthracene and d4-1,4 dichlorobenzene. All surrogate recoveries were within the quality control limits of 30-150%except for d4-1,4 dichlorobenzene in one sample. The recovery was 25%, above the warning limit of 20%, therefore no re-extraction was performed. All sample results are surrogate corrected.

MATRIX SPIKES

One sample was spiked with all PAH compounds. Matrix spike recoveries for 6 of the 16 PAH compounds spiked were outside of the QC limits of 50-120% due to high native levels, relative to the levels spiked. Spike concentrations were from 10-35 times lower than native concentrations.

REPLICATES

One sample was extracted and analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. RSDs ranged from 21 to 107% and were outside of the limits of ±30% for all but one compound. The results for two of the replicates were in good agreement, however, the third replicate had values from 20 to 10 times higher. This is most likely due to non-homogeneity of the sample since all other QC was acceptable. No further action was taken.

SRMs

One SRM,1941a, a marine sediment obtained by the National Institute for Science and Technology (NIST), was analyzed with the samples. Fourteen of the sixteen PAH compounds analyzed are certified. Twelve of the 14 PAHs were detected within 30% of the certified mean. Two compounds, chrysene and dibenzo(a,h)anthracene, were recovered above the certified range at recoveries of 47 and 54%, respectively. These two compounds all coelute with other specific compounds present at significant levels in the SRM, which accounts for the high recoveries.

QA/QC SUMMARY/PAHs (continued)

MISCELLANEOUS

Some of the compounds are flagged with "*" to indicate that the ion ratio for that compound was outside of the QC range. This is due primarily to low levels of the compound of interest. Because the confirmation ion is present at only a fraction of the level of the parent ion, when the native level of the compound is low, the amount of error in the concentration measurement of the confirmation ion goes up. The compound is actually quantified from the parent ion only so most likely this will not effect the quality of the data. For sample values that are relatively high (>5 times the MDL) it may be an indication of some sort of interference.

REFERENCES

Krahn, Margaret M., Catherine A. Wigren, Ronald W. Pearce, Leslie K. Moore, Richard G. Bogar, William D. MacLeod, Jr., Sin-Lam Chan, and Donald W. Brown. 1988. *New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants*. NOAA Technical Memorandum NMFS F/NWC-153. National Oceanic and Atmospheric Administration, National Marine Fisheries, Seattle, Washington.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington D. C.

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: PCB Congeners/Chlorinated Pesticides

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Sediment

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Target Surrogate Recovery	Spike Recovery	Relative Precision	Detection Limit
GC/ECD	30-150%	50-120%	≤30%	1.0 ng/g dry wt.

SAMPLE CUSTODY

A total of 15 samples were received on 11/1/95 and were logged into Battelle's log-in system. Only 4 samples were received in containers for organics analyses (3 on-site sediment composite samples and one background, upland soil). The remaining samples were split for additional physical analyses. Samples for organic analyses were frozen (-20 deg C) until extraction.

METHOD

A 20 gram (wet wt.) aliquot of sediment was extracted with methylene chloride using the roller technique under ambient conditions following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (Krahn et al. 1988). Samples were then cleaned using Silica/Alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were analyzed for 15 chlorinated pesticides and 22 individual PCB congeners using Gas Chromatography/Electron Capture Detection (GC/ECD) following a procedure based on EPA method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES

Samples were extracted on 11/21/95. Extracts were analyzed by GC/ECD from 12/11-12/95, within the established holding time of 40 days.

Y/PCB CONGENERS/PESTICIDES (continued)

TS Target detection limits were met for all PCBs and pesticides. MDLs were determined from multiplying the standard deviation of 7 spiked replicates of a representative clean marine sediment by the student t value. A MDL verification was performed within the last 6 months on sediments from New York Harbor, consisting of 4 spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the 4 replicate spike results by 3.5. All MDL verification results were below the target detection limit.

S One method blank was extracted. No PCB congeners or pesticides were detected above the MDL in the method blank with the exceptin of PCB 49, 184 and 187 at levels less than 3 times the MDL. All sample values detected at concentrations less than 5 times the concentrations detected in the blanks were flagged with a "B".

Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Sample surrogate recoveries were all within the QC guidelines of 30-150%. Note that all results are corrected for recovery of the surrogates.

Five out of the 22 congeners and 12 of the 15 pesticides were spiked into one sample. Matrix spike recoveries ranged from 11 - 125%. Recoveries of 4 pesticides and 1 congener exceeded the control limit range of 50-120%. However, all recoveries that were outside of the control limits were for compounds that were spiked from 1 to 15 times below the native levels, therefore no corrective action was taken.

One sample was analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. RSDs for all detectable values were below the target precision goal of ≤30% with the exception of dieldrin, which was detected at relatively low values in all 3 replicates.

One SRM,1941a, a marine sediment obtained by the National Institute for Science and Technology (NIST), was analyzed with the samples. Thirteen of the 22 PCB congeners and 5 of the 15 pesticide compounds analyzed are certified. A number of the pesticides and congeners were detected at levels above 30% of the certified mean, however, all were detected within 42% of the certified values. The average percent difference from mean certified values was 24.9% and 40% of the compounds exceeded 35% difference. Note that one of the pesticides, 2,4'DDE, is certified below the MDL.

All congener and pesticide results are confirmed using a second dissimilar column. Results for each column must be within a factor of 2 of each other to be considered a confirmed value.

REFERENCES

Krahn, Margaret M., Catherine A. Wigren, Ronald W. Pearce, Leslie K. Moore, Richard G. Bogar, William D. MacLeod, Jr., Sin-Lam Chan, and Donald W. Brown. 1988. *New HPLC Cleanup and Revised Extraction Procedures for Organic Contaminants*. NOAA Technical Memorandum NMFS F/NWC-153. National Oceanic and Atmospheric Administration, National Marine Fisheries, Seattle, Washington.

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington D. C.

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GLENCOVE
PESTICIDE & PCB ANALYSES OF SEDIMENT SAMPLES

(CF#912)

MSL Code	Blank	Blank (BS) SPK A			Blank (BS) SPK B			SRM		
Sponsor Code								1941a		
Matrix	Sed	Sed			Sed			Sed		
Wet Weight								15.0		
Units (dry wt)	ng/g	ng/g	Spike	%	ng/g	Spike	%	ng/g	certified	%
Batch	1	1	Amount	ecovery	1	Amount	ecovery	1	value	Difference
PCB 153	0.03 U	4.34	4.17	104%	4.47	4.17	107%	13.2	17.6	25%
PCB 105	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	4.77	3.65	31% &
PCB 138	0.03 U	2.90	3.22	90%	2.86	3.22	89%	7.79	13.4	42% &
PCB 187	0.04	0.03 U	NS	NA	0.03 U	NS	NA	6.03	NA	NA
PCB 183	0.07 U	0.07 U	NS	NA	0.07 U	NS	NA	3.55	NA	NA
PCB 128	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	1.82	1.87	3%
PCB 180	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	9.02	5.83	55% &
PCB 170	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	7.63	3.00	154% &
PCB 195	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	3.14	NA	NA
PCB 206	0.03 U	0.03 U	NS	NA	0.03 U	NS	NA	4.58	3.67	25%
PCB 209	0.02 U	0.02 U	NS	NA	0.02 U	NS	NA	8.35	8.34	0%
Surrogate Recoveries (%)										
PCB 103 (SIS)	69	83			83			62		
PCB 198 (SIS)	88	88			87			93		

& Outside QC limits
B Analyte detected in blank; sample value <5x blank value.
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

400472

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(CF#912)

GLENCOVE
PESTICIDE & PCB ANALYSES OF SEDIMENT SAMPLES

		Dup	*Trip*			*(MS)*				
MSL Code	912*11	912*11	912*11		912*13	912*13MS			912*12	912*15
Sponsor Code						Matrix Spike				
Matrix	Sed	Sed	Sed		Sed	Sed			Sed	Sed
Wet Weight	20.3	20.3	20.0		20.9	20.8			20.0	20.1
Units (dry wt)	ng/g	ng/g	ng/g	RSD%	ng/g	ng/g	Spike	%	ng/g	ng/g
Batch	1	1	1		1	1	Amount	Recovery	1	1
PCB 153	2.89	2.30	2.05	18%	26.5	29.0	3.80	66%	20.4	1.33
PCB 105	0.50	0.47	0.41	10%	21.0	17.8	NS	NA	14.0	0.46
PCB 138	1.56	1.36	1.13	16%	32.5	31.2	2.93	44%	19.4	1.22
PCB 187	1.28	0.94	0.84	23%	5.97	5.68	NS	NA	5.58	0.60
PCB 183	0.69	0.49	0.44	24%	3.46	3.25	NS	NA	3.22	0.28
PCB 128	0.34	0.34	0.34	0%	7.15	6.17	NS	NA	3.86	0.37
PCB 180	1.80	1.26	1.16	24%	15.2	12.9	NS	NA	10.7	0.02 U
PCB 170	0.88	0.70	0.65	16%	8.13	7.78	NS	NA	6.58	0.55
PCB 195	0.20	0.02 U	0.10	NA	1.02	1.15	NS	NA	1.73	0.10
PCB 206	0.10	0.02 U	0.02 U	NA	0.03 U	0.03 U	NS	NA	0.04 U	0.30
PCB 209	0.02 U	0.02 U	0.02 U	NA	0.02 U	0.02 U	NS	NA	0.03 U	0.02 U
Surrogate Recoveries (%)										
PCB 103 (SIS)	78	89	82		100	120			93	85
PCB 198 (SIS)	90	93	86		102	120			115	82

& Outside QC limits
B *Analyte detected in blank;*
NA Not available/applicable
NS Not spiked
U Not detected at or above

400473

PCB CONGENERS
NY4 MDL VERIFICATION STUDY (ng/g dry weight)
Study performed with control sediment provided by Betsy Barrows
DATE: 5/16/95
SEQUENCE: 8244

SAMPLE:	824 MDL-1	824 MDL-2	824 MDL-3	824 MDL-4			
FILE NAME:	009F0101 009R0101	010F0101 010R0101	011F0101 011R0101	012F0101 012R0101	MEAN VALUES		MDL, ng/L
PK NAME	conc, ng/g	conc, ng/g	conc, ng/g	conc, ng/g	conc, ng/g	STD. DEV.	= 3.5 X Std Dev.
PCB 8*	0.68	0.78	0.67	0.78	0.73	0.06	0.22
PCB 18	0.83	0.83	0.79	0.90	0.84	0.05	0.16
PCB 28	1.01	1.05	0.88	1.07	1.00	0.09	0.30
PCB 52 *	0.75	0.76	0.73	0.80	0.76	0.03	0.11
PCB 44	1.13	1.13	1.05	1.16	1.12	0.05	0.17
PCB 66	1.18	1.21	1.09	1.24	1.18	0.07	0.23
PCB 101	0.88	0.91	0.81	0.91	0.88	0.05	0.16
PCB 87 *	0.82	0.80	0.73	0.79	0.78	0.04	0.13
PCB 118	0.91	0.94	0.83	0.94	0.91	0.05	0.19
PCB 163	0.79	0.80	0.70	0.79	0.77	0.05	0.16
PCB 105	0.98	0.98	0.88	0.98	0.95	0.05	0.18
PCB 138*	0.90	0.91	0.82	0.89	0.88	0.04	0.14
PCB 187	0.77	0.79	0.72	0.79	0.77	0.03	0.12
PCB 128	0.82	0.85	0.77	0.85	0.82	0.04	0.13
PCB 180	0.85	0.86	0.79	0.87	0.84	0.04	0.13
PCB 170	0.81	0.85	0.74	0.80	0.80	0.04	0.15
PCB 195	0.84	0.82	0.77	0.84	0.82	0.03	0.11
PCB 206	0.74	0.74	0.66	0.73	0.72	0.04	0.13
PCB 209	0.73	0.73	0.68	0.74	0.72	0.03	0.09

400474

* = Expanded RPD criteria used --interferences.

PESTICIDES							
NEW YORK 4 - SEDIMENT MDL STUDY (ng/g dry weight)							
Control Sediment Provided by Betsy Barrows spiked for this study.							
DATE:	5/16/95						
SEQUENCE:	8244						
SAMPLE:	824 MDL-1	824 MDL-2	824 MDL-3	824 MDL-4			
FILE NAME:	009F0101	010F0101	011F0101	012F0101	MEAN VALUES		MDL, ng/g
	009R0101	010R0101	011R0101	012R0101			
PK NAME	conc, ng/g	conc, ng/g	conc, ng/g	conc, ng/g	conc, ng/g	STD. DEV.	=3.5 X STD. DEV.
HEPTACHLOR	0.43	0.44	0.39	0.39	0.41	0.02	0.08
ALDRIN	0.69	0.69	0.66	0.70	0.68	0.02	0.05
HEPT EPOXIDE	0.60	0.58	0.66	0.59	0.68	0.02	0.06
2,4'-DDE	0.77	0.76	0.87	0.76	0.74	0.04	0.15
a-CHLORDANE	0.97	0.96	0.86	0.96	0.94	0.05	0.18
4,4'-DDE	1.75	1.78	1.65	1.76	1.71	0.11	0.38
DIELDRIN	0.85	0.83	0.73	0.81	0.80	0.05	0.19
2,4'-DDD	2.31	2.28	2.04	2.24	2.22	0.12	0.42
2,4'-DDT	0.90	0.86	0.75	0.84	0.84	0.07	0.23
4,4'-DDD	1.05	1.03	0.94	1.02	1.01	0.05	0.17
4,4'-DDT	1.19	1.32	1.11	1.21	1.21	0.09	0.31

400475

* = Expanded RPD confirmation criteria used due to know interference problem.

MSL Code	Blank	Blank SPK A (BS)			Blank SPK B (BS)			SRM		
Sponsor Code								1941a		
Matrix	Sed	Sed			Sed			Sed		
Wet Weight								15.0		
Units (dry wt)	ng/g	ng/g	Spike	%	ng/g	Spike	%	ng/g	certified	%
Batch	1	1	Amount	ecovery	1	Amount	ecovery	1	value	Difference
Heptachlor	0.07 U	3.51	3.95	89%	3.54	3.95	90%	0.06 U	NA	NA
Aldrin	0.21 U	3.60	3.95	91%	3.51	3.95	89%	5.27	NA	NA
Heptachlor Epoxide	0.31 U	3.24	3.95	82%	3.38	3.95	86%	0.26 U	NA	NA
2,4'-DDE	0.67 U	0.67 U	NS	NA	0.67 U	NS	NA	0.57 U	0.73	NA
Endosulfan I	0.36 U	2.98	3.95	75%	3.05	3.95	77%	0.30 U	NA	NA
a-Chlordane	0.51 U	3.37	3.95	85%	3.45	3.95	87%	3.12	2.33	34% &
Trans Nonachlor	0.23 U	0.23 U	NS	NA	0.23 U	NS	NA	1.16	1.26	8%
4,4'-DDE	0.14 U	3.30	3.95	84%	3.50	3.95	89%	9.63	6.59	46% &
Dieldrin	0.21 U	3.62	3.95	92%	3.80	3.95	96%	0.18 U	NA	NA
2,4'-DDD	0.20 U	0.20 U	NS	NA	0.20 U	NS	NA	2.61	NA	NA
2,4'-DDT	0.24 U	0.24 U	NS	NA	0.24 U	NS	NA	0.20 U	NA	NA
4,4'-DDD	0.26 U	3.93	3.95	99%	4.05	3.95	103%	5.60	5.06	11%
Endosulfan II	0.36 U	3.15	3.95	80%	3.26	3.95	83%	0.30 U	NA	NA
4,4'-DDT	0.74 U	5.95	3.95	151% &	5.68	3.95	144% &	48.7	NA	NA
Endosulfan Sulfate	0.22 U	3.29	3.95	83%	3.44	3.95	87%	0.19 U	NA	NA
PCB 8	0.59 U	0.59 U	NS	NA	0.59 U	NS	NA	3.03	NA	NA
PCB 18	0.20 U	0.20 U	NS	NA	0.20 U	NS	NA	4.07	NA	NA
PCB 28	0.06 U	4.89	5.04	97%	4.83	5.04	96%	10.3	NA	NA
PCB 52	0.03 U	8.99	10.5	86%	9.26	10.5	88%	8.98	6.89	30%
PCB 49	0.08	0.07 U	NS	NA	0.07 U	NS	NA	6.61	9.50	30%
PCB 44	0.03 U	0.03 U	NS	NA	0.03 U	NS	NA	6.63	4.80	38% &
PCB 66	0.03 U	0.03 U	NS	NA	0.03 U	NS	NA	8.91	6.80	31% &
PCB 101	0.04 U	7.10	7.13	100%	7.22	7.13	101%	11.7	11.0	6%
PCB 87	0.03 U	0.03 U	NS	NA	0.03 U	NS	NA	3.92	6.70	41% &
PCB 118	0.04 U	0.04 U	NS	NA	0.04 U	NS	NA	9.70	10.0	3%
PCB 184	0.12	0.07 U	NS	NA	0.11	NS	NA	0.06 U	NA	NA

400476

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: Semivolatiles; Phthalates and 4-Methylphenol

LABORATORY: Analytical Resources Inc., Seattle, WA.

MATRIX: Site Water and Elutriates

QA/QC DATA QUALITY OBJECTIVES

Reference Method	MS Recovery	Surrogate Recovery	SRM Accuracy	Relative Precision	Target Detection Limit (dry wt)
GC/MS	50-120%	30-150%	≤30%	≤30%	phenol 10 ng/g Phthalate 100 ng/g

SAMPLE CUSTODY Two site water samples were received on 11/2/95 and 3 elutriate samples were received on 11/8/95. Samples were received from Aqua Survey, Inc. in good condition. Samples were logged into Battelle's log-in system and stored cold (4°C) and sent to Analytical Resources Inc., in Seattle for analysis of phthalates and 4-methylphenol.

METHOD Water samples were extracted following EPA Method 3520C (continuous liquid-liquid extraction). Extracts were quantified using gas chromatography/mass spectrometry (GC/MS) following EPA method 8270 (EPA 1986).

HOLDING TIMES Samples were extracted on 11/6/95. All extracts were analyzed by GC/MS on 11/13/95.

DETECTION LIMITS Detection limits reported are in ug/L and are based on an MDL study determined by multiplying the standard deviation of 7 spiked replicates of a background water sample by the student t value.

METHOD BLANKS One method blank was extracted with the extraction batch. Only bis(2-ethylhexyl)phthalate was detected in the blank. All blank levels were less than the target MDL of 10 ng/g dry wt and all sample concentrations were well above 5 times the blank concentration therefore, no data were flagged. No data were blank corrected

SURROGATES A number of isotopically labelled compounds were added prior to extraction to assess the efficiency of the method. All surrogate recoveries were within the quality control limits of 30-150%.

QA/QC SUMMARY/Semivolatiles (continued)

MATRIX SPIKES One sample was spiked with a number of semivolatile compounds; however, these did not include the compounds of interest. Recoveries of the semivolatiles spiked ranged from 87 to 165%. All recoveries except one were within 40-120%. This data is not reported here but is available upon request.

REPLICATES One sample was extracted and analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. No analytes were detected in any of the replicates so no RSDs were calculated

SRMs Not Available for phenols or phthalates.

REFERENCES

U.S. Environmental Protection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*. SW-846. U.S. Document No. 955-001-00000, U.S. EPA, Washington D. C.

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400479

GLENCOVE - Navy
ORGANICS ANALYSIS OF ELUTRIATES

(CF#911)

MSL Code	GLEN*5	*Dup* GLEN*5	*Trip* GLEN*5		Sequim Bay	*Dup* Sequim Bay	*Trip* Sequim Bay	
Sponsor Code	5803/GC-3	5803/GC-3	5803/GC-3		Water	Water	Water	
Matrix	Elutriate	Elutriate	Elutriate					
Units	µg/L	µg/L	µg/L	RSD%	µg/L	µg/L	µg/L	RSD%
Batch	2	2	2		2	2	2	
4-Methylphenol	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
Butylbenzylphthalate	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
bis(2-Ethylhexyl)phthalate	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
Surragate Recovery (%)								
d5-Nitrobenzene	72.2	68.8	69.2		72.2	71.1	56.2	
2-Fluorobiphenyl	69.5	65.0	62.7		70.2	61.5	57.7	
d14-p-Terphenyl	84.6	85.0	84.8		83.1	80.7	75.5	
d4-1,2-Dichlorobenzene	62.5	59.5	57.0		61.4	48.5	46.8	
d5-Phenol	71.5	72.4	69.7		71.8	70.4	62.8	
2-Fluorophenol	74.0	70.3	71.0		72.2	65.4	61.0	
2,4,6-Tribromophenol	71.8	67.6	69.8		62.2	62.9	46.6	
d4-2-Chlorophenol	73.8	70.8	72.4		74.5	68.8	65.2	

NA Not applicable/available
U Not detected at or above the MDL shown

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GLENCOVE - Navy
ORGANICS ANALYSIS OF ELUTRIATES

(CF#911)

MSL Code	Blank	GLEN*3	*Dup* GLEN*3	*Trip* GLEN*3		*MS* GLEN*3	GLEN*4	*Dup* GLEN*4	*Trip* GLEN*4	
Sponsor Code		5801/GC-1	5801/GC-1	5801/GC-1		Matrix Spike	5802/GC-2	5802/GC-2	5802/GC-2	
Matrix	Elutriate	Elutriate	Elutriate	Elutriate		Elutriate	Elutriate	Elutriate	Elutriate	
Units	µg/L	µg/L	µg/L	µg/L	RSD%	µg/L	µg/L	µg/L	µg/L	RSD%
Batch	2	2	2	2		2	2	2	2	
4-Methylphenol	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	NA
Butylbenzylphthalate	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	NA
bis(2-Ethylhexyl)phthalate	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	NA
Surragate Recovery (%)										
d5-Nitrobenzene	71.8	69.6	69.8	69.0		69.6	72.9	65.1	68.8	
2-Fluorobiphenyl	71.1	65.1	68.6	60.9		64.9	65.1	60.8	65.6	
d14-p-Terphenyl	81.8	79.9	80.8	71.3		83.8	83.7	77.9	83.4	
d4-1,2-Dichlorobenzene	59.4	60.6	61.8	53.7		53.9	58.1	57.4	54.3	
d5-Phenol	69.1	69.2	71.2	69.0		69.5	72.7	66.2	69.6	
2-Fluorophenol	70.6	66.0	72.7	66.4		70.9	70.3	64.1	72.5	
2,4,6-Tribromophenol	55.5	66.2	76.0	61.1		74.1	69.4	61.3	70.5	
d4-2-Chlorophenol	73.6	67.9	71.6	66.4		72.8	72.7	64.0	69.7	

NA Not applicable/available
U Not detected at or above the MDL shown

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GLENCOVE - Navy
ORGANICS ANALYSIS OF SITEWATER

(CF#911)

MSL Code	Blank	GLEN*1	*Dup* GLEN*1	*Trip* GLEN*1	GLEN*1	*(MS)* + SPK		GLEN*2	*Dup* GLEN*2	*Trip* GLEN*2	
Sponsor Code		Site 3	Site 3	Site 3		Site 3		Site 1&2	Site 1&2	Site 1&2	
Matrix	Water	Water	Water	Water		Water		Water	Water	Water	
Units	µg/L	µg/L	µg/L	µg/L	RSD%	µg/L	%	µg/L	µg/L	µg/L	RSD%
Batch	1	1	1	1		1	Recovery	1	1	1	
4-Methylphenol	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
Butylbenzylphthalate	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
bis(2-Ethylhexyl)phthalate	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA
Surragate Recovery (%)											
d5-Nitrobenzene	83.7	79.4	80.2	80.3		87.7		72.8	77.2	77.3	
2-Fluorobiphenyl	84.6	71.9	75.9	76.8		82.2		73.1	72.3	84.1	
d14-p-Terphenyl	103	93.4	101	107		104		91.5	95.4	99.9	
d4-1,2-Dichlorobenzene	81.2	60.1	68.5	79.3		72.0		65.5	75.9	71.2	
d5-Phenol	88.3	83.1	80.9	85.9		86.3		78.4	82.4	76.2	
2-Fluorophenol	85.7	77.2	81.7	85.7		84.9		76.4	83.7	79.4	
2,4,6-Tribromophenol	61.1	78.2	82.1	78.9		85.4		69.2	75.3	90.8	
d4-2-Chlorophenol	87.8	80.3	81.6	87.6		89.2		76.1	84.5	82.3	

NA Not applicable/available
U Not detected at or above the MDL shown

400481

QA/QC SUMMARY

PROGRAM: Glen Cove

PARAMETER: PCB Congeners/Chlorinated Pesticides

LABORATORY: Battelle/Marine Sciences Laboratory, Sequim, Washington

MATRIX: Site and Elutriate Water

QA/QC DATA QUALITY OBJECTIVES

Reference Method	Surrogate Recovery	Spike Recovery	Relative Precision	Target Detection Limit
GC/ECD	30-150%	50-120%	≤30%	1.0 ng/L

SAMPLE CUSTODY Two site water samples were received on 11/2/95 and 3 elutriate samples were received on 11/8/95. Samples were received from Aqua Survey, Inc. in good condition. Samples were logged into Battelle's log-in system and stored cold (4°C) until extraction.

METHOD One liter of water was extracted with methylene chloride in a separatory funnel following a procedure which is based on methods used by the National Oceanic and Atmospheric Administration for their Status and Trends Program (Krahn et al. 1988). Sample extracts were then cleaned using Silica/Alumina (5% deactivated) chromatography followed by HPLC cleanup (Krahn et al. 1988). Extracts were analyzed for 15 chlorinated pesticides and 22 individual PCB congeners using Gas Chromatography/Electron Capture Detection (GC/ECD) following a procedure based on EPA method 8080 (EPA 1986). The column used was a J&W DB-17 and the confirmatory column was a DB-1701, both capillary columns (30m x 0.25mm I.D.).

HOLDING TIMES The following summarizes the extraction and analyses dates:

	Extraction	Analysis
Batch 1 - Site Water	11/3/95	12/8/95
Batch 2 - Elutriates	11/13/95	12/10/95-12/11/95

QA/QC SUMMARY/PCB CONGENERS/PESTICIDES - Site Water (continued)

DETECTION LIMITS

Target detection limits were met for all PCBs and pesticides. MDLs were determined from multiplying the standard deviation of 7 spiked replicates of a representative clean Sequim Bay water by the student t value. A MDL verification was performed consisting of 4 spiked replicate samples of a representative clean sediment. MDL verification values were determined by multiplying the standard deviation of the 4 replicate spike results by 3.5. All MDL verification results were below the target detection limit.

METHOD BLANKS

One method blank was extracted with each extraction batch. No PCB congeners or pesticides were detected above the MDL in either method blank with the exception of PCB 187 in Batch 1 blank. This value was less than 3 times the MDL and therefore no further action was taken and no data were flagged.

SURROGATES

Two compounds, PCB congeners 103 and 198, were added to all samples prior to extraction to assess the efficiency of the analysis. Surrogate recoveries were all within the QC guidelines of 30-150% with the exception of PCB 103 in the blank for Batch 1.

MATRIX SPIKES

Five out of the 22 congeners and 12 of the 15 pesticides were spiked into one elutriate sample and one site water sample. Matrix spike recoveries ranged from 76 - 140%, all within the control limit range of 50-120% with the exception of the recovery of 4,4'-DDT which was recovered at 140% in the elutriate and 134% in the site water.

REPLICATES

All samples were analyzed in triplicate. Precision was measured by calculating the relative standard deviation (RSD) between the replicate results. However, the third replicate of sample 5801/GC-1/elutriate, was lost and precision for this sample was calculated using the relative percent difference between the remaining duplicate sample results. For site waters, very few analytes were detected in all three replicates above the MDL. Of these only one pesticide RSD exceeded the precision goal of ≤30% (Aldrin, 38%). Elutriate samples had more detectable analytes, however, the sample results were more variable with a number of RSDs exceeding the target precision goal of ≤30%, ranging from 2 to 81%. These elutriate samples contained varying levels of particulates and therefore are not very homogeneous, which accounts for the lower precision of the results.

SRMs

Standard reference material for organics in water are not available.

MISCELLANEOUS

All congener and pesticide results are confirmed using a second dissimilar column. Results for each column must be within a factor of 2 of each other to be considered a confirmed value.

Cleanup and Revised Extraction Procedures for Organic
echnical Memorandum NMFS F/NWC-153. 1988.

ection Agency (EPA). 1986. *Test Methods for Evaluating Solid Waste:*
ds. SW-846. U.S. Document No. 955-001-00000, U.S. EPA,

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GLENCOVE - Navy
PESTICIDE AND PCB ANALYSIS OF ELUTRIATES

(CF#911)

		(BS)				*Dup*	
MSL Code	Blank	BLANK SPK A			GLEN*3	GLEN*3	
Sponsor Code					5801/GC-1	5801/GC-1	
Matrix	DI Water	DI Water			Elutriate	Elutriate	
Units	ng/L	ng/L	Spike	%	ng/L	ng/L	RPD%
Batch	2	2	Amount	Recovery	2	2	
Heptachlor	0.50 U	25.9	25.0	104%	0.47 U	0.47 U	NA
Aldrin	0.41 U	19.3	25.0	77%	1.77	2.22	23%
Heptachlor Epoxide	0.12 U	24.6	25.0	98%	0.11 U	0.11 U	NA
2,4'-DDE	0.24 U	0.24 U	NS	NA	0.23 U	0.23 U	NA
Endosulfan I	0.49 U	23.3	25.0	93%	0.46 U	0.46 U	NA
a-Chlordane	0.88 U	21.1	25.0	84%	0.81 U	0.81 U	NA
Trans Nonachlor	1.18 U	1.18 U	NS	NA	1.10 U	1.10 U	NA
4,4'-DDE	0.29 U	23.3	25.0	93%	0.27 U	0.97	NA
Dieldrin	0.13 U	30.1	25.0	120%	3.24	4.16	25%
2,4'-DDD	1.00 U	1.00 U	NS	NA	0.93 U	0.93 U	NA
2,4'-DDT	0.46 U	0.46 U	NS	NA	0.43 U	0.43 U	NA
4,4'-DDD	0.48 U	31.9	25.0	128% &	0.45 U	0.45 U	NA
Endosulfan II	0.49 U	25.6	25.0	102%	0.46 U	0.46 U	NA
4,4'-DDT	0.43 U	38.9	25.0	156% &	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.49 U	19.7	25.0	79%	0.46 U	0.46 U	NA
PCB 8	1.06 U	1.06 U	NS	NA	0.99 U	0.99 U	NA
PCB 18	1.12 U	1.12 U	NS	NA	1.05 U	1.05 U	NA
PCB 28	0.75 U	28.6	31.9	89%	0.70 U	0.70 U	NA
PCB 52	0.38 U	55.6	66.5	84%	0.44	0.57	26%
PCB 49	0.57 U	0.57 U	NS	NA	0.79	0.88	11%
PCB 44	0.33 U	0.33 U	NS	NA	0.30 U	0.30 U	NA
PCB 66	0.41 U	0.41 U	NS	NA	0.38 U	0.38 U	NA
PCB 101	0.52 U	45.2	45.1	100%	0.48 U	0.48 U	NA
PCB 87	0.38 U	0.38 U	NS	NA	0.35 U	0.35 U	NA

400485

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GLENCOVE - Navy
PESTICIDE AND PCB ANALYSIS OF ELUTRIATES

(CF#911)

		(BS)				*Dup*	
MSL Code	Blank	BLANK SPK A			GLEN*3	GLEN*3	
Sponsor Code					5801/GC-1	5801/GC-1	
Matrix	DI Water	DI Water			Elutriate	Elutriate	
Units	ng/L	ng/L	Spike	%	ng/L	ng/L	RPD%
Batch	2	2	Amount	Recovery	2	2	
PCB 118	0.50 U	0.50 U	NS	NA	0.47 U	0.47 U	NA
PCB 184	0.57 U	0.57 U	NS	NA	0.53 U	0.53 U	NA
PCB 153	0.42 U	21.9	26.4	83%	0.39 U	0.51	NA
PCB 105	0.32 U	0.32 U	NS	NA	0.29 U	0.29 U	NA
PCB 138	0.36 U	17.8	20.4	87%	0.34 U	0.64	NA
PCB 187	0.41 U	0.41 U	NS	NA	0.38 U	0.60	NA
PCB 183	0.57 U	0.57 U	NS	NA	0.53 U	0.53 U	NA
PCB 128	0.26 U	0.26 U	NS	NA	0.24 U	0.24 U	NA
PCB 180	0.29 U	0.29 U	NS	NA	0.27 U	0.27 U	NA
PCB 170	0.21 U	0.21 U	NS	NA	0.20 U	0.20 U	NA
PCB 195	0.29 U	0.29 U	NS	NA	0.27 U	0.27 U	NA
PCB 206	0.42 U	0.42 U	NS	NA	0.39 U	0.39 U	NA
PCB 209	0.29 U	0.29 U	NS	NA	0.27 U	0.27 U	NA
Surrogate Recoveries (%)							
PCB 103 (SIS)	66	61			68	70	
PCB 198 (SIS)	75	69			79	74	

& Outside QC limits
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

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GLENCOVE - Navy
PESTICIDE AND PCB ANALYSIS OF ELUTRIATES

(CF#911)

		Dup	*Trip*	
MSL Code	GLEN*4	GLEN*4	GLEN*4	
Sponsor Code	5802/GC-2	5802/GC-2	5802/GC-2	
Matrix	Elutriate	Elutriate	Elutriate	
Units	ng/L	ng/L	ng/L	RSD%
Batch	2	2	2	
Heptachlor	0.47 U	0.47 U	0.47 U	NA
Aldrin	1.60	3.21	1.98	37% &
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA
2,4'-DDE	0.91	0.23 U	0.23 U	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA
a-Chlordane	0.81 U	1.36	0.82 U	NA
Trans Nonachlor	1.10 U	1.10 U	1.10 U	NA
4,4'-DDE	4.09	6.65	3.25	38% &
Dieldrin	5.56	6.36	5.04	12%
2,4'-DDD	0.93 U	0.93 U	0.93 U	NA
2,4'-DDT	0.43 U	0.43 U	0.43 U	NA
4,4'-DDD	4.16	6.01	3.52	28%
Endosulfan II	0.46 U	0.46 U	0.46 U	NA
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA
PCB 8	1.13 U	0.99 U	0.99 U	NA
PCB 18	2.38	3.00	2.42	13%
PCB 28	0.80 U	1.85	0.70 U	NA
PCB 52	0.91	3.71	1.13	81% &
PCB 49	1.29	2.37	1.07	44% &
PCB 44	0.35 U	2.88	0.30 U	NA
PCB 66	0.43 U	0.38 U	0.38 U	NA
PCB 101	1.01	3.57	0.48 U	NA
PCB 87	0.40 U	1.95	0.35 U	NA

400487

	GLEN*4 5802/GC-2 Elutriate	Dup GLEN*4 5802/GC-2 Elutriate	Trip GLEN*4 5802/GC-2 Elutriate	
Units	ng/L	ng/L	ng/L	RSD%
Batch	2	2	2	
PCB 118	0.80	2.52	0.47 U	NA
PCB 184	0.61 U	0.53 U	0.53 U	NA
PCB 153	0.67	2.38	0.39 U	NA
PCB 105	0.39	1.85	0.29 U	NA
PCB 138	0.53	2.58	0.34 U	NA
PCB 187	0.53	0.94	0.38 U	NA
PCB 183	0.61 U	0.53 U	0.53 U	NA
PCB 128	0.27 U	1.03	0.24 U	NA
PCB 180	0.31 U	1.38	0.27 U	NA
PCB 170	0.23 U	0.20 U	0.20 U	NA
PCB 195	0.31 U	0.27 U	0.27 U	NA
PCB 206	0.44 U	0.39 U	0.39 U	NA
PCB 209	0.31 U	0.27 U	0.27 U	NA
Surrogate Recoveries (%)				
PCB 103 (SIS)	75	72	71	
PCB 198 (SIS)	73	76	78	

& Outside QC limits
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

400488

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GLENCOVE - Navy
PESTICIDE AND PCB ANALYSIS OF ELUTRIATES

(CF#911)

		Dup	*Trip*		*MS*		
MSL Code	GLEN*5	GLEN*5	GLEN*5		GLEN*5		
Sponsor Code	5803/GC-3	5803/GC-3	5803/GC-3		5803/GC-3		
Matrix	Elutriate	Elutriate	Elutriate		Elutriate		
Units	ng/L	ng/L	ng/L	RSD%	ng/L	Spike	%
Batch	2	2	2		2	Amount	Recovery
Heptachlor	0.47 U	0.47 U	0.47 U	NA	26.3	23.4	112%
Aldrin	4.62	3.11	4.01	19%	22.5	23.4	79%
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA	27.9	23.4	119%
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA	0.23 U	NS	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA	24.0	23.4	103%
a-Chlordane	2.38	0.81 U	1.89	NA	20.9	23.4	81%
Trans Nonachlor	1.10 U	1.10 U	1.10 U	NA	1.10 U	NS	NA
4,4'-DDE	7.81	3.70	6.94	35% &	25.9	23.4	81%
Dieldrin	7.34	7.17	7.05	2%	32.3	23.4	108%
2,4'-DDD	0.93 U	0.93 U	0.93 U	NA	1.43	NS	NA
2,4'-DDT	0.43 U	0.43 U	0.43 U	NA	0.43 U	NS	NA
4,4'-DDD	7.44	3.14	6.17	40% &	33.2	23.4	116%
Endosulfan II	0.46 U	0.46 U	0.46 U	NA	23.9	23.4	102%
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA	32.8	23.4	140% &
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA	19.0	23.4	81%
PCB 8	0.99 U	0.99 U	0.99 U	NA	0.99 U	NS	NA
PCB 18	5.34	5.13	4.32	11%	8.54	NS	NA
PCB 28	3.42	2.25	3.33	22%	30.4	29.8	91%
PCB 52	6.71	2.83	5.79	40% &	59.2	62.2	86%
PCB 49	4.44	1.72	4.25	44% &	4.12	NS	NA
PCB 44	4.62	2.69	4.78	29%	4.32	NS	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA	0.38 U	NS	NA
PCB 101	4.50	1.04	4.52	60% &	46.2	42.2	99%
PCB 87	2.11	0.35 U	2.08	NA	1.68	NS	NA

400489

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GLENCOVE - Navy
PESTICIDE AND PCB ANALYSIS OF ELUTRIATES

(CF#911)

		Dup	*Trip*		*MS*		
MSL Code	GLEN*5	GLEN*5	GLEN*5		GLEN*5		
Sponsor Code	5803/GC-3	5803/GC-3	5803/GC-3		5803/GC-3		
Matrix	Elutriate	Elutriate	Elutriate		Elutriate		
Units	ng/L	ng/L	ng/L	RSD%	ng/L	Spike	%
Batch	2	2	2		2	Amount	Recovery
PCB 118	2.83	0.68	2.70	58% &	2.48	NS	NA
PCB 184	0.53 U	0.53 U	0.53 U	NA	0.53 U	NS	NA
PCB 153	2.77	0.54	2.52	63% &	21.3	24.7	76%
PCB 105	1.69	0.29 U	1.77	NA	1.52	NS	NA
PCB 138	2.75	0.46	2.54	66% &	18.8	19.1	85%
PCB 187	0.96	0.38 U	0.85	NA	0.84	NS	NA
PCB 183	0.53 U	0.53 U	0.53 U	NA	0.53 U	NS	NA
PCB 128	0.24 U	0.24 U	0.82	NA	0.88	NS	NA
PCB 180	1.14	0.27 U	1.33	NA	1.14	NS	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA	0.20 U	NS	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA	0.27 U	NS	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA	0.39 U	NS	NA
PCB 209	0.27 U	0.27 U	0.27 U	NA	0.27 U	NS	NA
Surrogate Recoveries (%)							
PCB 103 (SIS)	79	74	77		70		
PCB 198 (SIS)	78	81	76		78		

**Rep3 used for spike recovery

& Outside QC limits
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

GLENCOVE - Navy

ORGANICS ANALYSIS OF SITEWATER

(CF#911)

MSL Code	Blank	(BS) BLANK SPK A			(BS) BLANK SPK B		
Sponsor Code							
Matrix	Water	Water			Water		
Units	ng/L	ng/L	Spike	%	ng/L	Spike	%
Batch	1	1	Amount	Recovery	1	Amount	Recovery
Heptachlor	0.50 U	18.5	25.0	74%	15.7	25.0	63%
Aldrin	0.41 U	10.6	25.0	42%	9.54	25.0	38% &
Heptachlor Epoxide	0.12 U	30.7	25.0	123% &	35.5	25.0	142% &
2,4'-DDE	0.24 U	0.24 U	NS	NA	0.24 U	NS	NA
Endosulfan I	0.49 U	30.4	25.0	122% &	34.8	25.0	139% &
a-Chlordane	0.88 U	20.4	25.0	82%	20.4	25.0	82%
Trans Nonachlor	1.18 U	1.18 U	NS	NA	1.18 U	NS	NA
4,4'-DDE	0.29 U	20.1	25.0	80%	20.4	25.0	82%
Dieldrin	0.13 U	33.4	25.0	134% &	39.3	25.0	157% &
2,4'-DDD	1.00 U	1.00 U	NS	NA	1.00 U	NS	NA
2,4'-DDT	0.46 U	0.46 U	NS	NA	0.46 U	NS	NA
4,4'-DDD	0.48 U	38.5	25.0	154% &	39.9	25.0	160% &
Endosulfan II	0.49 U	31.5	25.0	126% &	34.6	25.0	138% &
4,4'-DDT	0.43 U	36.2	25.0	145% &	30.3	25.0	121% &
Endosulfan Sulfate	0.49 U	20.6	25.0	82%	21.4	25.0	86%
PCB 8	1.06 U	1.06 U	NS	NA	1.06 U	NS	NA
PCB 18	1.12 U	1.12 U	NS	NA	1.12 U	NS	NA
PCB 28	0.75 U	27.7	31.9	87%	28.5	31.9	89%
PCB 52	0.38 U	56.0	66.5	84%	59.3	66.5	89%
PCB 49	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA
PCB 44	0.33 U	0.33 U	NS	NA	0.33 U	NS	NA
PCB 66	0.41 U	0.41 U	NS	NA	0.41 U	NS	NA
PCB 101	0.52 U	53.3	45.1	118%	61.6	45.1	137% &
PCB 87	0.38 U	0.38 U	NS	NA	0.38 U	NS	NA
PCB 118	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA
PCB 184	0.57 U	0.60	NS	NA	0.57 U	NS	NA
PCB 153	0.42 U	22.0	26.4	83%	22.4	26.4	85%
PCB 105	0.32 U	0.32 U	NS	NA	0.32 U	NS	NA
PCB 138	0.36 U	17.8	20.4	87%	18.0	20.4	88%
PCB 187	0.60	0.41 U	NS	NA	0.41 U	NS	NA

400491

GLENCOVE MDL VERIFICATION
Sequim Bay Water
(CF#911)

PESTICIDES & PCBs

MSL Code Units	BLANK ng/L	MDL-1 ng/L	MDL-4 ng/L	MDL-6 ng/L	MDL-8 ng/L	STD DEV.	MDL
Hexachlorbenzene	0.36 U	4.22	4.40	4.37	4.35	0.079	0.278
G-BHC	0.44 U	4.44	5.08	5.17	5.02	0.331	1.16
Heptachlor	0.50 U	4.41	4.83	4.59	4.56	0.174	0.608
Aldrin	0.41 U	5.55	4.44	5.52	4.05	0.762	2.67
Heptachlor Epoxide	0.12 U	5.38	5.81	5.49	5.82	0.224	0.784
2,4'-DDE	0.24 U	6.12	6.56	7.64	6.79	0.639	2.24
a-Chlordane	0.88 U	5.47	5.59	6.07	5.53	0.274	0.960
Trans Nonachlor	1.18 U	4.80	5.34	4.76	5.10	0.273	0.955
4,4'-DDE	0.29 U	10.9	8.10	9.86	8.92	1.21	4.23
Dieldrin	0.13 U	6.98	7.60	7.14	8.37	0.623	2.18
2,4'-DDD	1.00 U	2.78	3.36	2.49	3.21	0.398	1.39
2,4'-DDT	0.46 U	5.95	6.21	4.15	6.32	1.02	3.56
4,4'-DDD	0.48 U	5.54	7.09	4.05	5.99	1.26	4.41
4,4'-DDT	0.43 U	17.4	18.7	18.2	18.9	0.67	2.34
Mirex	0.45 U	3.04	0.45 U	3.23	3.01	NA	NA
PCB 8	1.06 U	7.54	7.97	7.71	7.81	0.180	0.631
PCB 18	1.75	8.45	8.33	8.51	9.81	0.694	2.43
PCB 28	0.75 U	8.00	8.76	8.42	8.35	0.312	1.09
PCB 52	0.38 U	8.07	8.40	8.62	7.75	0.381	1.33
PCB 44	0.33 U	7.98	8.26	0.33 U	8.47	NA	NA
PCB 66	0.41 U	8.48	9.48	9.19	9.43	0.461	1.61
PCB 101	0.52 U	8.69	9.90	9.20	9.38	0.499	1.75
PCB 87	0.38 U	8.91	9.33	9.42	9.38	0.236	0.827
PCB 118	0.50 U	7.31	7.93	7.57	7.58	0.254	0.891
PCB 153	0.42 U	7.49	8.11	7.58	7.53	0.291	1.02
PCB 105	0.32 U	8.91	9.29	9.22	9.29	0.181	0.635
PCB 138	0.36 U	7.93	8.63	8.28	8.8	0.386	1.35
PCB 187	0.41 U	7.64	7.65	7.93	7.97	0.177	0.619
PCB 128	0.26 U	8.14	8.67	8.47	8.49	0.221	0.773
PCB 180	0.29 U	7.96	8.31	7.11	8.13	0.531	1.86
PCB 170	0.21 U	7.60	7.79	7.36	7.70	0.185	0.649
PCB 195	0.29 U	8.44	8.65	8.44	8.50	0.099	0.347
PCB 206	0.42 U	8.99	9.14	9.01	8.99	0.0723	0.253
PCB 209	0.29 U	10.5	10.3	10.2	10.3	0.126	0.440

Surrogate Recoveries (%) (MDL=3.5 X Std. Dev.)

PCB 103 (SIS)	66	70	67	66	66
PCB 198 (SIS)	57	60	57	60	57

400492

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

GLENCOVE - Navy
ORGANICS ANALYSIS OF SITEWATER

(CF#911)

MSL Code	Blank	(BS) BLANK SPK A			(BS) BLANK SPK B		
Sponsor Code							
Matrix	Water	Water			Water		
Units	ng/L	ng/L	Spike Amount	% Recovery	ng/L	Spike Amount	% Recovery
Batch	1	1			1		
PCB 183	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA
PCB 128	0.26 U	0.26 U	NS	NA	0.26 U	NS	NA
PCB 180	0.29 U	0.29 U	NS	NA	0.29 U	NS	NA
PCB 170	0.21 U	0.21 U	NS	NA	0.21 U	NS	NA
PCB 195	0.29 U	0.29 U	NS	NA	0.29 U	NS	NA
PCB 206	0.42 U	0.42 U	NS	NA	0.42 U	NS	NA
PCB 209	0.29 U	0.29 U	NS	NA	0.29 U	NS	NA
Surrogate Recoveries (%)							
PCB 103 (SIS)	25 &	40			39		
PCB 198 (SIS)	34	55			61		

& Outside QC limits
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

400493

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

GLENCOVE - Navy

ORGANICS ANALYSIS OF SITEWATER

(CF#911)

MSL Code	GLEN*1	*Dup* GLEN*1	*Trip* GLEN*1		GLEN*2	*Dup* GLEN*2	*Trip* GLEN*2		*(MS)* GLEN*2 + SPK		
Sponsor Code	Site 3	Site 3	Site 3		Site 1&2	Site 1&2	Site 1&2		Site 1&2		
Matrix	Water	Water	Water		Water	Water	Water		Water		
Units	ng/L	ng/L	ng/L	RSD%	ng/L	ng/L	ng/L	RSD%	ng/L	Spike	%
Batch	1	1	1		1	1	1		1	Amount	Recovery
Heptachlor	0.47 U	0.47 U	0.47 U	NA	0.47 U	0.53 U	0.53 U	NA	21.4	23.6	91%
Aldrin	1.51	0.66	1.18	38% &	1.72	2.49	1.85	20%	18.6	23.6	71%
Heptachlor Epoxide	0.11 U	0.11 U	0.11 U	NA	0.11 U	0.13 U	0.13 U	NA	22.7	23.6	96%
2,4'-DDE	0.23 U	0.23 U	0.23 U	NA	0.23 U	0.26 U	0.26 U	NA	0.23 U	NS	NA
Endosulfan I	0.46 U	0.46 U	0.46 U	NA	0.46 U	0.52 U	0.52 U	NA	21.0	23.6	89%
a-Chlordane	0.83 U	0.83 U	0.83 U	NA	1.02	1.44	1.17	18%	21.4	23.6	86%
Trans Nonachlor	1.11 U	1.11 U	1.11 U	NA	1.11 U	1.25 U	1.25 U	NA	1.11 U	NS	NA
4,4'-DDE	0.28 U	0.28 U	0.28 U	NA	0.28 U	2.01	0.31 U	NA	22.3	23.6	94%
Dieldrin	0.13 U	0.13 U	0.13 U	NA	0.13 U	2.80	0.14 U	NA	25.1	23.6	106%
2,4'-DDD	0.94 U	0.94 U	0.94 U	NA	0.94 U	1.06 U	1.06 U	NA	0.94 U	NS	NA
2,4'-DDT	0.44 U	0.44 U	0.44 U	NA	0.44 U	0.49 U	0.49 U	NA	0.44 U	NS	NA
4,4'-DDD	0.45 U	0.45 U	0.45 U	NA	0.45 U	3.74	3.03	NA	30.9	23.6	118%
Endosulfan II	0.46 U	0.46 U	0.46 U	NA	0.46 U	0.52 U	0.52 U	NA	21.3	23.6	90%
4,4'-DDT	0.40 U	0.40 U	0.40 U	NA	0.40 U	0.45 U	0.45 U	NA	31.7	23.6	134% &
Endosulfan Sulfate	0.46 U	0.46 U	0.46 U	NA	0.46 U	0.52 U	0.52 U	NA	16.1	23.6	68%
PCB 8	1.00 U	1.00 U	1.00 U	NA	1.00 U	1.00 U	1.00 U	NA	1.00 U	NS	NA
PCB 18	1.06 U	1.06 U	1.06 U	NA	1.06 U	1.06 U	1.06 U	NA	1.06 U	NS	NA
PCB 28	0.71 U	0.71 U	0.71 U	NA	0.71 U	0.71 U	0.71 U	NA	25.3	30.1	84%
PCB 52	0.35 U	0.35 U	0.35 U	NA	0.48	0.74	0.55	23%	50.2	62.7	79%
PCB 49	0.54 U	0.54 U	0.54 U	NA	0.76	1.04	0.85	16%	0.54 U	NS	NA
PCB 44	0.31 U	0.31 U	0.31 U	NA	0.31 U	0.31 U	0.31 U	NA	0.31 U	NS	NA
PCB 66	0.38 U	0.38 U	0.38 U	NA	0.38 U	0.38 U	0.38 U	NA	0.38 U	NS	NA
PCB 101	0.49 U	0.49 U	0.49 U	NA	0.49 U	1.07	0.92	NA	41.3	45.6	89%
PCB 87	0.36 U	0.36 U	0.36 U	NA	0.36 U	0.36 U	0.36 U	NA	0.36 U	NS	NA
PCB 118	0.47 U	0.47 U	0.47 U	NA	0.47 U	0.47 U	0.47 U	NA	0.47 U	NS	NA
PCB 184	0.54 U	0.54 U	0.54 U	NA	0.54 U	0.54 U	0.54 U	NA	0.54 U	NS	NA
PCB 153	0.39 U	0.39 U	0.39 U	NA	1.01	1.65	1.37	24%	21.7	24.9	82%
PCB 105	0.30 U	0.30 U	0.30 U	NA	0.30 U	0.30 U	0.30 U	NA	0.30 U	NS	NA
PCB 138	0.34 U	0.34 U	0.34 U	NA	1.05	1.47	1.16	18%	17.2	19.2	84%
PCB 187	0.39 U	0.39 U	0.39 U	NA	0.39 U	0.77	0.63	NA	0.79	NS	NA

400494

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

GLENCOVE - Navy

ORGANICS ANALYSIS OF SITEWATER

(CF#911)

MSL Code	GLEN*1	*Dup* GLEN*1	*Trip* GLEN*1		GLEN*2	*Dup* GLEN*2	*Trip* GLEN*2		*(MS)* GLEN*2 + SPK		
Sponsor Code	Site 3	Site 3	Site 3		Site 1&2	Site 1&2	Site 1&2		Site 1&2		
Matrix	Water	Water	Water		Water	Water	Water		Water		
Units	ng/L	ng/L	ng/L	RSD%	ng/L	ng/L	ng/L	RSD%	ng/L	Spike Amount	% Recovery
Batch	1	1	1		1	1	1		1		
PCB 183	0.54 U	0.54 U	0.54 U	NA	0.54 U	0.54 U	0.54 U	NA	0.54 U	NS	NA
PCB 128	0.24 U	0.24 U	0.24 U	NA	0.24 U	0.24 U	0.24 U	NA	0.24 U	NS	NA
PCB 180	0.28 U	0.28 U	0.28 U	NA	1.09	1.48	1.28	15%	1.60	NS	NA
PCB 170	0.20 U	0.20 U	0.20 U	NA	0.20 U	0.20 U	0.20 U	NA	0.20 U	NS	NA
PCB 195	0.27 U	0.27 U	0.27 U	NA	0.27 U	0.27 U	0.27 U	NA	0.27 U	NS	NA
PCB 206	0.39 U	0.39 U	0.39 U	NA	0.39 U	0.39 U	0.39 U	NA	0.39 U	NS	NA
PCB 209	0.28 U	0.28 U	0.28 U	NA	0.28 U	0.28 U	0.28 U	NA	0.28 U	NS	NA
Surrogate Recoveries (%)											
PCB 103 (SIS)	59	55	62		62	61	63		63	**Rep3 used for	
PCB 198 (SIS)	49	51	50		50	50	55		51	spike recovery	

& Outside QC limits
NA Not available/applicable
NS Not spiked
U Not detected at or above the MDL shown

400495

Attachment I

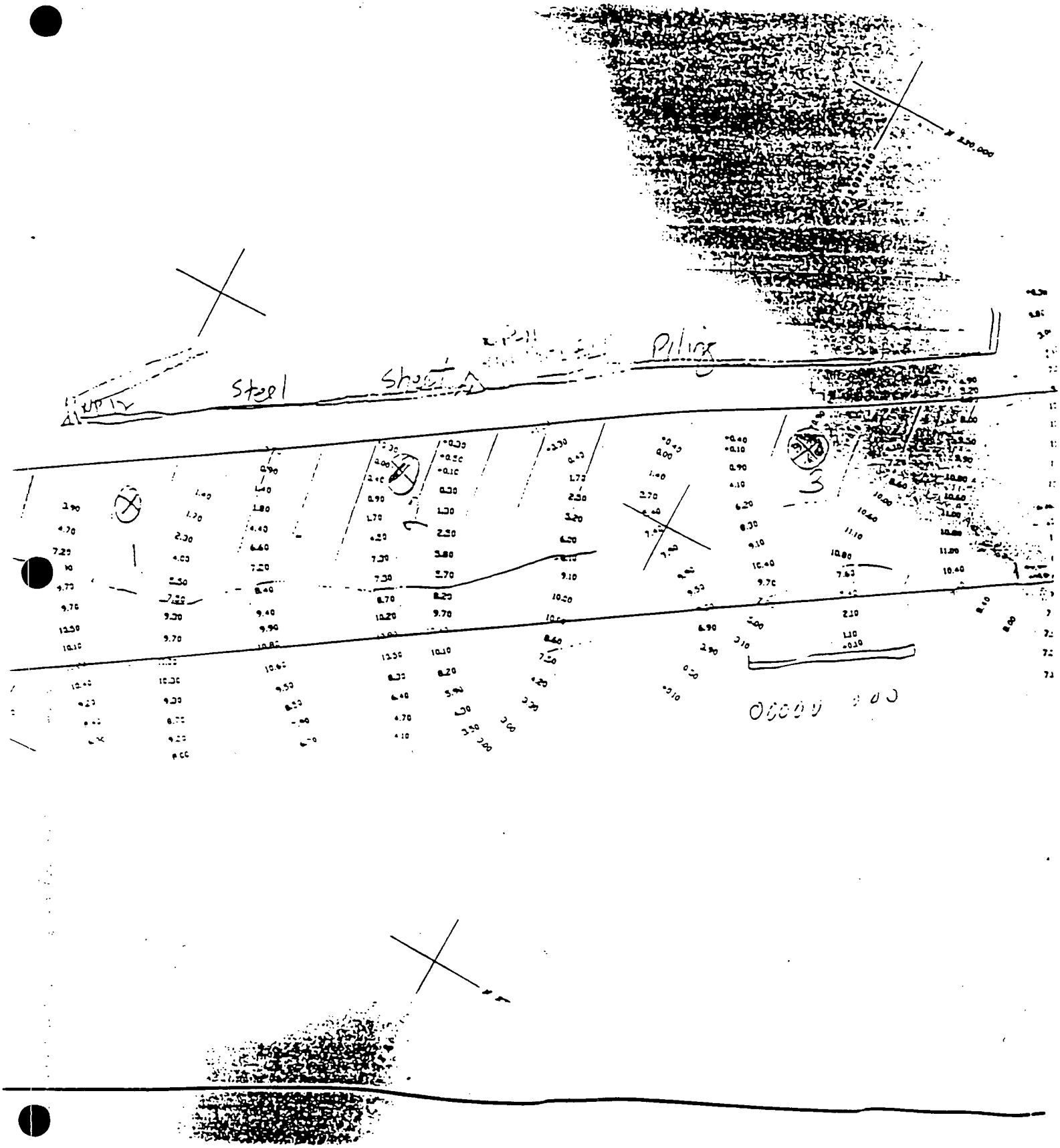
Glen Cove Creek

FP #13

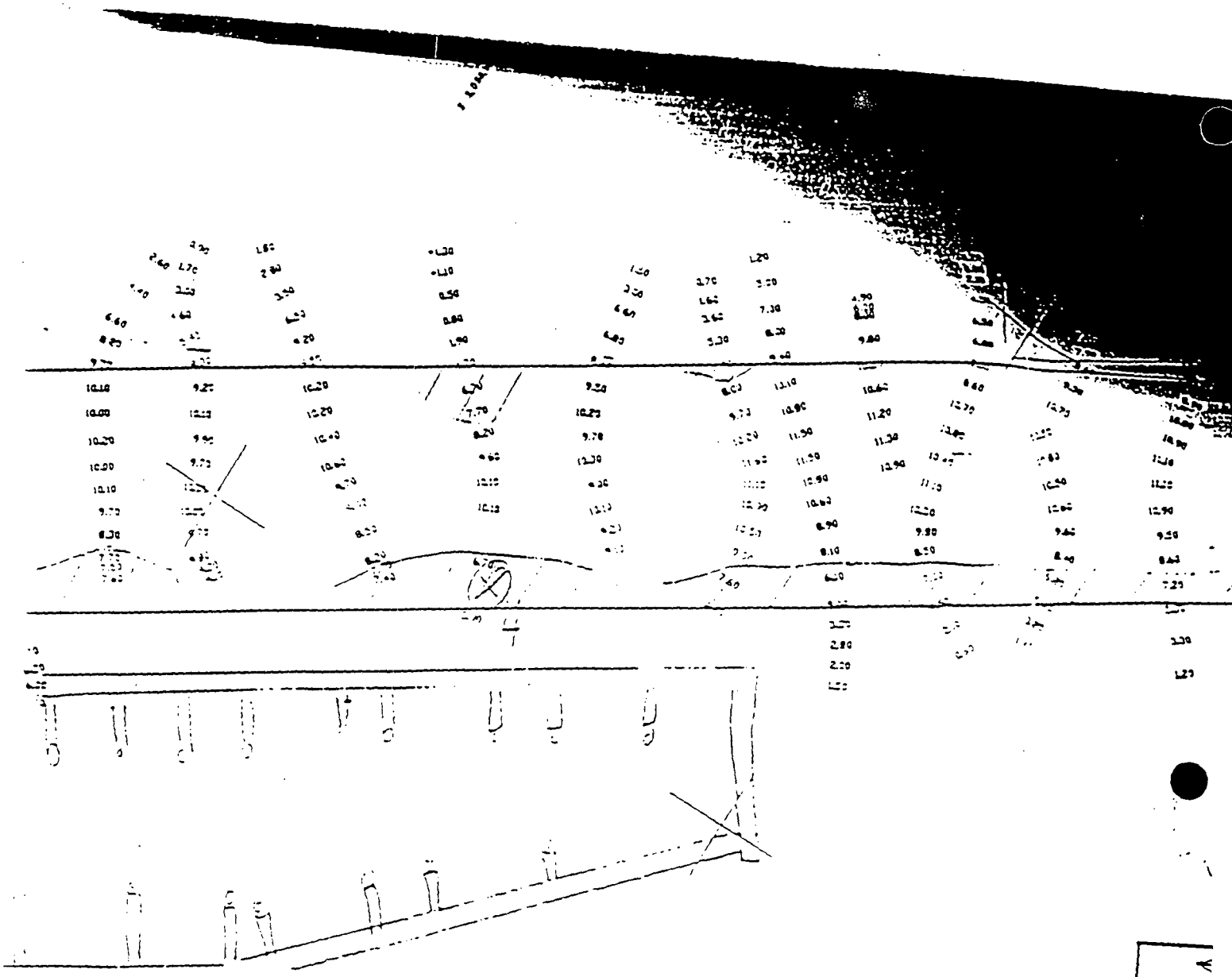
FY 95

project map

400496



400497



hand drawing
1999

proj depth 8+2'
Samples # 1-10

NOTES

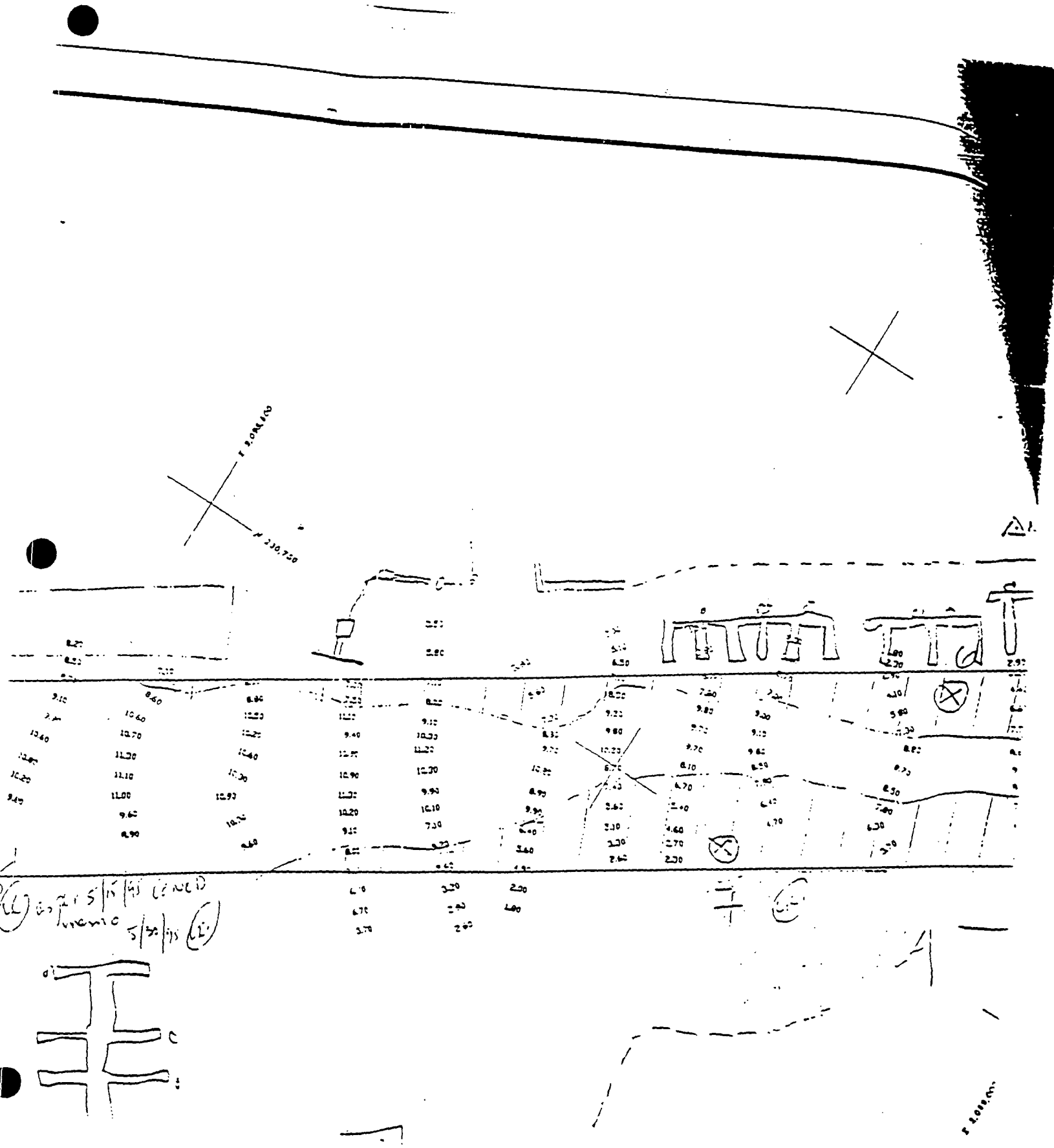
Coordinates are expressed in feet and refer to the LONG ISLAND LAMBERT System

Soundings or Elevations refer to MEAN LOW WATER As determined from

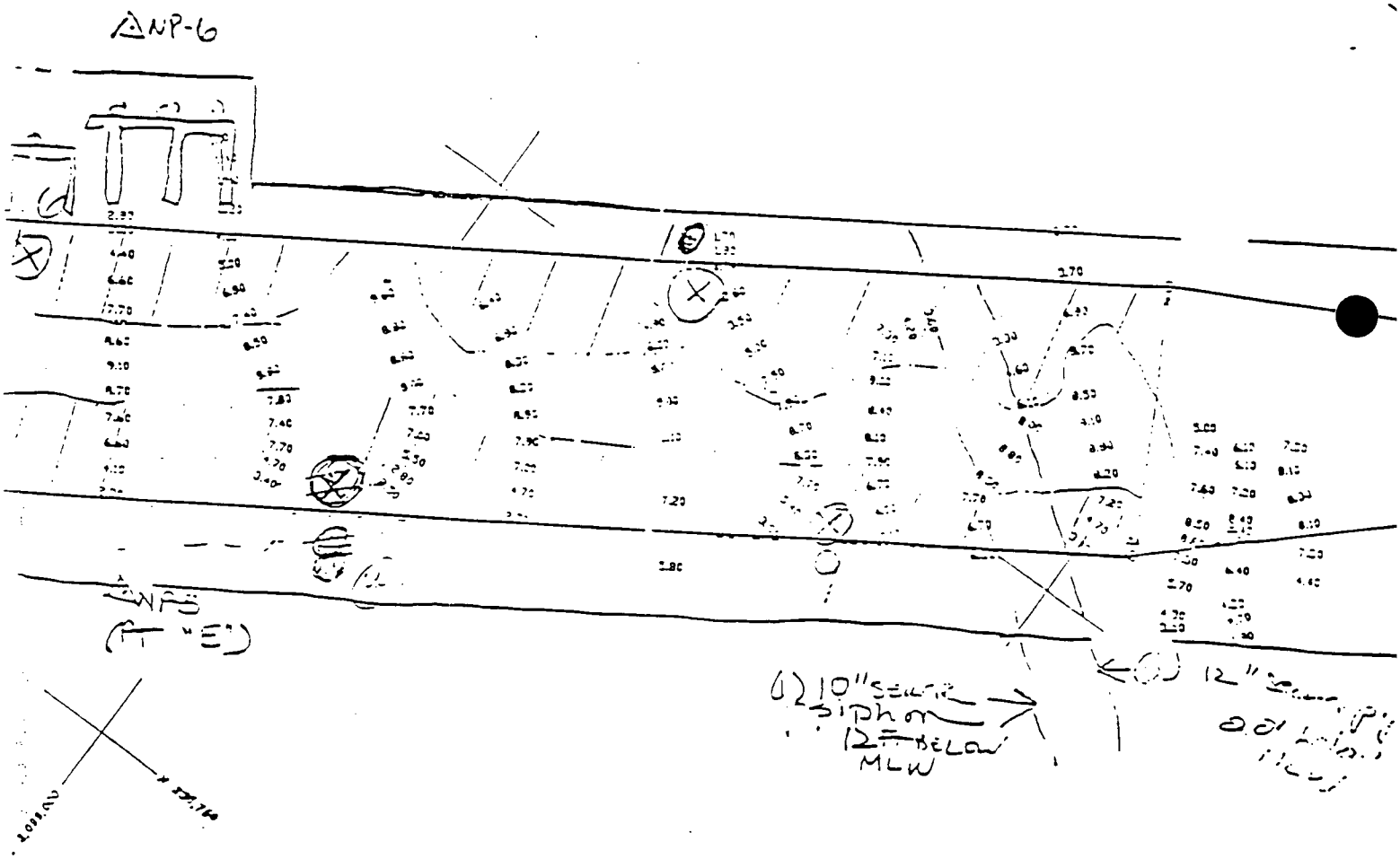
PLOTTE

SUBMIT

400498



400499



400500

Attachment I cont.

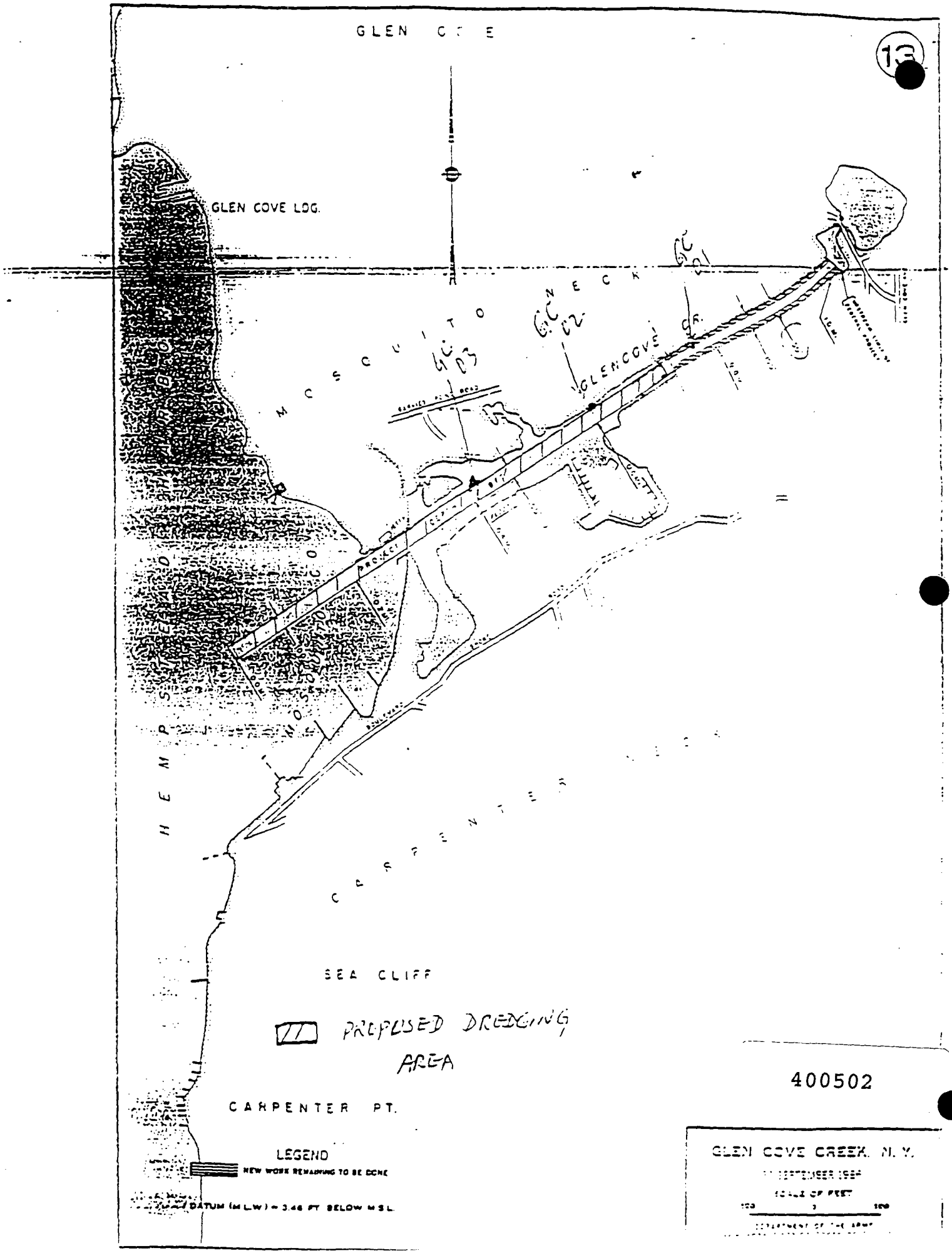
GLEN COVE CREEK

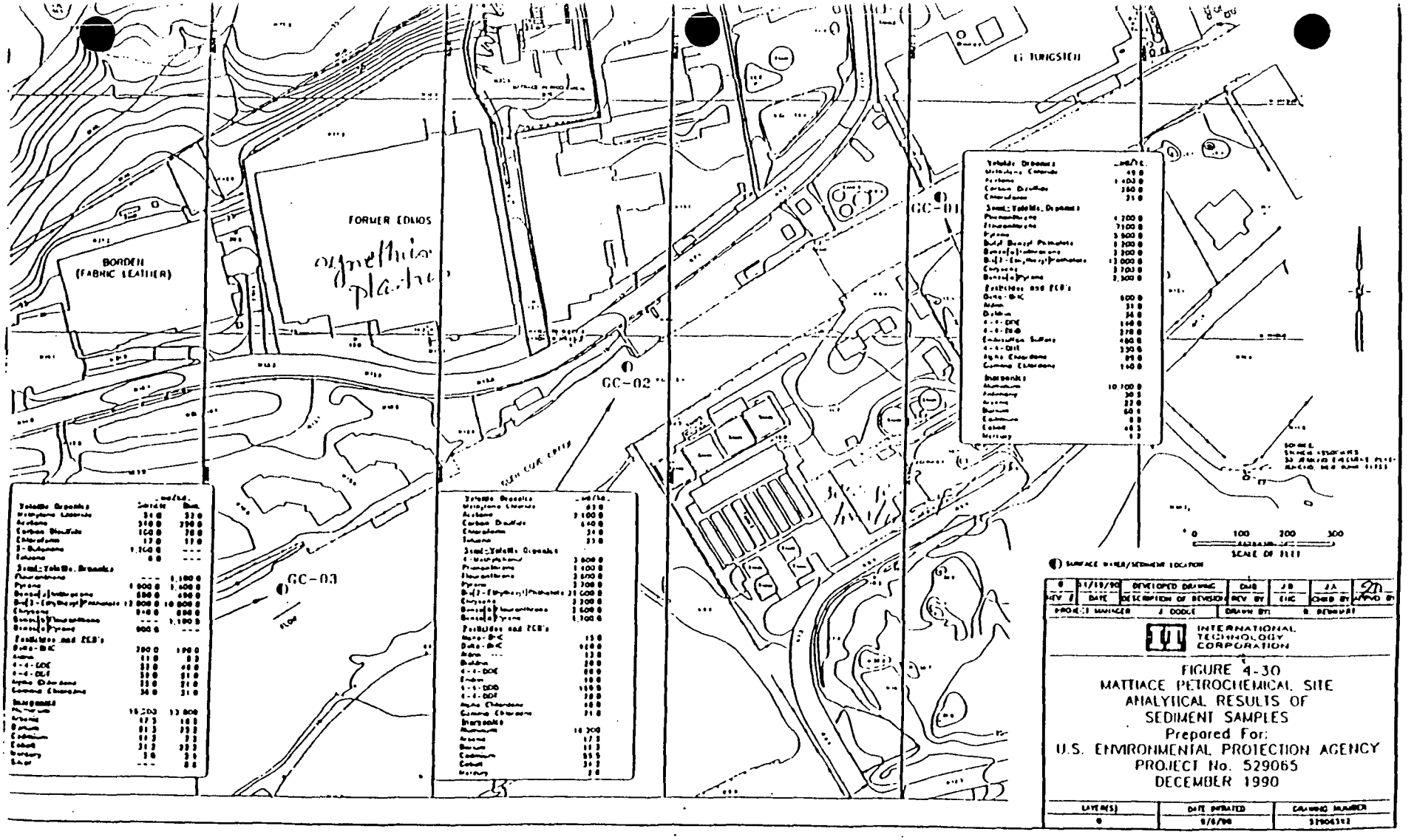
Sample Location	NAD 83 Geographic Coordinates Latitude	Longitude
1	40 51 19.3968 N	73 38 56.0489 W
2	40 51 20.1631 N	73 38 54.6134 W
3	40 51 21.2333 N	73 38 52.3693 W
4	40 51 25.7357 N	73 38 41.6089 W
5	40 51 28.2403 N	73 38 36.7412 W
6	40 51 31.6930 N	73 38 31.6991 W
7	40 51 30.3021 N	73 38 32.4744 W
8	40 51 31.5885 N	73 38 29.8776 W
9	40 51 32.5407 N	73 38 27.8683 W
10	40 51 32.9297 N	73 38 29.0114 W

Revised 6/95

Station 5 relocated
Old station 5 now #7, old #7 now 8, old #8 now 10.

Attachment II





ATTACHMENT II CONT

400503

Roy F. Weston, Inc.
Federal Programs Division
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
908-225-6116 • Fax 908-225-7037

HNICAL ASSESSMENT AND RESPONSE TEAM
W5-0019

)9

ıne
ɔordinator
ımental Protection Agency
ion Branch
ridge Avenue
3837

-99-02-0015
CONTROL NO START-02-F-03531
SAMPLING TRIP REPORT FOR SITE INVESTIGATION SOIL SAMPLES AT THE LI TUNGSTEN SITE, GLEN COVE, NASSAU COUNTY, NEW YORK

e find the Sampling Trip Report for the March 15-17, 1999 sampling event for the
e located in Glen Cove, Nassau County, New York.

questions, do not hesitate to call me at (732) 225-6116.

)N, INC.

A. Romaine

aine

400504

esource Applications, Inc., R.E. Samera Associates, PRC Environmental Management, Inc.,
C. Johnson & Malhotra, P.C., and GRB Environmental Services, Inc.

SAMPLING TRIP REPORT

SITE NAME: Li Tungsten Site: Glen Cove, Nassau County, New York
DCN = START-02-F-03531
TDD = 02-99-02-0015
PCS = 4595

SAMPLING DATE: March 15-17, 1999

1. Site Location: 63 Herbhill Road, Glen Cove, Nassau County, New York. (Refer to Attachment A).

2. Sample Locations: Refer to Attachment B for specific locations.

3. Sample Descriptions: Refer to Table 1

4. Laboratory Receiving Samples:

Sample Type	Name and Address of Laboratory
Soil: TCL/TAL	Severn Trent Laboratories 200 Monroe Turnpike Monroe, CT 06468
Soil: Gamma Spectroscopy/ Alpha Spectroscopy	O'Brien & Gere Laboratories 5000 Brittonfield Parkway East Syracuse, NY 13057

5. Sample Dispatch Data:

The following samples were shipped by Earth Tech personnel via Federal Express to Severn Trent Laboratories on March 16, 1999 at approximately 1730: 30 soil samples for TCL/TAL analysis.

The following samples were shipped by Earth Tech personnel via Airborne Express to O'Brien & Gere Laboratories on March 16, 1999 at approximately 1730: 30 soil samples for gamma spectroscopy analysis and one sample for alpha spectroscopy analysis.

The following samples were shipped by Earth Tech personnel via Federal Express to Severn Trent Laboratories on March 17, 1999 at approximately 1700: 20 soil samples for TCL/TAL analysis.

The following samples were shipped by Earth Tech personnel via Airborne Express to

400505

O'Brien & Gere Laboratories on March 17, 1999 at approximately 1700. 20 soil samples for gamma spectroscopy analysis and six samples for alpha spectroscopy analysis

6 On-Site Personnel:

Name	Company	Duties on Site
Mark Pane	EPA	Task Monitor (TM)
Charles Keegan	ERRS Contractor	Response Manager
David Gushleff	ERRS Contractor	Health & Safety/Sampler
Lloyd Warren	ERRS Contractor	Sampler
Robert Buraer	Zebra Environmental	Geoprobe Operator
Richard Miller	Zebra Environmental	Geoprobe Operator
Luke Caballero	Zebra Environmental	Geoprobe Operator
Kathleen Romaine	Region II START	Sampler/Documentation QA/QC

7. Weather Conditions:

March 15, 1999:	Overnight snowfall produced 6". Mostly cloudy, 40 degrees F, west wind.
March 16, 1999:	Clear, strong west wind, 52 degrees F.
March 17, 1999:	Clear, west wind, 60 degrees F

8. Additional Comments:

A Geoprobe was used to collect all samples. At each sampling location, one-inch diameter steel sampling tubes with dedicated, disposable acetate liners were advanced through the sampling intervals to obtain the necessary sample volumes. At sample locations within a site building, or on a concrete foundation of a former building, a one-inch diameter solid steel rod was used to advance through the 2" to 8" initial concrete layer. The steel rod was removed, and then the steel sampling rods were advanced as described above. Each section of steel tubing was decontaminated with Alconox between sampling locations.

Earth Tech personnel opened each acetate liner and first screened the material with a Ludlum 12 instrument with pancake probe for radiological activity. Then, approximately eight ounces of material was removed from the bottom part of the acetate liner and placed in a dedicated, disposable, aluminum pan. A sample was then collected for TCL VOCs by directly transferring material from the acetate liner to a four-ounce sample jar provided by Severn Trent Laboratories. The remainder of the soil was then transferred to the aluminum pan, homogenized, and placed in one, eight-ounce jar for TCL Semivolatile and TAL Metals analysis, and one, one-quart jar for Gamma Spectroscopy analysis.

All sample locations were field sighted by USEPA OSC Mark Pane. At seven sample locations selected by the OSC, additional volumes were collected for Alpha Spectroscopy analysis to determine levels of Polonium and Lead radioisotopic contamination. At these locations, two adjacent holes were drilled with the Geoprobe to identical depths. After the collection of the TCL VOC sample, the remaining material from both acetate liners was composited, homogenized, placed in the laboratory glassware described above, with an additional one-quart jar for the Alpha

Spectroscopy analysis.

Three blind duplicate samples, A, B, and C, were collected from sample locations 017, 026, and 031 respectively. At each location, double volumes were collected by drilling adjacent holes, as described above. One TCL VOC sample was collected per acetate liner, and the remaining material from both acetate liners was composited, homogenized, and placed in the appropriate glassware.

No radiological readings above background were observed on the Ludlum 12 instrument.

The chain of custody records are included as Attachment C.

All analytical results have been received from the laboratory by Earth Tech, Inc. The results have been validated and summarized by Earth Tech, Inc. personnel, and have been included as Attachment D to this report.

9. Report Prepared by: Kathleen Romaine Date:

Noblet for K. Romaine 5/18/99

10. Report Reviewed by: Tamre Noblet Date:

Tam Noblet 5/18/99

400507

TABLE 1
SAMPLE DESCRIPTIONS
LI TUNGSTEN SITE
GLEN COVE, NEW YORK

Sample ID	Date/ Time	Matrix	Analysis	Sample Depth	Remarks
01	03/15/99 1500	Soil	TCL/TAL Gamma Spec.	4-8 feet	Sandy Soil
02	03/15/99 1500	Soil	TCL/TAL Gamma Spec.	4-8 feet	Sandy Soil
03	03/15/99 1500	Soil	TCL/TAL Gamma Spec.	4-8 feet	Clay Soil
04	03/15/99 1500	Soil	TCL/TAL Gamma Spec.	4-8 feet	Clay Soil
05	03/15/99 1515	Soil	TCL/TAL Gamma Spec.	4-8 feet	
06	03/15/99 1515	Soil	TCL/TAL Gamma Spec.	4-8 feet	
07	03/15/99 1515	Soil	TCL/TAL Gamma Spec.	4-8 feet	Clay Soil
08	03/15/99 1605	Soil	TCL/TAL Gamma Spec.	4-8 feet	
09	03/15/99 1605	Soil	TCL/TAL Gamma Spec.	0-4 feet	
010	03/15/99 1630	Soil	TCL/TAL Gamma Spec.	0-4 feet	
011	03/15/99 1645	Soil	TCL/TAL Gamma Spec.	4-8 feet	Strong Fuel Odor
012	03/15/99 1700	Soil	TCL/TAL Gamma Spec.	4-8 feet	
013	03/15/99 1730	Soil	TCL/TAL Gamma Spec.	4-8 feet	

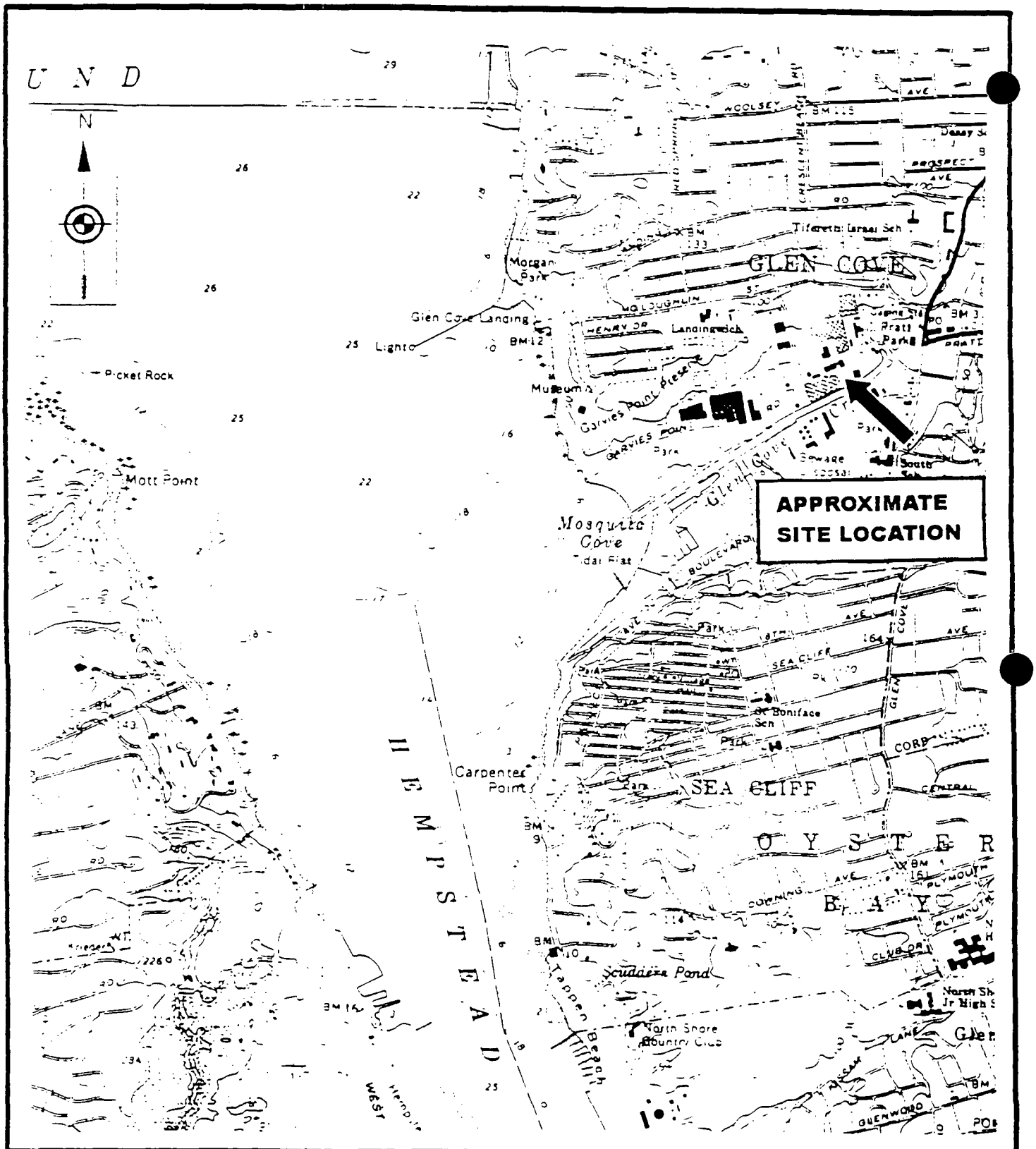
Sample ID	Date/ Time	Matrix	Analysis	Sample Depth	Remarks
014	03/15/99 1545	Soil	TCL/TAL Gamma Spec.	4-8 feet	
015	03/15/99 1600	Soil	TCL/TAL Gamma Spec.	4-8 feet	
016	03/16/99 0850	Soil	TCL/TAL Gamma Spec.	4-8 feet	
017 (MS/MSD)	03/16/99 0810	Soil	TCL/TAL Gamma Spec.	4-8 feet	
018	03/16/99 0810	Soil	TCL/TAL Gamma Spec.	8-12 feet	
019	03/16/99 0915	Soil	TCL/TAL Gamma Spec.	4-8 feet	
020	03/16/99 0930	Soil	TCL/TAL Gamma Spec.	4-8 feet	
021	03/16/99 1100	Soil	TCL/TAL Gamma Spec.	0-4 feet	
022	03/16/99 1010	Soil	TCL/TAL Gamma Spec.	0-4 feet	
023	03/16/99 1115	Soil	TCL/TAL Gamma Spec.	4-8 feet	Strong fuel odor
023A	03/16/99 1115	Soil	Alpha Spec.	4-8 feet	Strong fuel odor
024	03/16/99 1140	Soil	TCL/TAL Gamma Spec.	8-12 feet	
025	03/16/99 1440	Soil	TCL/TAL Gamma Spec.	4-8 feet	
026	03/16/99 1530	Soil	TCL/TAL Gamma Spec.	8-12 feet	
026A	03/16/99 1530	Soil	Alpha Spec.	8-12 feet	
027	03/16/99 1605	Soil	TCL/TAL Gamma Spec.	0-12 feet	
028	03/16/99 1655	Soil	TCL/TAL Gamma Spec.	0-8 feet	

Sample ID	Date/ Time	Matrix	Analysis	Sample Depth	Remarks
029 (MS/MSD)	03/16/99 1720	Soil	TCL/TAL Gamma Spec.	0-8 feet	
030	03/17/99 0740	Soil	TCL/TAL Gamma Spec.	0-4 feet	
031	03/17/99 0755	Soil	TCL/TAL Gamma Spec.	0-4 feet	Very rocky soil
031A	03/17/99 0755	Soil	Alpha Spec.	0-4 feet	Very rocky soil
032	03/17/99 0810	Soil	TCL/TAL Gamma Spec.	0-4 feet	
032A	03/17/99 0810	Soil	Alpha Spec.	0-4 feet	
033	03/17/99 0830	Soil	TCL/TAL Gamma Spec.	0-4 feet	Sandy Soil
033A	03/17/99 0830	Soil	Alpha Spec.	0-4 feet	Sandy Soil
034	03/17/99 0840	Soil	TCL/TAL Gamma Spec.	0-4 feet	Sandy Soil
034A	03/17/99 0840	Soil	Alpha Spec.	0-4 feet	Sandy Soil
035	03/17/99 0850	Soil	TCL/TAL Gamma Spec.	0-5 feet	Clay Soil
036	03/17/99 0910	Soil	TCL/TAL Gamma Spec.	0-4 feet	Sandy soil with rocks
037	03/17/99 0930	Soil	TCL/TAL Gamma Spec.	0-4 feet	Sandy Soil
038	03/17/99 0930	Soil	TCL/TAL Gamma Spec.	0-4 feet	Sandy soil with rocks
039	03/17/99 0950	Soil	TCL/TAL Gamma Spec.	0-4 feet	Clay soil
040	03/17/99 1010	Soil	TCL/TAL Gamma Spec.	0-4 feet	
040A	03/17/99 1010	Soil	Alpha Spec.	0-4 feet	

Sample ID	Date/ Time	Matrix	Analysis	Sample Depth	Remarks
041 (MS/MSD)	03/17/99 105[illegible]	Soil	TCL/TAL Gamma Spec.	4-8 feet	Clay, sand, brick
042	03/17/99 1200	Soil	TCL/TAL Gamma Spec.	0-8 feet	Clay, sand
043	03/17/99 1215	Soil	TCL/TAL Gamma Spec.	0-8 feet	Clay, sand
044	03/17/99 1225	Soil	TCL/TAL Gamma Spec.	0-8 feet	Clay, sand
A	03/16/99 0810	Soil	TCL/TAL Gamma Spec.	4-8 feet	Blind Duplicate of 017
B	03/16/99 1530	Soil	TCL/TAL Gamma Spec.	8-12 feet	Blind Duplicate of 026
C	03/17/99 0755	Soil	TCL/TAL Alpha Spec.	0-4 feet	Blind Duplicate of 031

ATTACHMENT A

SITE MAP

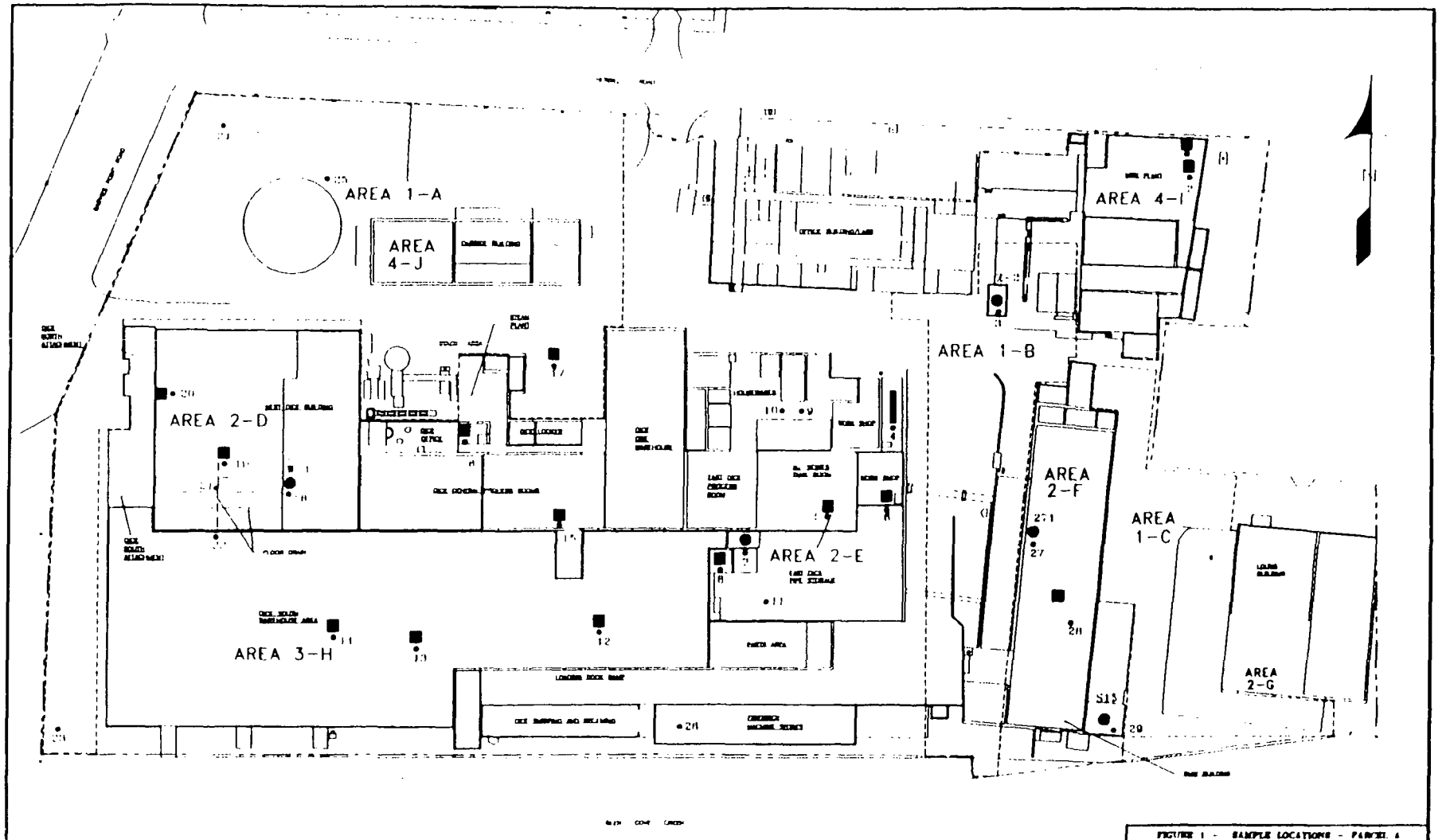


WESTON MANAGERS DESIGNERS/CONSULTANTS **Roy F. Weston, Inc.** **FEDERAL PROGRAMS DIVISION**	TITLE: Figure 1 Site Location Map	SITE NAME, LOCATION: LI TUNGSTEN Glen Cove, N.Y.
IN ASSOCIATION WITH RESOURCE APPLICATION, Inc. C.C. JOHNSON & MALHOTRA, P.C., R.E. SARRIERA ASSOCIATES, PRC ENVIRONMENTAL MANAGEMENT, AND GRB ENVIRONMENTAL SERVICES, INC.	SOURCE: USGS Topographic Map Sea Cliff, N.Y.	PREPARED BY: K. Romaine Region II START April 1999

400513

ATTACHMENT B

SAMPLE LOCATION MAPS



LEGEND

- COVERED OR SHUTTLED SAMPLE TANKS
- UNDERGROUND TANKS
- SAMPLE LOCATIONS

DRAWING ADOPTED FROM FRED C. HART ASSOCIATES INTERIM REMEDIAL ACTION REPORT - 1990

WESTON Roy F. Weston, Inc.
FEDERAL PROGRAMS DIVISION

IN ASSOCIATION WITH PRC ENVIRONMENTAL MANAGEMENT, INC.,
C.C. JOHNSON & MALHOTRA, P.C., RESOURCE APPLICATIONS, INC.
R.E. SARRERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

FIGURE 1 - SAMPLE LOCATIONS - PARCEL A
LJ TUNGSTEN SITE
GLEN COVE, NEW YORK
MARCH 1990

US EPA REMOVAL ACTION BRANCH

DRAWN BY: J. HAMPTON JR.
EPA TASK MONITOR: M. PANE
START PROJECT MANAGER: D. RONANE

D:\CADFILE\ 4884.DWG

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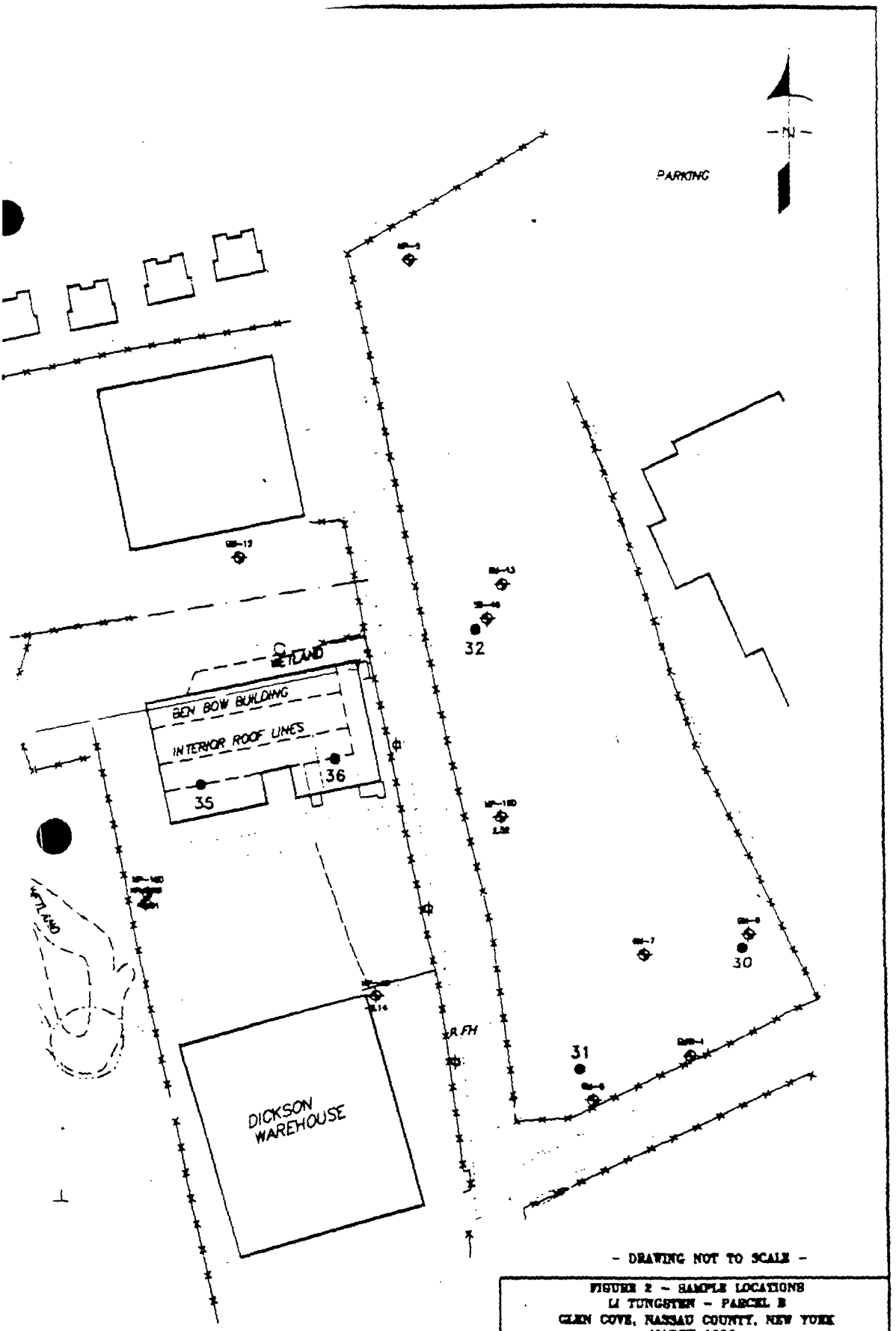

- DRAWING NOT TO SCALE -

FIGURE 2 - SAMPLE LOCATIONS
LI TUNGSTEN - PARCEL B
GLEN COVE, NASSAU COUNTY, NEW YORK
MARCH 1999

US EPA REMOVAL ACTION BRANCH

Roy F. Weston, Inc.
FEDERAL PROGRAMS DIVISION

IN ASSOCIATION WITH PRC ENVIRONMENTAL MANAGEMENT, INC., C.C. JOHNSON & MALHOTRA, P.C., RESOURCE APPLICATIONS, INC., R.E. SANDERS ASSOCIATES, AND GEO ENVIRONMENTAL SERVICES, INC.

REVISED BY: J. HAMPTON JR.
EPA TASK MONITOR: M. PAINE
START PROJECT MANAGER: K. ROMAINE

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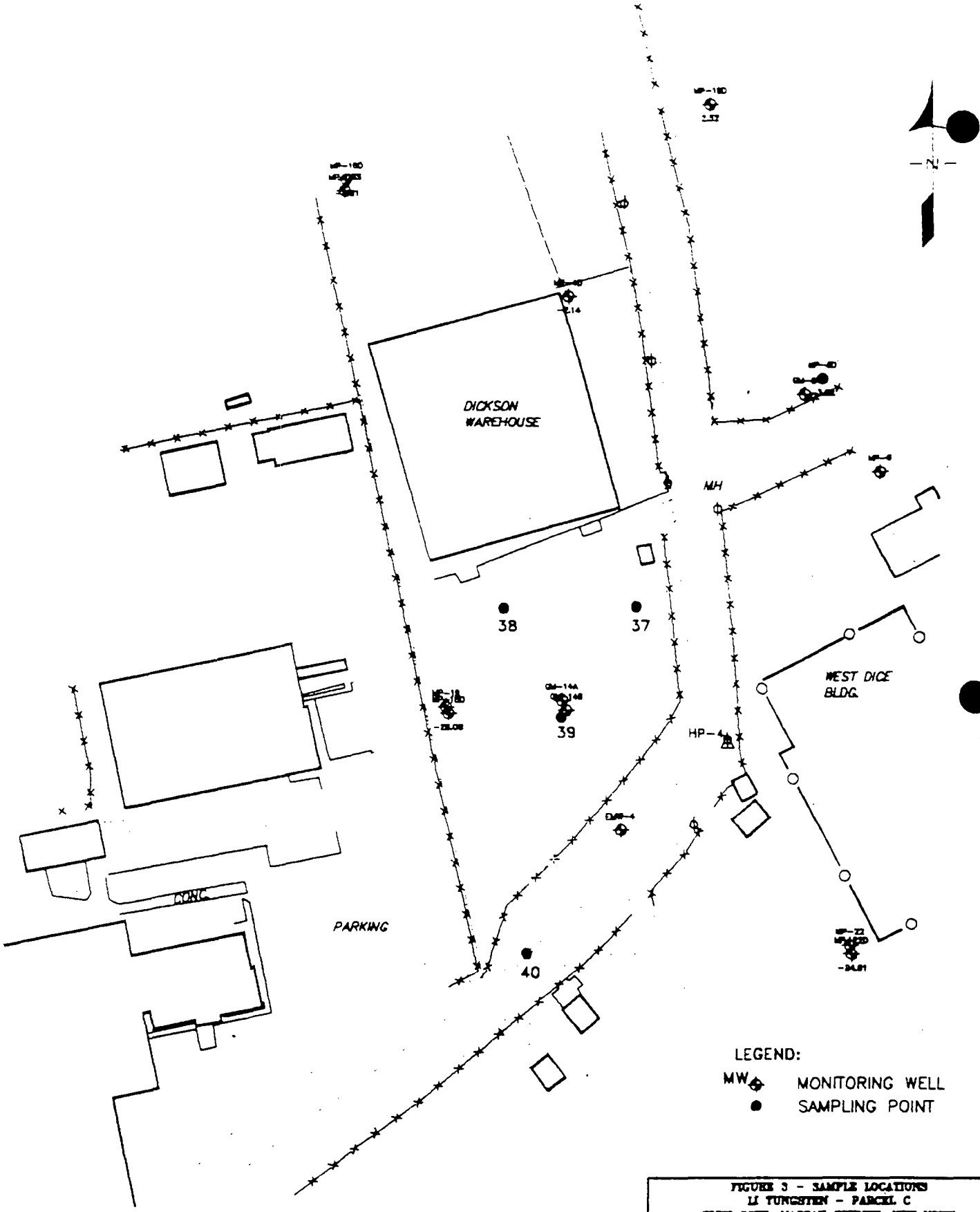


- DRAWING NOT TO SCALE -

FIGURE 3 - SAMPLE LOCATIONS
LI TUNGSTEN - PARCEL C
GLEN COVE, NASSAU COUNTY, NEW YORK
MARCH 1999

US EPA REMOVAL ACTION BRANCH

MALCOLM PIRNIE

LOCATION PLAN
MONITORING WELLS & SAMPLING POINTS
MATTIACE PETROCHEMICAL SITE
GLEN COVE, NASSAU COUNTY, NEW YORK

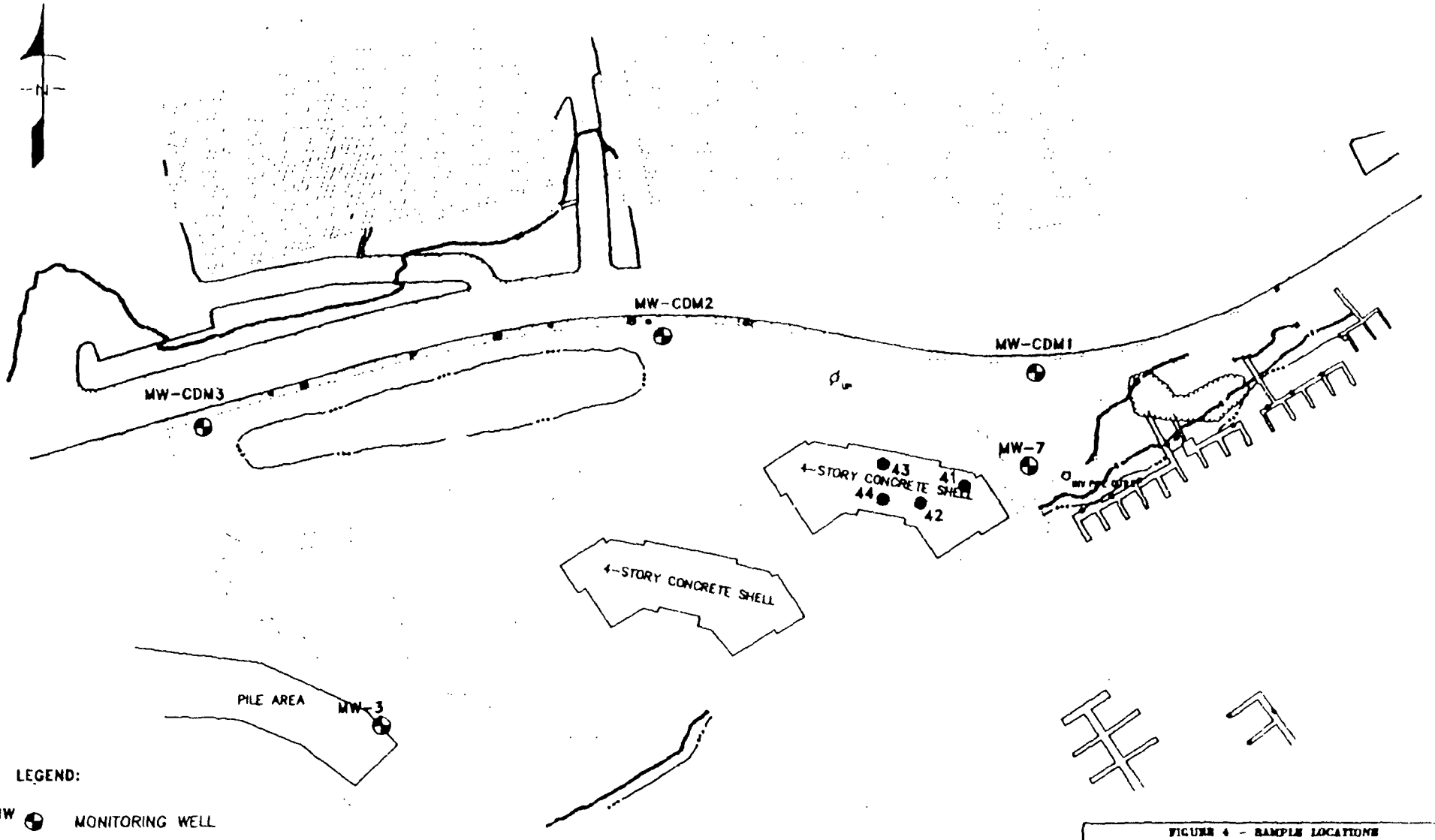
WESTON

Roy F. Weston, Inc.
FEDERAL PROGRAMS DIVISION

IN ASSOCIATION WITH PRC ENVIRONMENTAL MANAGEMENT, INC.,
C.C. JOHNSON & MALHOTRA, P.C., RESOURCE APPLICATIONS, INC.,
R.E. SARRERA ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

REVISED BY : J. HAMPTON JR.
EPA TASK MONITOR: M. PANE
START PROJECT MANAGER: E. ROMAINE

400517



LEGEND:

MW MONITORING WELL

SAMPLING POINT

FIGURE 4 - SAMPLE LOCATIONS
LI TUNGSTEN - CAPTAIN'S COVE
GLEN COVE, NASSAU COUNTY, NEW YORK
MARCH 1999
US EPA REMOVAL ACTION BRANCH

MALCOLM PIRNIE

LOCATION PLAN
MONITORING WELLS & SAMPLING POINTS
NATTIACE PETROCHEMICAL SITE
GLEN COVE, NASSAU COUNTY, NEW YORK

WESTON Roy F. Weston, Inc.
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IN ASSOCIATION WITH PRC ENVIRONMENTAL MANAGEMENT, INC., C.C. JOHNSON & MALHOTRA, P.C., RESOURCE APPLICATIONS, INC., R.E. SARGENT ASSOCIATES, AND GRB ENVIRONMENTAL SERVICES, INC.

REVISED BY: J. HAMPTON JR.
EPA TASK MONITOR: M. PANE
START PROJECT MANAGER: K. ROMANE

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400518

ATTACHMENT C

CHAIN OF CUSTODY RECORD

CHAIN OF CUSTODY RECORD

PAGE ___ OF ___

nitted To Your Success

JOB #

CLIENT: EARTH TECH

PROJECT ID: ELDORADO-TORRESTER

PROJECT MGR: PAUL ROBERT

RUSH: | YES | | NO | DUE DATE:

TESTS

GENERAL REMARKS

BOTTLE TYPE AND PRESERVATION

FIELD FILTERED - CIRCLE Y or N

LE #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	SAMPLE REMARKS
	01	3/15/99 1500	SO		N									
	02	3/15/99 1500	SO		N									
	03	3/15/99 1500	SO		N									
	04	3/15/99 1500	SO		N									
	05	3/15/99 1515	SO		N									
	06	3/15/99 1515	SO		N									
	07	3/15/99 1515	SO		N									
	08	3/15/99 1605	SO		N									
	09	3/15/99 1605	SO		N									
	010	3/15/99 1630	SO		N									

400520

MATRIX CODES

AIR	S	SOIL
AQUEOUS	SL	SLUDGE
COMPLEX	W	WIPE
DRUM WASTE	O	OTHER
OIL	FB	FIELD BLANK
	TB	TRIP BLANK

BOTTLES PREPARED BY — DATE / TIME 3/12 1515
SIGNATURE

SAMPLES COLLECTED BY — DATE / TIME 3/16/99 1440
C. MEEGAN
SIGNATURE

BOTTLES REC'D BY — DATE / TIME
SIGNATURE

RECEIVED IN LAB BY — DATE / TIME
SIGNATURE

RECEIVED SAMPLE RECEIPT

CLIENT COPY

Committed To Your Success

TESTS

SAMPLE REMARKS

TL JOB #

CLIENT: EARTH TECH

PROJECT ID: E12079-TUNGSTEN

TL PROJECT MGR: PAUL HOBART

RUSH | YES | NO | DUE DATE

BOTTLE TYPE AND PRESERVATION

FIELD FILTERED - CIRCLE Y or N

BOTTLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N			SAMPLE REMARKS
11	011	3/15/99 1645	SO		N	1	1	
12	012	3/15/99 1700	SO		N	1		
13	013	3/15/99 1730	SO		N	1	1	
14	014	3/15/99 1815	SO		N	1	1	
15	015	3/15/99 1600	SO		N	1		
16	016	3/16/99 0850	SO	3/15/99 1630	N	1	1	
17	017	3/16/99 0800	SO		N	1		
18	018	3/16/99 0810	SO		N	1		
19	019	3/16/99 0915	SO		N	1		
20	017 MS/MSD	3/16/99 0810	SO		N	1	1	

MATRIX CODES

- A - AIR
- AQ - AQUEOUS
- C - COMPLEX
- D - DRUM WASTE
- OIL
- S - SOIL
- SL - SLUDGE
- W - WIPE
- O - OTHER
- FB - FIELD BLANK
- TB - TRIP BLANK

BOTTLES PREPARED BY — DATE / TIME: 3/12/99 1000

SIGNATURE: [signature]

SAMPLES COLLECTED BY: C. KEEGAN — DATE / TIME: 3/16/99 / 1140

SIGNATURE: [signature]

BOTTLES REC'D BY — DATE TIME

SIGNATURE

RECEIVED IN LAB BY — DATE TIME

SIGNATURE

REMARKS ON SAMPLE RECEIPT

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STL JOB #

CLIENT: EARTH TECH

PROJECT ID: E12079-TUNGSTEN

STL PROJECT MGR.: PAUL MOGAFE

RUSH | YES | NO | DUE DATE

TESTS

GENERAL REMARKS

BOTTLE TYPE AND PRESERVATION

BOTTLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	FIELD FILTERED - CIRCLE Y or N								SAMPLE REMARKS
						Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y	N	
21	A	3/16/99 1300	SO		N	1								
22	020	3/16/99 0930	SO		N	1	1							
23	021	3/16/99 1100	SO		N	1	1							
24	022	3/16/99 1010	SO		N	1	1							
25	023	3/16/99 1115	SO		N	1	1							
26	024	3/16/99 1110	SO		N	1								
27	025	3/16/99 1449	SO		N	1	1							
28	026	3/16/99 1515	SO		N	1	1							
29	027	3/16/99 1605	SO		N	1	1							
30	B	3/16/99 1700	SO		N	1	1							

MATRIX CODES

A	AIR	S	SOIL
AQ	AQUEOUS	SL	SLUDGE
C	COMPLEX	W	WIPE
D	DRUM WASTE	O	OTHER
OI	OIL	FB	FIELD BLANK
		TB	TRIP BLANK

BOTTLES PREPARED BY	DATE / TIME	BOTTLES REC'D BY	DATE / TIME
SIGNATURE	3/12/99 1000	SIGNATURE	
SAMPLES COLLECTED BY	DATE / TIME	RECEIVED IN LAB BY	DATE / TIME
J. FEGAN	3/16/99 1730		
SIGNATURE		SIGNATURE	

REMARKS ON SAMPLE RECEIPT

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TO RE-ORDER CALL THE GRAPHIC DESIGN GROUP, INC. 516-243-1082

400522

Severn Trent Laboratories
200 Monroe Turnpike
Monroe, CT 06468
Tel (203) 261-3700
Fax (203) 261-5346

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CHAIN CUSTODY RECORD

PAGE 4 OF 10

JOB #

CLIENT: EARTH TECH

PROJECT ID: EE070-TUNGSTEN

STL PROJECT MGR: PAUL HOBART

RUSH | YES | NO | DUE DATE

TESTS: MET-TAL, GRA-TSS, VOA-TCL

BOTTLE TYPE AND PRESERVATION: GL-50, SEPTA00

FIELD FILTERED - CIRCLE Y or N

GENERAL REMARKS

TITLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	SAMPLE REMARKS
31	028	3/16/99 1655	SO		N	1	1							
32	029	3/16/99 1700	SO		N	1	1							
33	029 MS/MSD	3/16/99 1700	SO		N	1	1							
34	030	3/17 0740	SO		N	1	1							
35	031	3/17 0755	SO		N	1	1							
36	C	3/17 1100	SO		N	1	1							
37	032	3/17 0810	SO		N	1	1							
38	033	3/17 0830	SO		N	1	1							
39	034	3/17 0840	SO		N	1	1							
40	035	3/17 0850	SO		N	1	1							

400523

MATRIX CODES

- AIR
- AQUEOUS
- COMPLEX
- DRUM WASTE
- OIL
- S - SOIL
- SL - SLUDGE
- W - WIPE
- O - OTHER
- FB - FIELD BLANK
- TB - TRIP BLANK

BOTTLES PREPARED BY — DATE / TIME: 3/12/99 1000 — SIGNATURE: [signature]

SAMPLES COLLECTED BY: [illegible] — DATE / TIME: 3/17 1100 — SIGNATURE: [signature]

BOTTLES REC'D BY — DATE / TIME — SIGNATURE

RECEIVED IN LAB BY — DATE / TIME — SIGNATURE

REMARKS ON SAMPLE RECEIPT

- BOTTLES INTACT
- [illegible]
- [illegible]
- [illegible]
- SAMPLES

Severn Trent Laboratories
[illegible]
[illegible]
Tel (208) [illegible]
Fax (208) [illegible]

...ited To Your Success

CHAIN OF CUSTODY RECORD

PAGE OF NO

JOB #

CO EARTH TECH

PROJECT ID E12070-TUNGSTEN

PROJECT MGR PAUL HOBART

RUSH | | YES | | NO | DUE DATE

TESTS: MET-TAL ; BNA-TCL ; VOA TCL

BOTTLE TYPE AND PRESERVATION: GLASS ; PLASTIC

FIELD FILTERED - CIRCLE Y or N

CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	SAMPLE REMARKS
036	3/17 0910	SO		N	1	1							
037	3/17 0930	SO		N	1	1							
038	3/17 0940	SO		N	1	1							
039	3/17 0950	SO		N	1	1							
040	3/17 1010	SO		N	1	1							
041	3/17 1050	SO		N	1	1							
041 MS/MSD	3/17 1050	SO		N	1	1							
042	3/17 1200	SO		N	1	1							
043	3/17 1215	SO		N	1	1							
044	3/17 1225	SO		N	1	1							

GENERAL REMARKS

400524

MATRIX CODES

...R	S	SOIL
...EOUS	SL	SLUDGE
...MPLEX	W	WIPE
...DM WASTE	O	OTHER
	FB	FIELD BLANK
	TB	TRIP BLANK

BOTTLES PREPARED BY — DATE / TIME 3/12/98 1000
SIGNATURE [illegible]

SAMPLES COLLECTED BY [illegible] — DATE / TIME 3/17 1700
SIGNATURE [illegible]

BOTTLES REC'D BY — DATE / TIME
SIGNATURE

RECEIVED IN LAB BY — DATE / TIME
SIGNATURE

REMARKS ON SAMPLE RECEIPT

[ ] [illegible]
[ ] [illegible]
[ ] [illegible]

Sampled by: [illegible]

Client Contact: [illegible] Phone #: [illegible]

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp or Grab	Containers	Cyanide Chlorinated Hydrocarbons							Comments
01	3/15	1500	S	C	1	+							
02	3/15	1500	S	C	1	+							
03	3/15	1500	S	C	1	+							
04	3/15	1500	S	C	1	+							
05	3/15	1500	S	C	1	+							
06	3/15	1500	S	C	1	+							
07	3/15	1500	S	C	1	+							
08	3/15	1500	S	C	1	+							
09	3/15	1500	S	C	1	+							
010	3/15		S	C	1	+							
011	3/15	1530	S	C	1	+							
012	3/15	1530	S	C	1	+							

Relinquished by: [illegible]	Date: [illegible]	Time: [illegible]	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by Lab:	Date:	Time
Shipment Method: [illegible]			Airbill Number:		

Turnaround Time Required:

Routine_____

Rush (Specify)_____

Comments:

Cooler Temperature:

400525

O'B. n & Gere Laboratories, Inc.

50 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain Custody

Client: EARTH TECH
Project: Li TUNGSTEN
Sampled by: C. REEGAN
Client Contact: Dawn LEWIS Phone # 804/[illegible]

Sample Description

Analysis/Method: GAMMA SPECTROMETRY

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	GAMMA SPECTROMETRY	Comments
		1706		C	1	X	
013	3/15	1535	SS	C	1	X	
014	3/15	1515	S	C	1	X	
015	3/15	1600	S	C	1	X	
~~016~~	~~3/15~~	~~0850~~	~~S~~	~~C~~	~~1~~	~~X~~	
~~017~~	~~3/16~~	~~0810~~	~~S~~	~~C~~	~~1~~	~~X~~	
018	3/16	0810	S	C	1	X	
012	3/15	1700	S	C	1	X	
019	3/16	0900	S	C	1	X	

Relinquished by: C. REEGAN	Date: 3/16/99 Time: 1120	Received by:	Date: Time:
Relinquished by:	Date: Time:	Received by:	Date Time
Relinquished by:	Date: Time:	Received by Lab:	Date. Time
Shipment Method: Air Bonne		Airbill Number:	

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

Cooler Temperature:_____

400526

Original Laboratory Copy Client

O'B n & Gere Laboratories, Inc.

50 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain Custody

Client: EARTH TECH
Project: CI TUNGSTEN
Sampled by: C. FLEEGAN
Client Contact: Chuck Elkins Phone # 101/216 2705

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Gamma Spectrometry	Plus Spectrometry						Comments
017	3/16	0810	S	C	1	X							
017 MS/MSD	3/16	0810	S	C	1	X							
020	3/16	0930	S	C	1	X							
021	3/16	1100	S	C	1	X							
022	3/16	1010	S	C	1	X							
A	3/16	1300	S	C	1	X							
023	3/16	1115	S	C	1	X	X						
023A	3/16	1115	S	C	1		X						
024	3/16	1140	S	C	1	X							
025	3/16	1000	S	C	1	X							
026	3/16	1530	S	C	1	X							
026A	3/16	1530	S	C	1		X						

Relinquished by: C. FLEEGAN	Date: 3/16/99 Time: 1605	Received by:	Date: Time:
Relinquished by:	Date: Time:	Received by:	Date Time
Relinquished by:	Date: Time:	Received by Lab:	Date Time
Shipment Method: Air Donne		Airbill Number:	

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

Cooler Temperature:_____

400527

Original Laboratory Copy Client

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client: EARTH TECH
Project: Ci TUNGSTEN
Sampled by: C. REEGAN
Client Contact: LEON BLEVINS Phone #304/346 3705

Analysis/Method: GAMMA SPECTROMETRY

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Comments
B	3/16	1700	S	C	1	

Relinquished by: C. REEGAN	Date: 3/16	Time: 1730	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date	Time
Relinquished by:	Date:	Time:	Received by Lab:	Date	Time
Shipment Method:			Airbill Number:		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

Cooler Temperature:_____

400528

Original Laboratory Copy Client

Earth Tech
2229 Tomlynn Street
Richmond, Virginia 23230
(804) 358-5400

№ 0705

CHAIN OF CUSTODY RECORD

PROJ. NO. 34215 | PROJECT NAME Li Tungsten

SAMPLERS: (Signature) C. Reegan

STA. NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	Gamma Spectrometry	Alpha Spectrometry						REMARKS
027	3/16	1605	X		027	1	X							
028	3/16	1655	X		028	1	X							
029	3/16	1720	X		029	1	X							
029MS/MSD	3/16	1720	X		029 MS/MSD	1	X							
030	3/17	0740	X		030	1	X							
031	3/17	0755	X		031	1	X							
031A	3/17	0755	X		031A	1		X						
C	3/17	1100	X		C	1		X						
032	3/17	0810	X		032	1	X							
032A	3/17	0810	X		032A	1		X						
033	3/17	0830	X		033	1	X							
033A	3/17	0830	X		033A	1		X						

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
C. Reegan C. Reegan	3/17 1230				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

400529

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client: EARTH TECH

Project: Li TUNGSTEN

Sampled by: C. MEEGAN

Client Contact: DAWN BEVINS Phone # 804/246 2705

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Analysis/Method: Gamma Spectrometry	Analysis/Method: Alpha Spectrometry							Comments
034	3/17	840	S	C	1	X								
034A	3/17	840	S	C	1		X							
035	3/17	850	S	C	1	X								
036	3/17	0910	S	C	1	X								
037	3/17	0930	S	C	1	X								
038	3/17	0940	S	C	1	X								
039	3/17	0950	S	C	1	X								
040	3/17	1010	S	C	1	X								
040A	3/17	1010	S	C	1		X							
041	3/17	1050	S	C	2	X								
041 MS/MSD	3/17	1050	S	C	2	X								
042	3/17	1050	S	C	2	X								

Relinquished by: C. MEEGAN C. Meegan	Date: 3/17	Time: 1700	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time
Relinquished by:	Date:	Time:	Received by Lab:	Date:	Time
Shipment Method:			Airbill Number:		

Turnaround Time Required:
- Routine_____
- Rush (Specify)_____

Comments:

400530

Cooler Temperature:_____

Original Laboratory Copy Client

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client: EARTH TECH
Project: Li Tungsten
Sampled by: C. REEGAN
Client Contact: Dawn BEVINS Phone # 8047346 3705

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Analysis/Method: Gamma Spectrometry							Comments
043	3/17	1215	S	C	2	X							
044	3/17	1225	S	C	2	X							

Relinquished by: C. REEGAN	Date: 3/17	Time: 1700	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time
Relinquished by:	Date:	Time:	Received by Lab:	Date:	Time
Shipment Method:			Airbill Number:		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

400531

Cooler Temperature:_____

Original Laboratory Copy - Client

ATTACHMENT D

LABORATORY ANALYTICAL RESULTS

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
TCL Volatiles								
Vinyl chloride				170	48			
Chloroethane				31				
Methylene Chloride	2	2	1	2	46	8	10	5
Acetone	11	19	9	14	260	14	39	15
Carbon disulfide		2	1	2	7	1	2	1
1,1-Dichloroethylene				.9	6			
1,1-Dichloroethane				13				
1,2-Dichloroethylene		.7		90	1100			
Chloroform	.9	.5	.4	.6				
1,2-Dichloroethane				1				
Methyl ethyl ketone		4		4	74	3	10	
1,1,1-Trichloroethane				1				
Trichloroethylene				6	110			
Benzene				.8	16			
4-Methyl-2-Pentanone	4	2	2					
Toluene					4			
Ethylbenzene	.4							
Xylenes	2	.7		1				
TCL Semivolatiles								
Phenol					41			
4-Methylphenol					64			200
Naphthalene					28	7	61	41
2-Methylnaphthalene							54	31
Acenaphthylene					27		34	64
Acenaphthene				11	22	17	170	55
Dibenzofuran					13	8	68	23
Diethylphthalate		7	6	9				
Phenanthrene	37			67	120	80	1900	460
Di-n-butylphthalate	11	30	9	11	19	8	10	14
Fluorene				12	22	17	190	54
N-Nitrosodiphenylamine					840			
Anthracene				18	43	21	450	150
Carbazole							110	31
Fluoranthene	30			55	170	82	1500	730
Pyrene	18		7	78	210	150	2200	1000
Benzo(a)anthracene	9			29	120	170	1000	400
Chrysene	11			38	150	210	1000	440
bis(2-ethylhexyl) phthalate	43	13	110	34	110	42	46	54
Benzo(b)fluoranthene	9			23	110	78	640	280
Benzo(k)fluoranthene	11			28	120	73	670	300
Benzo(a)pyrene	10			28	130	140	920	380

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07	Sample 08
Indeno(1,2,3-cd)pyrene				13	72	60	430	200
Dibenzo(a,h)anthracene					35	71	160	71
Benzo(g,h,i)perylene				21	86	74	420	210
TAL Metals								
Aluminum	1880	695	1630	4960	1860	2650	6910	4340
Antimony						2.6		
Arsenic				15.2	8.9	1.1	3.4	4.8
Barium	13.8	3.8	11	46.2	20.3	116	67	28.8
Beryllium				.23		.2	.47	.27
Cadmium								
Calcium	1080	213	801	2420	7420	2060	3400	1770
Chromium	5.1	1.9	9.2	10.4	7	5.6	12	11.8
Cobalt	8.5	.4	3.4	8.6	519	1.2	3.5	16
Copper	3.8	1.5	4.2	11.4	29.7	37.5	21.2	21.6
Iron	5180	2050	3590	38300	9610	5790	12400	10400
Lead	2.9	1.3	3.4	18.7	30.4	386	36.4	32
Magnesium	722	235	536	1370	934	704	2050	1730
Manganese	164	15	63.6	180	95.4	54	328	197
Mercury		.018	.042	.053	.069	.027	.16	.11
Nickel	5.5	1.7	7.4	10.2	20.2	4	7.6	16.9
Potassium	300	105	194	579	314	304	445	669
Selenium		.78	1.4	3.2	6.3	1.4	1.5	1.8
Silver								1.1
Sodium	60.6	30.6	171	67	187	73	160	121
Thallium	1.4		1.2					
Vanadium	4.8	2	3.7	11.2	5.6	5.7	13.1	11.2
Zinc	12.7	5.3	25.2	91.1	83.1	731	40.8	49.3

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 09	Sample 10	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15	Sample 16
TCL Volatiles								
Vinyl chloride					8			
Chloroethane								
Methylene Chloride	5	9		9	8	7	7	3
Acetone	15	15	37	31	31	26	43	19
Carbon disulfide	1	1		3	2	4	4	2
1,1-Dichloroethylene								
1,1-Dichloroethane								
1,2-Dichloroethylene								
Chloroform								
1,2-Dichloroethane								
Methyl ethyl ketone		2		7	8	8	10	4
1,1,1-Trichloroethane								
Trichloroethylene						.8		
Benzene								
4-Methyl-2-Pentanone		2				3	3	2
Toluene								
Ethylbenzene						.5		
Xylenes		.7						
TCL Semivolatiles								
Phenol								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
4-Methylphenol		17			42			
1,2,4-Trichlorobenzene								
Naphthalene	23	29	25	9	72	20		
2-Methylnaphthalene		23	21		43	19		
Acenaphthylene		37	30		76	8		
Acenaphthene		75	74	44	65	18		
Dibenzofuran		21	15		33	13		
Diethylphthalate				11	10	11		9
Phenanthrene		83	200	71	240	120	29	
Di-n-butylphthalate	10	9		11	15	11	11	11
Fluorene		72	51	47	45	20		
N-Nitrosodiphenylamine								
Anthracene		200	87	54	140	28	12	
Carbazole		37	10		17	12		
Fluoranthene	12	880	360	310	68	150	64	17
Pyrene	17	1500	460	310	1200	130	89	16
Benzo(a)anthracene		520	200	57	500	60	18	10
Chrysene		560	250	58	470	68	24	9
bis(2-ethylhexyl)		30	43	36	42	52	20	28
phthalate								

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 09	Sample 10	Sample 11	Sample [illegible]	Sample 13	Sample 14	Sample 15	Sample 16
Benzo(b)fluoranthene		330	110	31	340	48	16	
Benzo(k)fluoranthene		400	160	34	370	58	20	
Benzo(a)pyrene		470	190	43	500	52	22	12
Indeno(1,2,3-cd)pyrene		290	91	23	290	29		
Dibenzo(a,h)anthracene		100	33		110			
Benzo(g,h,i)perylene		330	83	26	310	30		
TAL Metals								
Aluminum	8910	9190	4900	5140	7760	2020	1170	3740
Antimony								
Arsenic		3.7	4.3	2.3	7.2	3	16.9	**315**
Barium	46.7	46.7	44.2	22.5	56.4	17.8	7.6	14.8
Beryllium	.48	.45	.28	.26	.44			.22
Cadmium								
Calcium	2140	9210	8630	2380	2790	2010	30800	642
Chromium	18.6	2.15	13.4	14.6	21.6	5.6	3.6	6.6
Cobalt	.4	6.7	3.7	5.6	6.28	30.7	1.2	7
Copper	6.9	22.7	19.1	6.8	24.9	4.6	3.2	5.7
Iron	12300	16400	11000	12000	20900	6560	2800	8860
Lead	28.2	58.5	36.9	13.4	67.7	19	21.3	6.6
Magnesium	2560	5930	5300	2230	2970	931	615	988
Manganese	142	229	169	183	396	102	28	62.1
Mercury	.19	.13	.087	.066	.18	.039		.066
Nickel	10.9	11.5	9.3	15.9	15	70.8	4.4	12.7
Potassium	422	1010	769	1090	1430	485	218	320
Selenium	1.6	2.1	1.8	1.7	2.6	1.4	1.2	1.1
Silver	.42	2	.74		2.6			1.1
Sodium	154	150	161	172	293	146	53.4	59
Thallium			1.2					
Vanadium	16.8	19.2	12.9	13.9	23	5.1	2.5	7.1
Zinc	34.6	109	52.2	26.6	94.7	55.6	27.9	18.6

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 17	Sample 18	Sample 19	Sample A	Sample	Sample	Sample	Sample
TCL Volatiles								
Vinyl chloride								
Chloroethane								
Methylene Chloride	3	8	8	3				
Acetone	17	220	180	13				
Carbon disulfide	1	13	6	2				
1,1-Dichloroethylene								
1,1-Dichloroethane			2					
1,2-Dichloroethylene	3							
Chloroform								
1,2-Dichloroethane								
Methyl ethyl ketone	3	5	49	3				
1,1,1-Trichloroethane								
Trichloroethylene	2							
Benzene		1						
4-Methyl-2-Pentanone	2	11		4				
Tetrachloroethylene	1			1				
Toluene		7						
Ethylbenzene		2						
Xylenes		8						
TCL Semivolatiles								
Phenol								
1,3-Dichlorobenzene	17	42		250				
1,4-Dichlorobenzene	120	77		2100				
1,2-Dichlorobenzene				130				
4-Methylphenol				60				
Benzoic acid			150					
1,2,4-Trichlorobenzene	18			100				
Naphthalene	25	170	180	74				
2-Methylnaphthalene	13	61	560	30				
Acenaphthylene	29	19		35				
Acenaphthene	41	44		90				
Dibenzofuran	10	13	41	32				
Diethylphthalate								
Phenanthrene	78	53	340	240				
Di-n-butylphthalate	10			8				
Fluorene	24	24	76	77				
N-Nitrosodiphenylamine								
Anthracene	51	27	100	120				
Carbazole		53		18				
Fluoranthene	310	160	310	450				
Pyrene	390	220	310	590				
Benzo(a)anthracene	130	100	160	230				

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

ample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
17	18	19	A				
	100	240	260				
	140	57	45				
	71	120	150				
	93	130	160				
	119	170	220				
	53	71	130				
		35	47				
	66	82	140				
	2820	4650	9640				
		41.6	20.4				
	7.3						
	13	75	37.1				
	.2	.27	.44				
		3.8					
	1180	2610	1850				
	8.2	14.2	21.3				
	27.6	114	28.3				
	5.8	302	17.5				
	5380	16700	23700				
	18.9	108	38.4				
	847	664	2330				
	198	97.8	223				
	.029	.95	.83				
	7.2	38	115				
	388	378	1060				
	3.1	7.3	2.4				
		4.2	1.2				
	612	427	164				
		1.2					
	9.8	9.8	21.3				
	35.5	234	75.6				

g/kg.

: RCRA waste.

400538

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 20	Sample 21	Sample 22	Sample 23	Sample 24	Sample 25	Sample 26	Sample 27
TCL Volatiles								
Vinyl chloride								
Chloroethane								
Methylene Chloride	3	2	3	100	1	2	3	3
Acetone	23	20	92	980	42	41	69	18
Carbon disulfide	2	2	17		2	2	10	12
1,1-Dichloroethylene								
1,1-Dichloroethane								
1,2-Dichloroethylene	.6						7	8
Chloroform								
1,2-Dichloroethane								
Methyl ethyl ketone	4	5	16	740	8	6	13	
1,1,1-Trichloroethane								
Trichloroethylene								61
Benzene								
4-Methyl-2-Pentanone	2	6	4		3	3		
Tetrachloroethylene								360
Toluene			.5	42				
1,1,2,2-Tetrachloro-ethane	.9							
Ethylbenzene	.5							
Xylenes	1							1
TCL Semivolatiles								
Phenol								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
1,2-Dichlorobenzene								
4-Methylphenol								
Benzoic acid								
1,2,4-Trichlorobenzene								
Naphthalene				1600			18	60
2-Methylnaphthalene				490				30
Acenaphthylene			21					45
Acenaphthene				1900			46	76
Dibenzofuran				1300			18	24
Diethylphthalate								
Phenanthrene		41	220	6300		18	290	370
Di-n-butylphthalate	97	31	55		87	21	27	27
Fluorene				1900			45	90
N-Nitrosodiphenylamine								
Anthracene			39	2300			66	98
Carbazole				580			21	14
Fluoranthene		48	200	4500		21	440	430

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 20	Sample 21	Sample 22	Sample 23	Sample [illegible]	Sample 25	Sample 26	Sample 27
Pyrene		57	200	4100		19	480	590
Benzo(a)anthracene		24	110	2500			190	220
Chrysene		26	110	2400			180	220
bis(2-ethylhexyl) phthalate	16	31	47		110	52	48	110
Benzo(b)fluoranthene		19	78	1600			130	150
Benzo(k)fluoranthene		18	94	2200			140	190
Benzo(a)pyrene		17	95	2400			150	200
Indeno(1,2,3-cd)pyrene			50	1600			40	54
Dibenzo(a,h)anthracene			19	6400				
Benzo(g,h,i)perylene			51	1500			41	55
TAL Metals								
Aluminum	3270	286	4120	2450	2500	4620	10800	10400
Antimony		4	22.6	30.6				
Arsenic	34.7	18.9	110	15.1	4.1	2.8	3.6	8.4
Barium	37.5	12.2	32.1	25.9	11.9	16	35.5	48
Beryllium			.41	.16	.19	.19	.46	.43
Cadmium			.63	1.6	.48	2.8		
Calcium	4230	316	17900	3030	1670	2630	2180	4780
Chromium	10.1	3.6	30.3	9.9	6.2	7.1	20.8	20
Cobalt	46.5	47.6	417	5.7	1.5	2.4	5.8	12.8
Copper	72.8	20.5	146	67.9	83.7	37.2	13.4	23.3
Iron	47100	2620	12000	6060	9760	5520	21400	18400
Lead	238	18.2	88.6	40.2	4.6	3.3	16.3	19.8
Magnesium	1570	115	4510	1490	678	867	3490	3350
Manganese	154	19.6	204	65.6	77.8	71.2	346	578
Mercury	.052	.26	.7	.034	.025			.11
Nickel	20.8	16.4	94.1	6.6	4.4	5.5	16	18.2
Potassium	378	96.1	556	356	183	328	1640	1040
Selenium	5.3	3.2	42.9	2.1	2.2	1.2	2.2	3.4
Silver	.34	1	4.3	.47		.48		
Sodium	68.3	87.2	348	66.4	560	2390	679	361
Thallium	1.3				.98	1.6	2.2	
Vanadium	12	2.3	15.3	7.1	6.7	5.6	24.4	23.6
Zinc	118	17.8	222	56	51.3	212	46.9	50.8

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

LI TUNGSTEN SITE								
Organic/Inorganic Lab Results Summary								
Analytical Parameter	Sample 28	Sample 29	Sample 30	Sample 31	Sample C	Sample 32	Sample 33	Sample 34
TCL Volatiles								
Vinyl chloride								
Chloroethane								
Methylene Chloride	7	3	2	2	2	2	2	2
Acetone	120	93	14	7	9	9	6	7
Carbon disulfide	10	1		2		2	.3	
1,1-Dichloroethylene								
1,1-Dichloroethane								
1,2-Dichloroethylene	4							
Chloroform								
1,2-Dichloroethane								
Methyl ethyl ketone	30	31	3		2			
1,1,1-Trichloroethane								
Trichloroethylene								
Benzene		.6						
4-Methyl-2-Pentanone	12	13	3	2	2	2	4	4
Hexanone		3						
Tetrachloroethylene								
Toluene	.9	1						
Ethylbenzene								
Xylenes								
TCL Semivolatiles								
Phenol		140						
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
1,2-Dichlorobenzene								
4-Methylphenol		240						
Benzoic acid								
1,2,4-Trichlorobenzene								
Naphthalene		10	12					
2-Methylnaphthalene			15					
Acenaphthylene			37					
Acenaphthene		38	160					
Dibenzofuran		12	47					
Diethylphthalate								
Phenanthrene	18	390	1400			13		
Di-n-butylphthalate	14	16	15	15	13	10	11	9
Fluorene		31	160					
N-Nitrosodiphenylamine								
Anthracene		79	440					
Carbazole		19	120					
Fluoranthene	13	360	1600	9	7	23		
Pyrene	19	490	1500	10	6	24		

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 28	Sample 29	Sample 30	Sample 31	Sample C	Sample 32	Sample 33	Sample 34
Benzo(a)anthracene		200	1000			15		
Chrysene		190	1000			18		
bis(2-ethylhexyl) phthalate	52	160	34	70	60	29	30	10
Di-n-octylphthalate					9			
Benzo(b)fluoranthene		110	640			15		
Benzo(k)fluoranthene		140	860			19		
Benzo(a)pyrene		160	890			18		
Indeno(1,2,3-cd)pyrene		91	460			11		
Dibenzo(a,h)anthracene			180					
Benzo(g,h,i)perylene		110	440			13		
TAL Metals								
Aluminum	11000	5080	9420	4260	5780	6130	3950	10000
Antimony			9.2	6.6	1.8	387	16.9	
Arsenic	220	15.1	24.1	78.6	16.3	127	591	297
Barium	40.2	15.6	63.4	50.2	58.3	36.6	15.9	42.1
Beryllium	.39	.23	.44		.22			.27
Cadmium			.52	.28		21.1	2.1	
Calcium	4310	1670	1300	704	639	980	245	340
Chromium	18.2	15.2	16	9.7	12	11	10.2	21
Cobalt	7.4	4.1	47.1	25.3	16.5	24.2	1.7	4.9
Copper	33.7	11.7	99	116	72.8	1790	53.2	117
Iron	17800	9880	22600	20000	23700	87300	18500	30000
Lead	19.4	17.7	43.4	108	37	31500	1700	32.6
Magnesium	2630	1750	1670	837	1070	914	881	2980
Manganese	185	67.2	981	1380	1760	332	164	278
Mercury	.1	.042	.15	.071	.076	.22	.12	.094
Nickel	14	9.4	32.5	33.2	15	48.4	5.3	11.6
Potassium	1080	706	473	350	468	444	454	1660
Selenium	6.3	3.6	2.8	3.5	2.6	51.2	6	3.1
Silver	.92		.79	3.7	.7	107	27.2	2.8
Sodium	1420	966	84.6	52.2	46.6	96.6	48.4	128
Thallium					2.9	6.1		1.9
Vanadium	21.6	11.1	20.2	12.6	11.4	11.8	10.4	21.4
Zinc	36.1	39.2	100	53.9	31.1	629	167	89.8

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 35	Sample 36	Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
TCL Volatiles								
Vinyl chloride					6			
Chloroethane								
Methylene Chloride	2	2	5	2	2	2	2	1
Acetone	12	6	20	13	29	43	120	60
Carbon disulfide	.9		130	.8	9	4	2	5
1,1-Dichloroethylene								
1,1-Dichloroethane	2							
1,2-Dichloroethylene								
Chloroform			2					
1,2-Dichloroethane								
Methyl ethyl ketone	2			3	6	5	24	13
1,1,1-Trichloroethane								
Trichloroethylene								.6
Benzene					1			49
4-Methyl-2-Pentanone	4		6		2	2	4	
Tetrachloroethylene	1							
Toluene			.6		.8			46
Ethylbenzene								170
Styrene								5
Xylenes								88
TCL Semivolatiles								
Phenol								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
1,2-Dichlorobenzene								
4-Methylphenol								
2,4-Dimethylphenol								160
Benzoic acid						46		
1,2,4-Trichlorobenzene								
Naphthalene							18	7000
2-Methylnaphthalene							12	1000
Acenaphthylene						12	40	55
Acenaphthene							13	1100
Dibenzofuran							19	670
Diethylphthalate								
Phenanthrene			9	8		46	210	2700
Di-n-butylphthalate	11	13		17		18	48	310
Fluorene							28	860
N-Nitrosodiphenylamine								
Anthracene						12	30	820
Carbazole							31	430
Fluoranthene			23	8	130	98	240	2700

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 35	Sample 36	Sample 37	Sample 38	Sample 39	Sample 40	Sample 41	Sample 42
Pyrene			22	10	490	77	220	2600
Butylbenzylphthalate							88	670
Benzo(a)anthracene			11			53	120	920
Chrysene			11		63	58	140	980
bis(2-ethylhexyl)	30	200	44	63	90	47	220	400
phthalate								
Benzo(b)fluoranthene					30	49	110	650
Benzo(k)fluoranthene						43	110	630
Benzo(a)pyrene						35	120	590
Indeno(1,2,3-cd)pyrene						29	63	320
Dibenzo(a,h)anthracene							16	120
Benzo(g,h,i)perylene						31	66	340
TAL Metals								
Aluminum	7890	2910	2110	1700	5030	4620	5860	5680
Antimony			142	67.6	3350	359	3.9	5
Arsenic	6.2		**150**	17.1	**260**	**9580**	16.6	45.5
Barium	47.2	11	41	20.4	491	51.7	154	115
Beryllium	.45			.15	.19		.29	.28
Cadmium								.2
Calcium	4650	3080	3180	5900	2960	2560	16700	5370
Chromium	14.9	6.8	37.6	5.5	28.5	12.8	22.9	21.8
Cobalt	121	3.8	30.4	8.2	30.6	102	19.8	22.9
Copper	8.6	1.9	161	18.6	337	170	68.1	53.8
Iron	10400	6140	41000	8390	85900	61200	18100	16200
Lead	6.8	2.7	**468**	97	**779**	**1600**	99.8	69.4
Magnesium	2570	780	850	558	1900	708	1840	1880
Manganese	102	74.5	504	103	639	117	2810	1110
Mercury	.058	.045	.89	.035	**7.2**	.36	.075	.14
Nickel	137	7	25	5.2	32.2	15.6	24	40.1
Potassium	1280	325	580	277	969	608	854	756
Selenium	2.6	1.7	6.6	1.7	14.6	14.6	2.2	2.9
Silver	4.9		10.7	1.3	14.8	81.8	2.2	3.6
Sodium	112	53.4	181	76.1	2730	445	252	165
Thallium				1.1				
Vanadium	15.8	5	7.8	4.6	26.9	11.9	13.3	16.7
Zinc	34.5	20.2	72.6	21.6	366	243	125	90

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 43	Sample 44	Sample B	Sample	Sample	Sample	Sample	Sample
TCL Volatiles								
Vinyl chloride								
Chloroethane								
Methylene Chloride	2		4					
Acetone	74	64	160					
Carbon disulfide	40	64	40					
1,1-Dichloroethylene								
1,1-Dichloroethane								
1,2-Dichloroethylene	1	2						
Chloroform								
1,2-Dichloroethane								
Methyl ethyl ketone	11	9	45					
1,1,1-Trichloroethane								
Trichloroethylene	.8							
Benzene	.8	2						
4-Methyl-2-Pentanone	4	6						
Tetrachloroethylene	1		1					
Toluene	1	.8	.7					
Ethylbenzene	.5							
Xylenes	1							
TCL Semivolatiles								
Phenol								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
1,2-Dichlorobenzene								
4-Methylphenol								
Benzoic acid								
1,2,4-Trichlorobenzene								
Naphthalene	8	220						
2-Methylnaphthalene		190						
Acenaphthylene	13	71						
Acenaphthene		2200						
Dibenzofuran		2100						
Diethylphthalate								
Phenanthrene	84	9500	86					
Di-n-butylphthalate	50	100	38					
Fluorene		3400						
N-Nitrosodiphenylamine								
Anthracene	28	1300	20					
Carbazole	19	660						
Fluoranthene	130	5400	120					
Pyrene	120	4700	120					
Benzo(a)anthracene	57	1200	42					

LI TUNGSTEN SITE

Organic/Inorganic Lab Results Summary

Analytical Parameter	Sample 43	Sample 44	Sample B	Sample	Sample	Sample	Sample	Sample
Chrysene	81	1200	49					
bis(2-ethylhexyl)	120	150	230					
phthalate								
Benzo(b)fluoranthene	72	620	31					
Benzo(k)fluoranthene	62	620	38					
Benzo(a)pyrene	64	540	36					
Indeno(1,2,3-cd)pyrene	39	270						
Dibenzo(a,h)anthracene		100						
Benzo(g,h,i)perylene	38	320						
TAL Metals								
Aluminum	4800	6160	8610					
Antimony	11.6	9.4						
Arsenic	43.8	110	4.2					
Barium	112	186	41.7					
Beryllium	.16	.51	.43					
Cadmium	1.8	4.4						
Calcium	3580	5810	1270					
Chromium	20.5	39.6	16					
Cobalt	24	47.2	8.6					
Copper	79.7	145	9.2					
Iron	34000	25200	12000					
Lead	168	259	15.6					
Magnesium	1950	1820	2100					
Manganese	6110	9620	234					
Mercury	.16	4.3	.052					
Nickel	27.6	65.2	25					
Potassium	605	763	655					
Selenium	7	5	1.9					
Silver	4	13.2						
Sodium	126	414	227					
Thallium			2.3					
Vanadium	15.3	44.8	15					
Zinc	130	350	31.6					

Blank space indicates no "hits".

Units for TCL volatiles/semivolatiles are ug/kg.

Units for TAL metals are mg/kg.

Bold and underline entries indicate possible RCRA waste.

Li Tungsten Site

Rad Analysis Summary

Project Number 34215

Parameter	Sample 01		Sample 02		Sample 03		Sample 04	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
Actinium-228	3.2E-01	8.5E-02	3.4E-01	7.3E-02	6.3E-01	1.3E-01	1.1E+00	1.9E-01
Bismuth-211	*	*	4.5E-02	1.9E-01	7.9E-02	2.9E-01	2.2E-01	4.3E-01
Bismuth-212	4.7E-01	3.1E-01	4.9E-01	2.0E-01	8.6E-01	3.3E-01	1.2E+00	3.4E-01
Bismuth-214	2.8E-01	6.4E-02	3.0E-01	6.3E-02	5.1E-01	1.1E-01	1.0E+00	1.8E-01
Cesium-137	-4.4E-03	1.2E-02	-4.9E-03	8.5E-03	1.3E-02	1.3E-02	3.7E-03	1.2E-02
Lead-210	4.2E-01	1.7E+00	*	*	4.6E-01	1.8E+00	*	*
Lead-212	2.8E-01	8.9E-02	3.1E-01	6.0E-02	5.5E-01	1.1E-01	9.9E-01	1.8E-01
Lead-214	3.1E-01	7.2E-02	3.1E-01	7.0E-02	5.1E-01	1.2E-01	1.0E+00	1.9E-01
Potassium-40	1.2E+01	2.3E+00	9.0E+00	1.7E+00	9.0E+00	1.7E+00	1.2E+01	2.2E+00
Protactinium-231	*	*	*	*	5.0E-01	6.7E-01	3.2E-01	5.1E-01
Radium-223	*	*	*	*	*	*	1.7E-01	5.5E-02
Radium-224	7.5E-01	1.0E+00	5.5E-01	2.3E-01	8.0E-01	5.3E-01	1.1E+00	4.0E-01
Radium-226	6.0E-01	4.3E-01	5.0E-01	2.3E-01	*	*	*	*
Thallium-208	8.0E-02	2.6E-02	1.0E-01	2.5E-02	2.0E-01	4.4E-02	3.6E-01	6.8E-02
Thorium-234	2.4E-01	2.7E-01	6.7E-01	4.1E-01	4.5E-01	2.3E-01	1.3E+00	5.2E-01
Uranium-235	*	*	*	*	6.6E-02	2.8E-02	1.4E-01	3.3E-02

Units are pCi/g unless otherwise specified.

* - Not detected.

Uncert. - the degree of uncertainty (2 sigma: ±).

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 05		Sample 06		Sample 07		Sample 08	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
Actinium-228	7.0E-01	1.3E-01	5.4E-01	1.0E-01	8.1E-01	1.5E-01	7.4E-01	1.3E-01
Bismuth-211	*	*	6.1E-02	2.2E-01	*	*	1.6E-01	3.3E-01
Bismuth-212	6.2E-01	2.8E-01	6.2E-01	2.8E-01	6.0E-01	3.8E-01	8.5E-01	2.6E-01
Bismuth-214	5.4E-01	1.1E-01	4.7E-01	9.0E-02	7.5E-01	1.4E-01	6.5E-01	1.2E-01
Cesium-137	-5.6E-03	1.3E-02	-6.4E-03	9.3E-03	-4.3E-03	1.4E-02	-1.2E-02	1.1E-02
Lead-210	3.2E-01	1.3E+00	*	*	4.3E-01	1.7E+00	*	*
Lead-212	3.3E-01	1.0E-01	4.6E-01	8.5E-02	5.3E-01	9.9E-02	6.8E-01	1.2E-01
Lead-214	5.9E-01	1.1E-01	4.2E-01	8.6E-02	7.2E-01	1.3E-01	6.3E-01	1.3E-01
Potassium-40	8.3E+00	1.6E+00	6.8E+00	1.3E+00	1.1E+01	2.2E+00	1.1E+01	2.1E+00
Protactinium-231	7.1E-01	6.6E-01	5.0E-02	3.0E-01	9.2E-01	5.6E-01	2.0E-01	4.9E-01
Radium-223	3.4E-02	3.0E-02	*	*	*	*	5.5E-02	3.8E-02
Radium-224	4.6E+00	1.5E+00	7.8E-01	2.7E-01	3.7E+00	1.0E+00	7.3E-01	4.2E-01
Radium-226	1.5E+00	5.2E-01	*	*	*	*	*	*
Thallium-208	2.2E-01	4.7E-02	1.6E-01	3.7E-02	2.7E-01	6.0E-02	2.2E-01	4.5E-02
Thorium-231	*	*	2.1E-01	1.7E-01	*	*	*	*
Thorium-234	5.8E-01	2.4E-01	7.7E-01	3.2E-01	8.6E-01	3.3E-01	4.8E-01	3.4E-01
Uranium-235	*	*	6.0E-02	2.1E-02	1.1E-01	3.3E-02	7.4E-02	2.4E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma; ±)

* - Not detected.

Li Tungsten Site

Rad Analysis Summary

Project Number 34215

Parameter	Sample 09		Sample 010		Sample 011		Sample 012	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
...um-228	1.2E+00	2.1E-01	9.6E-01	1.7E-01	6.8E-01	1.3E-01	6.1E-01	1.2E-01
211	5.1E-01	5.2E-01	1.8E-02	3.7E-01	2.0E-01	3.4E-01	9.5E-02	3.1E-01
212	1.1E+00	5.5E-01	1.0E+00	3.5E-01	7.3E-01	2.7E-01	8.7E-01	3.3E-01
214	1.1E+00	2.1E-01	8.1E-01	1.5E-01	7.1E-01	1.3E-01	4.6E-01	9.7E-02
27	-6.7E-03	1.7E-02	-1.6E-02	1.2E-02	-6.1E-03	1.1E-02	-7.0E-03	1.3E-02
	4.3E-01	1.8E+00	*	*	*	*	3.7E-01	1.5E+00
...ead-212	8.0E-01	1.5E-01	9.3E-01	1.7E-01	6.3E-01	1.2E-01	3.8E-01	7.5E-02
214	1.0E+00	2.0E-01	8.4E-01	1.6E-01	6.2E-01	1.3E-01	4.7E-01	1.1E-01
...m-40	1.2E+01	2.3E+00	1.2E+01	2.3E+00	1.2E+01	2.3E+00	9.4E+00	1.8E+00
...m-231	1.2E+00	8.8E-01	2.6E-01	4.8E-01	6.3E-02	4.6E-01	6.7E-01	6.4E-01
23	*	*	8.7E-02	4.0E-02	4.9E-02	6.7E-02	*	*
24	2.6E+00	9.5E-01	1.1E+00	4.7E-01	8.0E-01	4.3E-01	3.0E+00	8.5E-01
26	*	*	*	*	*	*	1.2E+00	4.1E-01
08	3.1E-01	6.9E-02	3.2E-01	6.3E-02	2.4E-01	4.8E-02	1.7E-01	4.3E-02
231	*	*	*	*	6.9E-02	2.7E-01	*	*
...n-234	1.3E+00	4.7E-01	9.5E-01	4.1E-01	8.5E-01	3.9E-01	5.6E-01	2.6E-01
...nium-235	1.3E-01	3.8E-02	1.0E-01	2.6E-02	9.1E-02	2.6E-02	*	*

...are pCi/g unless otherwise specified.

...Degree of uncertainty (2 sigma; ±)

...ected

400549

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 013		Sample 014		Sample 015		Sample 016	
	Result	Uncert.	Result	Uncert.	Result	Uncert	Result	Uncert.
Actinium-228	1.1E+00	1.9E-01	5.2E-01	9.9E-02	3.8E-01	9.0E-02	5.2E-01	9.8E-02
Bismuth-211	9.1E-01	4.1E-01	*	*	4.2E-01	2.8E-01	2.2E-01	2.3E-01
Bismuth-212	1.3E+00	4.1E-01	7.2E-01	2.4E-01	*	*	5.8E-01	2.2E-01
Bismuth-214	7.5E-01	1.5E-01	4.2E-01	8.2E-02	3.6E-01	7.6E-02	4.1E-01	8.2E-02
Cesium-137	-1.6E-03	1.5E-02	7.5E-03	1.0E-02	1.3E-03	1.1E-02	-2.5E-03	9.0E-03
Lead-210	6.5E-01	2.6E+00	*	*	3.4E-01	1.4E+00	*	*
Lead-212	5.5E-01	1.1E-01	5.1E-01	9.4E-02	2.7E-01	5.5E-02	4.7E-01	8.7E-02
Lead-214	4.9E-01	1.3E-01	4.2E-01	7.9E-02	2.3E-01	7.6E-02	3.7E-01	8.1E-02
Potassium-40	1.4E+01	2.7E+00	8.2E+00	1.6E+00	6.8E+00	1.3E+00	6.8E+00	1.3E+00
Protactimum-231	1.4E+00	7.4E-01	*	*	3.5E-01	3.9E-01	*	*
Radium-223	*	*	4.4E-02	7.2E-02	*	*	*	*
Radium-224	2.8E+00	8.3E-01	6.0E-01	3.2E-01	1.4E+00	5.5E-01	6.4E-01	2.7E-01
Thallium-208	2.5E-01	5.7E-02	1.8E-01	3.8E-02	1.3E-01	3.6E-02	1.8E-01	3.8E-02
Thorium-231	*	*	2.1E-03	2.8E-01	*	*	*	*
Thorium-234	8.9E-01	2.9E-01	7.5E-01	3.7E-01	*	*	5.7E-01	3.5E-01
Uranium-235	1.1E-01	3.4E-02	5.9E-02	2.0E-02	4.2E-02	2.4E-02	5.8E-02	2.1E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 017		Sample 018		Sample 019		Sample 020	
	Result	Uncert.	Result	Uncert	Result	Uncert.	Result	Uncert
Actinium-228	6.9E-01	1.2E-01	5.4E-01	1.2E-01	1.3E+00	2.3E-01	5.4E-01	9.9E-02
Bismuth-211	1.9E-01	2.5E-01	*	*	8.5E-01	6.4E-01	1.3E-01	2.1E-01
Bismuth-212	9.5E-01	2.9E-01	6.4E-01	2.6E-01	2.1E+00	6.3E-01	5.8E-01	2.3E-01
Bismuth-214	6.2E-01	1.1E-01	3.5E-01	7.9E-02	1.4E+00	2.6E-01	3.7E-01	7.3E-02
Cesium-137	-3.7E-03	8.7E-03	-2.3E-03	1.3E-02	-4.8E-03	1.9E-02	-2.3E-03	8.4E-03
Lead-210	*	*	2.4E-01	9.7E-01	5.5E-01	2.2E+00	*	*
Lead-212	6.2E-01	1.1E-01	4.5E-01	8.5E-02	9.8E-01	1.9E-01	4.8E-01	8.8E-02
Lead-214	5.2E-01	1.0E-01	4.2E-01	8.6E-02	1.1E+00	2.4E-01	3.5E-01	7.7E-02
Potassium-40	8.4E+00	1.6E+00	7.7E+00	1.5E+00	9.7E+00	1.9E+00	4.3E+00	8.5E-01
Protactinium-231	4.3D-01	3.8E-01	*	*	2.0E+00	9.9E-01	2.6E-01	3.3E-01
Radium-223	1.0E-01	3.9E-02	*	*	*	*	*	*
Radium-224	9.8E-01	3.5E-01	2.1E+00	6.8E-01	5.1E+00	1.4E+00	1.8E-01	2.5E-01
Thallium-208	2.3E-01	4.5E-02	1.5E-01	3.8E-02	4.1E-01	8.6E-02	1.7E-01	3.5E-02
Thorium-231	*	*	*	*	*	*	2.5E-01	1.6E-01
Thorium-234	8.5E-01	3.3E-01	3.9E-01	2.1E-01	9.3E-01	3.6E-01	7.0E-01	3.9E-01
Uranium-235	9.7E-02	2.4E-02	4.6E-02	2.4E-02	1.4E-01	4.6E-02	3.2E-02	2.1E-01

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 021		Sample 022		Sample 023		Sample 024	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert
Actinium-228	4.9E-01	5.5E-02	6.7E-01	1.2E-01	4.7E-01	1.0E-01	5.5E-01	1.0E-01
Bismuth-211	4.3E-02	2.3E-01	9.0E-02	2.5E-01	*	*	1.2E-01	2.4E-01
Bismuth-212	3.6E-01	2.8E-01	6.2E-01	2.7E-01	6.0E-01	3.4E-01	6.1E-01	2.0E-01
Bismuth-214	3.3E-01	7.1E-02	5.4E-01	1.0E-01	4.7E-01	9.6E-02	4.3E-01	8.3E-02
Cesium-137	-2.5E-04	5.1E-03	3.6E-03	9.3E-03	6.6E-03	1.3E-02	6.0E-03	9.5E-03
Lead-210	1.4E-01	6.0E-01	*	*	3.4E-01	1.4E+00	*	*
Lead-212	3.5E-01	6.7E-02	5.5E-01	1.0E-01	3.6E-01	1.0E-01	4.7E-01	8.7E-02
Lead-214	3.5E-01	8.5E-02	5.2E-01	1.0E-01	4.7E-01	9.1E-02	4.1E-01	8.7E-02
Potassium-40	7.5E+00	1.4E+00	9.3E+00	1.8E+00	9.6E+00	1.8E+00	6.9E+00	1.3E+00
Protactinium-231	4.6E-01	4.8E-01	3.0E-01	3.5E-01	*	*	8.4E-02	3.6E-01
Radium-223	*	*	3.8E-02	3.4E-02	*	*	4.0E-01	5.7E-02
Radium-224	1.1E+00	4.8D-01	8.8E-01	3.4E-01	1.9E+00	1.3E+00	5.5E-01	3.3E-01
Radium-226	*	*	*	*	1.2E+00	4.6E-01	*	*
Thallium-208	1.2E-01	3.3E-02	2.1E-01	4.3E-02	1.7E-01	4.2E-02	1.7E-01	3.5E-02
Thorium-231	*	*	2.4E-01	1.8E-01	*	*	2.2E-01	2.6E-01
Thorium-234	2.4E-01	1.8E-01	6.0E-01	3.4E-01	3.7E-01	2.1E-01	7.3E-01	3.6E-01
Uranium-235	4.5E-02	2.1E-02	8.0E-02	2.3E-02	*	*	5.6E-02	2.1E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 023A		Sample 026A		Sample 031A		Sample C	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert
Pulonium-210	3.9E-01	3.7E-01	7.4E-01	4.3E-01	6.9E-01	4.3E-01	6.7E-01	4.3E-01
All units are pCi/g unless otherwise specified.								
Uncert. - Degree of uncertainty (2 sigma: ±).								

Li Tungsten Site

Rad Analysis Summary

Project Number 34215

Parameter	Sample 025		Sample 026		Sample 027		Sample 028	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
Actinium-228	5.8E-01	1.1E-01	9.3E-01	1.7E-01	6.9E-01	1.2E-01	1.3E+00	2.4E-01
Bismuth-211	2.4E-01	2.7E-01	5.1E-01	3.7E-01	1.6E-01	3.0E-01	6.1E-01	5.3E-01
Bismuth-212	6.2E-01	2.3E-01	9.0E-01	3.4E-01	7.9E-01	2.7E-01	1.6E+00	6.9E-01
Bismuth-214	4.6E-01	9.0E-02	7.4E-01	1.4E-01	6.2E-01	1.1E-01	8.6E-01	1.8E-01
Cesium-137	-1.5E-02	1.0E-02	-1.3E-02	1.5E-02	-9.8E-03	9.7E-03	3.1E-03	2.1E-02
Lead-210	*	*	7.7E-01	3.1E-01	*	*	5.8E-01	2.4E+00
Lead-212	4.9E-01	9.1E-02	6.1E-01	1.1E-01	6.3E-01	1.2E-01	9.6E-01	1.8E-01
Lead-214	3.9E-01	9.5E-02	5.4E-01	1.2E-01	6.0E-01	1.2E-01	8.3E-01	1.9E-01
Potassium-40	1.3E+01	2.5E+00	1.2E+01	2.3E+00	9.6E+00	1.8E+00	1.4E+01	2.7E+00
Protactinium-231	*	*	1.4E+00	8.1E-01	*	*	1.2E+00	1.0E+00
Radium-223	7.4E-02	4.2E-02	*	*	8.2E-02	6.8E-02	*	*
Radium-224	7.8E-01	3.4E-01	2.1E+00	7.6E-01	9.5E-01	3.2E-01	8.9E-01	7.4E-01
Thallium-208	1.8E-01	3.7E-02	2.5E-01	5.7E-02	2.5E-01	4.9E-02	3.6E-01	8.2E-02
Thorium-231	*	*	*	*	6.4E-02	2.9E-01	*	*
Thorium-234	2.5E-01	2.9E-01	6.0E-01	2.7E-01	7.1E-01	4.2E-01	5.9E-01	4.1E-01
Uranium-235	5.9E-02	1.8E-02	9.6E-02	3.3E-02	8.8E-02	2.3E-02	1.4E-01	4.0E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma; ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 017 Field Dup		Sample 029 Field Dup		Sample 041 Field Dup		Sample	
	Result	Uncert.	Result	Uncert.	Result	Uncert	Result	Uncert
Actinium-228	9.3E-01	1.7E-01	7.0E-01	1.4E-01	9.4E-01	1.7E-01		
Bismuth-211	2.0E-01	3.7E-01	*	*	3.5E-01	3.8E-01		
Bismuth-212	1.1E+00	3.4E-01	9.5E-01	3.3E-01	9.3E-01	3.7E-01		
Bismuth-214	6.7E-01	1.3E-01	5.8E-01	1.2E-01	8.6E-01	1.6E-01		
Cesium-137	1.1E-03	1.3E-02	-1.0E-01	1.4E-02	1.2E-02	1.3E-02		
Lead-210	6.0E-01	2.4E+00	7.0E-01	2.8E+00	4.9E-01	2.0E+00		
Lead-212	7.3E-01	1.4E-01	4.1E-01	1.1E-01	6.7E-01	1.3E-01		
Lead-214	6.5E-01	1.5E-01	6.2E-01	1.2E-01	7.2E-01	1.5E-01		
Potassium-40	1.1E+01	2.1E+00	1.1E+01	2.1E+00	9.2E+00	1.7E+00		
Protactinium-231	4.9E-01	5.5E-01	1.4E+00	7.2E-01	1.6E+00	8.0E-01		
Radium-224	9.8E-01	5.6E-01	4.5E+00	1.6E+00	3.3E+00	8.7E-01		
Thallium-208	3.0E-01	6.3E-02	2.0E-01	4.5E-02	2.7E-01	5.9E-02		
Thorium-231	1.2E-01	9.5E-02	*	*	*	*		
Thorium-234	7.6E-01	2.6E-01	9.3E-01	2.9E-01	7.3E-01	2.8E-01		
Uranium-235	9.1E-02	2.9E-02	8.9E-02	3.3E-02	1.1E-01	3.0E-02		

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 029		Sample 030		Sample 031		Sample 032	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
Actinium-228	7.2E-01	1.3E-01	8.9E-01	1.6E-01	7.7E-01	1.4E-01	7.7E-01	1.4E-01
Bismuth-211	5.0E-02	2.9E-01	2.4E-01	3.7E-01	6.0E-01	3.8E-01	2.7E-01	3.7E-01
Bismuth-212	1.0E+00	3.7E-01	8.8E-01	3.0E-01	4.3E-01	1.8E-01	9.1E-01	2.7E-01
Bismuth-214	5.5E-01	1.1E-01	6.8E-01	1.3E-01	7.5E-01	1.4E-01	8.8E-01	1.6E-01
Cesium-137	-2.7E-03	1.1E-02	-8.7E-03	1.0E-02	9.0E-03	1.3E-02	-5.8E-03	1.0E-02
Lead-210	*	*	*	*	5.7E-01	2.3E+00	*	*
Lead-212	6.4E-01	1.2E-01	8.2E-01	1.5E-01	4.9E-01	9.7E-02	7.0E-01	1.3E-01
Lead-214	5.8E-01	1.2E-01	7.4E-01	1.5E-01	5.5E-01	1.3E-01	8.3E-01	1.6E-01
Potassium-40	1.1E+01	2.0E+00	9.6E+00	1.8E+00	9.0E+00	1.7E+00	1.0E+01	2.0E+00
Protactinium-231	4.1E-01	6.0E-01	2.8E-01	4.2E-01	9.9E-01	5.6E-01	2.4E-01	5.0E-01
Radium-223	7.7E-02	4.7E-02	*	*	*	*	5.5E-02	8.2E-02
Radium-224	9.6E-01	3.6E-01	1.1E+00	5.3E-01	1.9E+00	6.9E-01	1.0E+00	3.9E-01
Thallium-208	2.3E-01	4.9E-02	2.8E-01	5.6E-02	2.3E-01	5.0E-02	2.4E-01	4.9E-02
Thorium-231	*	*	*	*	*	*	1.3E-01	3.3E-01
Thorium-234	1.2E+00	4.6E-01	8.0E-01	4.3E-01	7.8E-01	3.2E-01	4.6E-01	3.1E-01
Uranium-235	1.0E-01	2.9E-02	1.1E-01	4.9E-02	1.1E-01	3.0E-02	1.1E-01	3.0E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 033		Sample 034		Sample 035		Sample 036	
	Result	Uncert.	Result	Uncert.	Result	Uncert	Result	Uncert
Actinium-228	7.7E-01	1.4E-01	7.3E-01	1.3E-01	1.1E+00	1.9E-01	4.9E-01	9.0E-02
Bismuth-211	9.2E-01	4.8E-01	2.6E-01	3.3E-01	2.4E-01	4.3E-01	1.1E-02	2.1E-01
Bismuth-212	1.3E+00	4.2E-01	8.8E-01	2.5E-01	1.0E+00	4.0E-01	6.3E-01	2.2E-01
Bismuth-214	1.1E+00	1.9E-01	7.2E-01	1.3E-01	9.2E-01	1.7E-01	3.8E-01	7.2E-02
Cesium-137	-3.1E-03	1.3E-02	-3.5E-03	1.0E-02	-1.8E-02	1.6E-02	-7.1E-03	7.8E-03
Lead-210	3.2E-01	1.3E+00	*	*	7.5E-01	3.0E+00	*	*
Lead-212	4.5E-01	9.0E-02	6.3E-01	1.2E-01	6.8E-01	1.3E-01	4.2E-01	7.8E-02
Lead-214	8.2E-01	1.7E-01	6.4E-01	1.3E-01	7.6E-01	1.6E-01	3.9E-01	8.6E-02
Potassium-40	9.1E+00	1.7E+00	1.0E+01	1.9E+00	1.4E+01	2.7E+00	6.5E+00	1.2E+00
Protactinium-231	1.7E+00	6.4E-01	1.9E-01	4.0E-01	6.7E-01	5.8E-01	4.8E-02	3.0E-01
Radium-223	*	*	5.8E-02	5.8E-02	*	*	3.4E-02	4.8E-02
Radium-224	3.8E+00	1.0E+00	8.3E-01	4.7E-01	2.2E+00	8.1E-01	4.4E-01	3.0E-01
Thallium-208	2.8E-01	5.8E-02	2.6E-01	5.0E-02	3.6E-01	7.3E-02	1.6E-01	3.3E-02
Thorium-231	*	*	4.0E-02	3.0E-01	*	*	1.5E-01	2.1E-01
Thorium-234	5.3E-01	5.9E-01	4.2E-01	3.4E-01	4.6E-01	2.5E-01	4.3E-01	2.8E-01
Uranium-235	1.0E-01	3.1E-02	8.8E-02	1.8E-02	1.1E-01	3.3E-02	4.7E-02	1.6E-02

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 037		Sample 038		Sample 039		Sample 040	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert
Actinium-228	9.0E-01	1.7E-01	2.6E-01	5.7E-02	1.2E+00	2.2E-01	1.1E+00	1.8E-01
Bismuth-211	1.3E+00	5.7E-01	4.4E-02	1.9E-01	8.1E-01	5.8E-01	1.6E+00	9.7E-01
Bismuth-212	1.1E+00	3.7E-01	2.7E-01	2.0E-01	1.1E+00	4.6E-01	1.3E+00	3.6E-01
Bismuth-214	1.2E+00	2.1E-01	3.4E-01	6.8E-02	1.1E+00	2.1E-01	2.7E+00	4.5E-01
Cesium-137	2.5E-04	1.6E-02	-1.7E-03	8.1E-03	2.1E-02	1.8E-02	4.5E-02	1.9E-02
Lead-210	7.9E-01	3.2E+00	*	*	7.9E-01	3.1E+00	*	*
Lead-212	5.8E-01	1.2E-01	2.3E-01	4.6E-02	7.0E-01	1.4E-01	8.7E-01	1.6E-01
Lead-214	8.4E-01	1.9E-01	3.2E-01	7.1E-02	1.0E+00	2.1E-01	2.1E+00	4.0E-01
Potassium-40	2.1E+01	4.0E+00	5.6E+00	1.1E+00	1.1E+01	2.1E+00	9.3E+00	1.8E+00
Protactinium-231	1.4E+00	7.8E-01	9.0E-02	3.0E-01	1.9E+00	7.9E-01	*	*
Radium-223	*	*	*	*	*	*	2.1E-01	5.9E-02
Radium-224	4.7E+00	1.2E+00	6.4E-01	2.9E-01	3.5E+00	1.1E+00	1.7E+00	8.1E-01
Radium-226	*	*	*	*	*	*	9.0E-01	1.7E+00
Thallium-208	2.5E-01	5.7E-02	8.8E-02	2.2E-02	3.8E-01	8.1E-02	3.5E-01	1.0E-01
Thorium-231	1.8E-01	1.3E-01	*	*	*	*	*	*
Thorium-234	3.5E-01	2.6E-01	2.1E-01	2.1E-01	9.0E-01	3.3E-01	1.6E+00	4.8E-01
Uranium-235	1.4E-01	3.9E-02	4.8E-02	1.4E-02	1.4E-01	4.3E-02	1.9E-01	1.0E-01

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample A		Sample B		Sample		Sample	
	Result	Uncert.	Result	Uncert.	Result	Uncert	Result	Uncert
Actinium-228	7.7E-01	1.4E-01	7.7E-01	1.4E-01				
Bismuth-211	3.6E-02	2.9E-01	1.9E-01	3.2E-01				
Bismuth-212	9.0E-01	3.3E-01	9.8E-01	2.9E-01				
Bismuth-214	6.4E-01	1.2E-01	6.2E-01	1.2E-01				
Cesium-137	-4.0E-03	1.1E-02	-7.9E-03	1.0E-02				
Lead-210	*	*	*	*				
Lead-212	6.9E-01	1.2E-01	7.7E-01	1.4E-01				
Lead-214	6.2E-01	1.2E-01	6.4E-01	1.3E-01				
Potassium-40	9.7E+00	1.8E+00	1.1E+01	2.1E+00				
Protactinium-231	1.3E-01	4.2E-01	*	*				
Radium-223	5.9E-02	6.6E-02	9.8E-02	6.1E-02				
Radium-224	8.3E-01	4.0E-01	1.3E+00	5.3E-01				
Thallium-208	2.3E-01	4.7E-02	2.5E-01	5.0E-02				
Thorium-231	4.3E-02	3.0E-01	7.5E-02	2.7E-01				
Thorium-234	1.3E+00	4.1E-01	6.6E-01	3.9E-01				
Uranium-235	9.7E-02	2.6E-02	9.5E-02	2.6E-02				

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma: ±).

* - Not detected.

400559

Li Tungsten Site

Rad Analysis Summary

Project Number 34215

Parameter	Sample 041		Sample 042		Sample 043		Sample 044	
	Result	Uncert.	Result	Uncert.	Result	Uncert.	Result	Uncert.
Actinium-228	9.9E-01	1.8E-01	1.1E+00	1.9E-01	1.1E+00	2.0E-01	4.2E+00	7.0E-01
Bismuth-211	4.1E-01	4.2E-01	3.4E-01	4.9E-01	1.2E+00	6.0E-01	7.4E+00	3.6E+00
Bismuth-212	1.1E+00	3.6E-01	1.1E+00	3.6E-01	1.3E+00	4.9E-01	5.1E+00	1.2E+00
Bismuth-214	9.1E-01	1.7E-01	1.0E+00	1.8E-01	1.4E+00	2.4E-01	1.0E+01	1.7E+00
Cesium-137	9.3E-03	1.5E-02	2.9E-02	1.6E-01	9.6E-03	1.6E-02	3.1E-02	2.9E-02
Lead-210	1.2E+00	4.9E+00	*	*	1.1E+00	4.2E+00	9.1E+00	3.6E+01
Lead-212	6.4E-01	1.2E-01	1.1E+00	1.9E-01	6.9E-01	1.4E-01	3.4E+00	6.4E-01
Lead-214	7.6E-01	1.6E-01	1.0E+00	2.0E-01	9.7E-01	2.1E-01	7.6E+00	1.4E+00
Potassium-40	1.2E+01	2.2E+00	1.1E+01	2.0E+00	1.1E+01	2.0E+00	1.2E+01	2.4E+00
Protactinium-231	1.0E+00	8.3E-01	*	*	1.5E+00	8.6E-01	4.9E-01	1.3E+00
Radium-223	*	*	1.1E-01	9.0E-02	4.9E-02	3.1E-02	5.7E-01	1.7E-01
Radium-224	1.6E+00	7.5E-01	1.4E+00	5.9E-01	4.3E+00	1.1E+00	8.5E+00	3.0E+00
Radium-226	*	*	*	*	*	*	9.7E+00	4.1E+00
Thallium-208	2.5E-01	5.2E-02	3.5E-01	6.8E-02	3.7E-01	7.4E-02	1.3E+00	2.3E-01
Thorium-231	*	*	6.4E-02	4.0E-01	*	*	1.1E+00	7.7E-01
Thorium-234	4.5E-01	2.7E-01	1.3E+00	4.6E-01	8.1E-01	3.0E-01	1.0E+01	2.1E+00
Uranium-235	9.8E-02	3.2E-02	1.5E-01	3.6E-02	1.8E-01	4.4E-02	7.8E-01	2.3E-01

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma; ±).

* - Not detected.

Li Tungsten Site								
Rad Analysis Summary								
Project Number 34215								
Parameter	Sample 032A		Sample 033A		Sample 034A		Sample 040A	
	Result	Uncert.	Result	Uncert.	Result	Uncert	Result	Uncert
Pulonium-210	7.9E-01	4.4E-01	6.6E-01	3.7E-01	8.5E-01	4.4E-01	3.0E+00	6.9E-01

All units are pCi/g unless otherwise specified.

Uncert. - Degree of uncertainty (2 sigma; ±).

FOSTER WHEELER ENVIRONMENTAL CORPORATION

August 10, 1998
ARCSII-074-98-181

Mr. Ed Als, Regional Project Manager
U.S. Environmental Protection Agency
290 Broadway, 20th Floor
New York, New York 10007-1866

SUBJECT: USEPA CONTRACT NO.: 69-W8-0110
USEPA WORK ASSIGNMENT NO.: 074-2R2B
MATTIACE PETROCHEMICAL SITE OU-3 AND OU-4
GLEN COVE, NEW YORK
GLEN COVE CREEK SAMPLING DATA

Dear Mr. Als:

Please find enclosed the data for the Glen Cove Creek sampling event. If you have any questions or need any additional information, please call me at (973) 597-7413.

Sincerely yours,

Marlene B. Lindhardt, CHMM
Site Manager

MBL/mie

Enclosures

cc: File

400562

8 PEACH TREE HILL ROAD, LIVINGSTON, NJ 07039
TEL: 973-597-7000 FAX: 973-597-7433

USEPA WORK ASSIGNMENT NUMBER 074-2R2B
USEPA CONTRACT NUMBER 68-W8-0110
FOSTER WHEELER ENVIRONMENTAL CORPORATION

FINAL

OU-3 AND 0U-4 REMEDIAL ACTION
GLEN COVE CREEK SAMPLING DATA
MATTIACE PETROCHEMICAL COMPANY SITE
TOWN OF GLEN COVE
LONG ISLAND, NEW YORK

AUGUST 1998

NOTICE

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MATTIACE PETROCHEMICAL SITE
OU-3 AND OU-4 REMEDIAL ACTION
GLEN COVE CREEK SAMPLING
FINAL REPORT

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1.0 INTRODUCTION

In May 1998, Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) conducted a sampling event within the Glen Cove Creek in accordance with the EPA WAF dated April 1998. The objectives of this sampling event were:

- Evaluate the Glen Cove Creek water column in the vicinity of the site to determine existing water quality and any increase or decrease in contaminant levels over time along with any contaminant spatial distribution patterns; and

- Evaluate the Glen Cove Creek sediment in the vicinity of the site to establish current sediment quality and to determine any spatial/temporal variations in contaminant levels.

Any spatial and/or temporal variation in contaminant levels were determined by comparing these data to data collected during similar sampling events previously reported in 1991 and 1995, and by comparing contaminant levels among sampling locations within each sampling event.

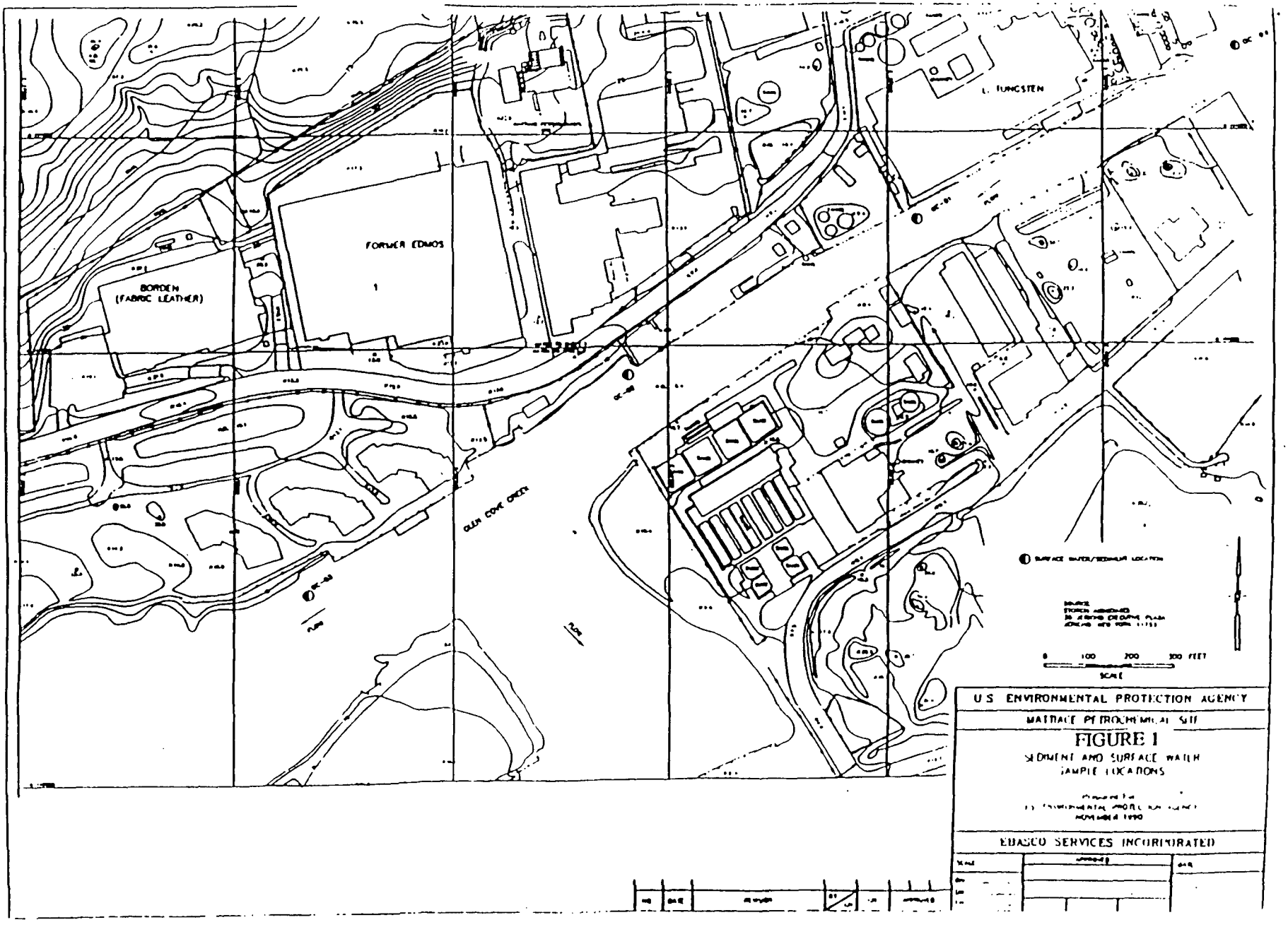
2.0 HISTORY OF FIELD INVESTIGATIONS

As part of the Remedial Investigation (RI) field work in 1989, IT Corporation as a subcontractor to Foster Wheeler Environmental (formerly Ebasco), collected three surface water and three sediment samples in Glen Cove Creek. The sample results were presented in the Final Remedial Investigation Report, Operable Unit One dated April, 1991. The samples were collected at locations designated GC-01 through GC-03 (see Figure 1).

In June 1995, Foster Wheeler Environmental collected four samples in Glen Cove Creek. Three samples corresponded to the same locations as those collected during the RI. The fourth sample (GC-04) was collected upstream of the Li Tungsten Superfund site.

On May 19, 1998, Foster Wheeler Environmental collected four samples (GC-01 through GC-04) in Glen Cove Creek at approximately the same locations of the previous sampling events. Glen Cove Creek is tidally influenced and fluctuates accordingly. Upstream is designated as the point furthest from Hempstead Harbor.

Figure 1 shows the locations of the sample points. Summary tables of all analytical data for the sampling events discussed above are provided in Section 5.0 and discussed in Section 6.0.


BORDEN
(FABRIC LEATHER)
FORMER EDMOS
GLEN COVE CREEK
L. TUNGSTEN
0 100 200 300 FEET
SCALE
U.S. ENVIRONMENTAL PROTECTION AGENCY
MATTACE PETROCHEMICAL SITE
FIGURE 1
SEDIMENT AND SURFACE WATER
SAMPLE LOCATIONS
EBASCO SERVICES INCORPORATED

400568

3.0 SUMMARY OF MAY 1998 FIELD PROGRAM

The objectives of the 1998 sampling event were accomplished through the collection of sediment and water samples from four locations on Glen Cove Creek as presented in Figure 1. One mid-depth surface water and one sediment sample were collected at each location in addition to required QA/QC samples. The samples were analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics, polychlorinated biphenyls (PCBs), pesticides and tungsten. In addition, field measurements of water depth, specific conductivity, pH and temperature were determined on the surface water at the time of collection. All laboratory analytical work was performed by DataChem Laboratories of Salt Lake City, Utah and IEA of Whippany, New Jersey. Both of these laboratories are certified by NYSDOH.

4.0 MAY 1998 FIELD PROGRAM ANALYTICAL RESULTS

Tables 1 through 5 present the analytical data for the May 1998 sediment sampling event. These data are discussed in Section 4.1. Tables 6 through 11 provide the surface water data which is discussed in Section 4.2. It should be noted that only those contaminants that exhibited concentrations greater than the detection limits are presented in these data tables.

Appendix A presents the complete surface water and sediment data packages for the May 1998 sampling event.

4.1 SEDIMENT DATA

TAL Metals in Sediments

Metals data for sediment samples obtained in May 1998 are presented in Table 1. Based on the 1989 RI report, heavy metals of concern include arsenic, cadmium, cobalt and mercury. As shown in Table 1, arsenic and cadmium were present at all sampling locations at concentrations ranging from 1.4 to 15.9 mg/kg, and 0.49 to 51.5 mg/kg, respectively. In contrast, cobalt and mercury were only detected at location GC-01 and GC-02 at levels ranging from 11.8 to 24.8 mg/kg and 0.32 to 0.51 mg/kg, respectively. Concentration maxima for all four of these metals occurred at sampling locations GC-01 or GC-02 (just slightly adjacent and downstream of the Li Tungsten facility and the next sampling location further downstream, respectively - see Figure 1), after which concentrations diminished at successive downstream locations. This same pattern was also noted for seven other metals (Ba, Be, Cu, Mn, Ni, Se, Ag, V and Zn) and suggests the Li Tungsten facility may be the source of these elevated metals concentrations in the Glen Cove Creek sediment.

TABLE 1

ANALYTICAL RESULTS FOR TARGET ANALYTE METALS IN SEDIMENT

	MPRS-SD04-02 GC-04 mg/kg	MPRS-SD01-02 GC-01 mg/kg	MPRS-SD02-02 GC-02 mg/kg	MPBD-SD02-02 GC-02D mg/kg	MPRS-SD03-02 GC-03 mg/kg
Aluminum	5280	8000	14400	12200	3220
Antimony	23.2 B	20.2 B	--	--	--
Arsenic	5.9	15.9	13.8	12.1	1.4 B
Barium	35.8 B	51.3B	68.5B	57.7B	8.0 B
Beryllium	0.21 B	0.47B	0.71B	0.57B	0.13 B
Cadmium	2.7	5.2	51.5	6.1	0.49 B
Calcium	7220	17200	8950	11400	2640
Chromium	33.3	36.0	65.9	60.2	8.0
Cobalt	--	24.8	11.8 B	16.2 B	--
Copper	71.8	224	362	297	1714
Iron	13700	19000	28600	21900	4580
Lead	121	167	181	164	11.5
Magnesium	5320	6670	8090	7080	1010 B
Manganese	115	205	243	203	37.7
Mercury	--	0.32	0.51	0.45	--
Nickel	13.2 B	43.1	35.5	33.9	--
Potassium	1450 B	1800 B	3910	3480	657 B
Selenium	0.96 B	2.4	2.4B	--	--
Silver	4.3	23.4	30.3	24.1	2.1 B
Sodium	6880	10800	20900	20300	3610
Vanadium	22.5	31.7	51.1	42	8.0 B
Zinc	164	299	338	290	39.9

NOTES:
1. B = Analyte detected in associated blank as well as the sample.
2. -- =- Compound was not detected.

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TABLE 2

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST VOLATILE ORGANICS IN SEDIMENT

COMPOUND	MPRS-SD04-02 GC-04 ug/kg	MPRS-SD01-02 GC-01 ug/kg	MPRS-SD02-02 GC-02 ug/kg	MPRD-SD02-02 GC-02D ug/kg	MPRS-SD03-02 GC-03 ug/kg
Acetone	--	35 B	31 B	67 B	15 B

NOTES:

1. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.
2. -- = Compound was not detected.

400571

TABLE 3

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST SEMI-VOLATILE ORGANICS IN SEDIMENT

COMPOUND	MPRS-SD04-02 GC-04 ug/kg	MPRS-SD01-02 GC-01 ug/kg	MPRS-SD02-02 GC-02 ug/kg	MPRD-SD02-02 GC-02D ug/kg	MPRS-SD03-02 GC-03 ug/kg
Acenaphthene	400 J	--	--	--	--
Dibenzofuran	200 J	--	--	--	--
Fluorene	360 J	--	--	--	--
Phenanthrene	3900	--	--	--	--
Anthracene	600 J	--	--	--	--
Carbazole	430 J	--	--	--	--
Di-n-butylphthalate	230 J	--	--	--	--
Fluoranthene	5800	--	--	--	--
Pyrene	5500	--	--	--	--
Butylbenzylphthalate	1200 J	--	--	--	--
Benzo(a)anthracene	2300	--	--	--	--
Chrysene	2500	--	--	--	--
Bis(2-ethylhexyl)phthalate	1400	--	--	--	--
Benzo(b)fluoranthene	2700	--	--	--	--
Benzo(k)fluoranthene	740 J	--	--	--	--
Benzo(a)pyrene	1900	--	--	--	--
Indeno(1,2,3-cd)pyrene	1400	--	--	--	--
Dibenzo(a,h)anthracene	370 J	--	--	--	--
Benzo(g,h,i)perylene	1700	--	--	--	--
Tentatively Identified Compounds	22170 JN	3910 JB	1420 J	5110 J	1960 J

Notes:
1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.

400572

TABLE 4

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST PESTICIDES AND PCBS IN SEDIMENT

Compound	MPRS-SD04-02 GC-04 ug/kg	MPRS-SD01-02 GC-01 ug/kg	MPRS-SD02-02 GC-02 ug/kg	MPRD-SD02-02 GC-02D ug/kg	MPRS-SD03-02 GC-03 ug/kg
alpha-BHC	--	4.1 J	0.50 J	--	--
delta-BHC	--	2.1 JP	--	--	--
gamma-BHC (Lindane)	--	--	0.65 JP	0.27 JP	--
Aldrin	2.4 J	--	--	--	--
Heptachlor epoxide	1.4 JP	--	--	--	--
Endosulfan I	--	--	--	--	0.63 J
Dieldrin	5.5 JP	3.2 JP	4.4 JP	3.7 J	--
4,4'-DDE	8.6 NJ	15 NJ	5.6 JP	7.8 JP	0.75 JP
Endrin	11 NJ	12 NJ	3.6 JP	3.8 JP	2.0 J
4,4'-DDD	20	21 J	5.4 JP	7.3 JP	0.37 JP
4,4'-DDT	12 NJ	26 NJ	--	--	--
alpha-Chlordane	13 NJ	9.8 NJ	4.0 JP	4.4 JP	0.64 JP
gamma-Chlordane	13	13	2.1 JP	3.2 JP	--
Methoxychlor	--	--	--	--	24 J
Aroclor-1254	69 J	240 J	61 JP	90 NJ	--

NOTES:
1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. P = A pesticide/Aroclor compound had a greater than 25 percent difference for the detected concentrations between two gas chromatograph columns.
4. NJ = Presumptive evidence indicates that the compound is present at the concentration listed. The level reported is approximate.

TABLE 5

ANALYTICAL RESULTS FOR TUNGSTEN IN SEDIMENT

	MPRS-SD04-02 GC-04 mg/kg	MPRS-SD01-02 GC-01 mg/kg	MPRS-SD02-02 GC-02 mg/kg	MPRS-SD02-02 GC-02D mg/kg	MPRS-SD03-02 GC-03 mg/kg
Tungsten	18	110	33	24	<5

TABLE 6

ANALYTICAL RESULTS FOR TARGET ANALYTE METALS IN SURFACE WATER

	MPRS-SW04-02 GC-04 ug/l	MPRS-SW01-02 GC-01 ug/l	MPRS-SW02-02 GC-02 ug/l	MPRD-SW02-02 GC-02D ug/l	MPRS-SW03-02 GC-03 ug/l
Aluminum	129 B	58.6 B	--	54.4 B	82.2 B
Barium	29.4 B	10.2 B	7.4 B	7.7 B	7.6 B
Cadmium	7.4	3.4 B	--	--	--
Calcium	95800	228000	231000	232000	225000
Iron	591	276	151	170	234
Magnesium	271000	742000	748000	746000	731000
Manganese	80.9	58.7	36.4	37.3	39.5
Mercury	--	--	--	0.14 B	--
Potassium	89400	256000	250000	242000	242000
Sodium	2360000	7540000	7390000	7140000	7620000
Thallium	5.1B	5.8 B	5.6 B	6.3B	4.9 B
Vanadium	--	--	--	4.2 B	--
Zinc	16.1 B	16.7 B	9 B	--	--

NOTES:
1. -- = Compound was not detected.
2. B = Analyte detected in associated blank as well as the sample.

400574

TABLE 7

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST VOLATILE ORGANICS IN SURFACE WATER

COMPOUND	MPRS-SW04-02 GC-04 ug/l	MPRS-SW01-02 GC-01 ug/l	MPRS-SW02-02 GC-02 ug/l	MPRS-SW02-02 GC-02D ug/l	MPRS-SW03-02 GC-03 ug/l
Methylene Chloride	--	--	--	--	--
Tetrachloroethene	16	--	--	--	--
1,1,2,2-Tetrachloro-ethane	10 J	10 J	10 J	10 J	10 J
2-Butanone	10 J	10 J	10 J	10 J	10 J
4-Methyl-2-Pentanone	10 J	10 J	10 J	10 J	10 J
2-Hexanone	10 J	10 J	10 J	10 J	10 J
Tentatively Identified Compounds	--	--	--	--	--

NOTES:

1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.

TABLE 8

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST SEMI-VOLATILE ORGANICS IN SURFACE WATER

COMPOUND	MPRS-SW04-02 GC-04 ug/l	MPRS-SW01-02 GC-01 ug/l	MPRS-SW02-02 GC-02 ug/l	MPRS-SW02-02 GC-02D ug/l	MPRS-SW03-02 GC-03 ug/l
2,4-Dinitrophenol	26 J	--	--	--	280 J
TICs	6 J	--	2JB	3JB	3JB

NOTES:

1. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.

TABLE 9

ANALYTICAL RESULTS FOR TARGET COMPOUND LIST PESTICIDES AND PCBs IN SURFACE WATER

Compound	MPRS-SW04-02 GC-04 ug/l	MPRS-SW01-02 GC-01 ug/l	MPRS-SW02-02 GC-02 ug/l	MPRS-SW02-02 GC-02D ug/l	MPRS-SW03-02 GC-03 ug/l
delta-BHC	--	--	--	--	--
gamma-BHC (Lindane)	--	--	--	--	--
Heptachlor	--	0.02 J	--	--	--
Dieldrin	--	0.02 J	--	--	--
Endrin	--	--	--	--	--
4,4-DDD	--	--	--	0.04 J	--
4,4-DDT	--	--	--	--	--
Endosulfan Sulfate	--	--	--	--	--
Methoxychlor	0.52 J	0.54 J	0.59 J	0.56 J	0.57 J
Endrin Aldehyde	--	--	--	--	--

NOTES:
1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.

TABLE 10

ANALYTICAL RESULTS FOR TUNGSTEN IN SURFACE WATER

	MPRS-SW04-02 GC-04 mg/l	MPRS-SW01-02 GC-01 mg/l	MPRS-SW02-02 GC-02 mg/l	MPRS-SW02-02 GC-02D mg/l	MPRS-SW03-02 GC-03 mg/l
Tungsten	<0.2	<0.2	<0.2	<0.2	<0.2

TABLE 11

RESULTS OF FIELD PARAMETERS IN SURFACE WATER

Parameter	SW04	SW01	SW02	SW03
Depth of Water (ft.)	3	9	7	12
Depth of Sample (ft.)	1.5	4.5	3.5	6
Temperature (°C)	62	65.7	62.9	64
pH	7.43	8.25	8.09	8.23
Conductivity (umhos/cm)	0.12	0.12	0.13	0.13

It should be noted that partial dredging of the Creek was performed in early 1997 by the Corps of Engineers from the mouth of the Creek up to the vicinity of GC-02, which may account for the much reduced concentrations of all metals seen at location GC-03. However, these reduced concentrations at the furthest downstream sampling location do not appear to be influencing/causing the distributional patterns observed since metals concentrations are lower or are non-detects at the furthest upstream location (GC-04), which then increase to maximum values at either GC-01 or GC-02 (which also was within the dredging footprint) before declining at successive downstream sampling locations.

Volatile Organics in Sediments

Only one volatile organic compound, acetone, was detected in the Glen Cove Creek sediments in 1998 (see Table 2). This compound was also present in the laboratory method blanks and therefore, may have been introduced into the samples at the laboratory.

Semi-volatile Organics in Sediments

Nineteen semi-volatile organic compounds plus numerous tentatively identified compounds (TICs) identified in the GC/MS library search were detected in the 1998 sediment samples. As shown in Table 3, target list semi-volatile compounds were only present in the furthest upstream sampling location (GC-04) at concentrations ranging from 200 to 5800 ug/kg, whereas TICs were found at all sampling locations. Although the exact source or sources of these compounds are unknown, all of these compounds are constituents of petroleum fuels, oil and grease and their presence only in the upstream location indicates a probable further upstream non-point source (e.g., road/stormwater runoff, etc.) or specific point source (e.g., oil/fuel spill, etc.).

Pesticides and PCBs in Sediments

Fourteen pesticides and one PCB (Aroclor 1254) were detected in the Glen Cove Creek sediment samples collected in 1998 (see Table 4). Pesticides typically were detected sporadically among the sampling locations at low concentration levels (i.e., <27 ug/kg), except for Endrin, DDE, DDD and Chlordane, which were present at all locations. Maximum concentrations of pesticides occurred in the furthest upstream sampling locations (GC-04 or GC-01) with no discernible distributional pattern. Aroclor 1254 was detected only at sampling locations GC-04, GC-01 and GC-02 at concentration levels ranging from 61 to 240 ug/kg. The maximum PCB concentration occurred at the sampling location adjacent and slightly downstream (GC-01) of the Li Tungsten facility and suggests that this facility may be a potential source area for PCB sediment contamination in Glen Cove Creek.

Tungsten in Sediments

Sediment tungsten data for the 1998 sampling event is presented in Table 5. As Table 5 illustrates, tungsten concentrations ranged from non-detect to 110 mg/kg in the Glen Cove Creek sediments. The highest concentration of tungsten in sediment was present at location GC-01, which is directly adjacent and slightly downstream of the Li Tungsten Superfund Site, and the distributional pattern for tungsten present among the creek sampling locations (see Table 5) indicates the Li Tungsten facility as the potential source area of this metal contaminant.

4.2 SURFACE WATER DATA

TAL Metals in Surface Water

The primary metal contaminants of concern, manganese and thallium, as indicated by the 1989 Risk Assessment, were present in all 1998 surface water samples at concentrations ranging from 36.4 to 80.9 ug/l and 4.9 to 6.3 ug/l, respectively. Manganese concentrations were greatest in the furthest upstream sampling location (GC-04) and progressively declined within the successive downstream sampling locations (see Table 6), suggesting a further upstream source of this metal in Glen Cove Creek surface water. In contrast, thallium levels were fairly comparable among all sampling locations. Although some exceptions were noted, in general, most metals detected in surface water exhibited a similar distributional pattern as that seen for manganese.

Volatile Organics in Surface Water

Five volatile organic compounds were detected in Glen Cove Creek surface water during the 1998 sampling event (see Table 7). Tetrachloroethene was present at 16 ug/l only at the furthest upstream sampling location (GC-04), which suggests a further upstream probable source. Three ketones (2-butanone, 4-methyl-2-pentanone, 2-hexanone) and 1,1,2,2-tetrachloroethane were detected at all sampling locations at a concentration of 10 ug/l.

Semi-volatile Organics in Surface Water

Table 8 presents the semi-volatile compounds detected in surface water during the 1998 sampling event. As the Table indicates, only 2,4-dinitrophenol was present at 26 ug/l at the furthest upstream sampling location (GC-04) and 280 ug/l at the furthest downstream sampling location (GC-03). Additionally, several TICs ranging in concentration from 2 to 3 ug/l were noted in samples from locations GC-04, GC-02 and GC-03. The probable source of these compounds is currently unknown.

Pesticides and PCBs in Surface Water

Only four pesticides (Heptachlor, Dieldrin, DDD and Methoxychlor) were detected at very low concentration levels (i.e., 0.02 to 0.59 ug/l) in the 1998 surface water samples (see Table 9). Methoxychlor exhibited fairly consistent concentration levels (~0.56 ug/l) among all sampling locations, whereas Heptachlor and Dieldrin were only present at sampling location GC-01 at a concentration of 0.002 ug/l. Similarly, DDD was only detected at 0.04 ug/l at location GC-02. No PCBs were detected in any of the surface water samples.

Tungsten in Surface Water

Tungsten was not detected in any surface water sample during the 1998 sampling event.

5.0 DATA SUMMARY - 1989, 1995 AND 1998 FIELD PROGRAMS

This section summarizes the 1989, 1995 and 1998 sampling events data in tabular format to assist in the determination of any apparent trends in contaminant levels among sample locations and/or with time in the surface water and sediments of Glen Cove Creek. For comparative purposes, the tables do not include analyses from duplicate samples. Discussion of these data are provided in Section 6.0, Conclusions.

Sample location GC-04 and the analytical parameter tungsten were added to the long-term creek monitoring program after the 1991 Record of Decision for the Mattiace site, in order to assess possible contributions from the neighboring Li Tungsten Superfund site. Therefore, the analytical results for 1989 do not include data for location GC-04, nor for tungsten at locations GC-01 through GC-03.

5.1 SEDIMENT DATA

Tables 12 through 16 present sediment data by analytical fraction for the 1989, 1995 and 1998 sampling events in Glen Cove Creek. Only analytes detected within one or more sampling location at each sampling event are listed in the tables.

5.2 SURFACE WATER DATA

Tables 17 and 18 present surface water data by analytical fraction for samples collected in 1989, 1995 and 1998. Data tables are not provided for analyses that were below detection limits or for analytes that were only detected in the 1998 sampling round.

It is important to note that in 1989, the surface water samples were analyzed for total dissolved metals (filtered) and total metals (unfiltered). The data in Table 17 from 1989 are the total metals results unless noted otherwise.

TABLE 12

COMPARISON OF ANALYTICAL RESULTS FOR METALS IN SEDIMENT

	GC-04 mg/kg 1995	GC-04 mg/kg 1998	GC-01 mg/kg 1989	GC-01 mg/kg 1995	GC-01 mg/kg 1998	GC-02 mg/kg 1989	GC-02 mg/kg 1995	GC-02 mg/kg 1998	GC-03 mg/kg 1989	GC-03 mg/kg 1995	GC-03 mg/kg 1998
Aluminum	1200	5280	10700	6700	8000	16300J	8800	14400	16200J	14000	3220
Antimony	--	23.2 B	30.5	16	20.2B	--	--	--	--	--	--
Arsenic	0.42	5.9	22	--	15.9	35.4J	18	13.8	17.5J	16	1.4 B
Barium	--	35.8 B	60.4BJ	509	51.3B	89.9J	70	68.5B	91.3BJ	96	8.0 B
Beryllium	--	0.21 B	--	--	0.47B	--	--	0.71B	--	--	0.13 B
Cadmium	--	2.7	6.9J	10	5.2	10.0J	12	51.5	11.3J	--	0.49 B
Calcium	3100	7220	11800J	6200	17200	10100J	10000	8950	6550J	12000	2640
Chromium	6.9 J	33.3	42.5J	43	36.0	88.1J	58	65.9	97.3J	94	8.0
Cobalt	2.8 J	--	46.5J	30	24.8	28.2BJ	26	11.8	34.2J	18J	--
Copper	20	71.8	377J	260	224	571J	400	362	663J	640	1714
Iron	3600	13700	20600J	15000	19000	3010J	17000	28600	28900J	30000	4580
Lead	39	121	410	260	167	770	330	181	490	290	11.5
Magnesium	1900	5320	8200J	180	6670	12300J	6100	8090	9930J	12000	1010 B
Manganese	115	115	277J	--	205	311J	--	243	279J	--	37.7
Mercury	--	--	1.7J	--	0.32	2.5J	1	0.51	2.0J	--	--
Nickel	5.6 J	13.2 B	98.2J	46	4.31	41.1J	50	35.5	40.5J	51	--
Potassium	2300	1450 B	2080BJ	1400	1800B	4590J	1900	3910	4190J	4000	657 B
Selenium	1.4	0.96 B	--	--	2.4	--	0.96 J	2.4B	--	2 J	--
Silver	5.6 J	4.3	--	27	23.4	--	47	30 3	6.6	83	2 1 B
Sodium	3100	6880	16300J	10000	10800	31600J	8000	20900	20800J	26000	3610
Vanadium	5.6 J	22.5	28.1BJ	23	31.7	54.5J	33	51.1	60J	55	8 0 B
Zinc	39	164	361J	340	299	533J	430	338	442J	460	39.9

1. B = Analyte detected in associated blank as well as the sample.
2. -- = Compound was not detected.

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TABLE 13

COMPARISON OF ANALYTICAL RESULTS FOR VOLATILE ORGANICS IN SEDIMENT

COMPOUND	GC-04 ug/kg 1995	GC-04 ug/kg 1998	GC-01 ug/kg 1989	GC-01 ug/kg 1995	GC-01 ug/kg 1998	GC-02 ug/kg 1989	GC-02 ug/kg 1995	GC-02 ug/kg 1998	GC-03 ug/kg 1989	GC-03 ug/kg 1995	GC-03 ug/kg .1998
Methylene Chloride	25 JB	--	49	40 JB	--	63BJ	12 JB	--	54BJ	74	--
Acetone	10 JB	--	1400	51 JB	35 B	2100	43 JB	67 B	540	300 J	15 B
Carbon Disulfide	--	--	260	--	--	640	--	--	100	--	--
Trans-1,2- dichloro-ethene	--	--	13J	--	--	--	--	--	--	--	--
Chloroform	--	--	21.0BJ	--	--	34BJ	--	--	17BJ	--	--
2-Butanone	--	--	--	14 J	--	--	--	--	1200	--	--
Trichloroethene	--	--	41.0J	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	25J	--	--	6J	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--

NOTES:
1. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.
2. -- = Compound was not detected.

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TABLE 14

COMPARISON OF ANALYTICAL RESULTS FOR SEMI-VOLATILE ORGANICS IN SEDIMENT

COMPOUND	GC-04 ug/kg 1995	GC-04 ug/kg 1998	GC-01 ug/kg 1989	GC-01 ug/kg 1995	GC-01 ug/kg 1998	GC-02 ug/kg 1989	GC-02 ug/kg 1995	GC-02 ug/kg 1998	GC-03 ug/kg 1989	GC-03 ug/kg 1995	GC-03 ug/kg 1998
4-Methylphenol	--	--	--	--	--	3800	--	--	--	--	--
Acenaphthene	--	400 J	--	--	--	--	--	--	--	--	--
Dibenzofuran	--	200 J	--	--	--	--	--	--	--	--	--
Fluorene	98 J	360 J	--	120 J	--	--	--	--	--	--	--
Phenanthrene	860	3900	4200	970	1400 J	--	190 J	--	550J	--	--
Anthracene	190 J	600 J	--	200 J	--	--	--	--	--	--	--
Carbazole	--	430 J	--	--	--	--	--	--	--	--	--
Di-n-butylphthalate	160 J	230 J	--	390 J	--	--	380 J	--	--	--	--
Fluoranthene	1600	5800	7100	1500	--	3600	440 J	--	1600J	460 J	--
Pyrene	1400	5500	5900	990	--	3700	330 J	--	1800	330 J	--
Butylbenzylphthalate	--	1200 J	1200J	--	--	--	--	--	--	--	--
Benzo(a)anthracene	790 J	2300	2200	530 J	--	--	220 J	--	680J	--	--
Chrysene	890	2500	3700	660 J	--	2200	250 J	--	940J	--	--
Bis(2-ethylhexyl)phthalate	--	1400	13000	560 J	--	21000	--	--	12000	--	--
Benzo(b)fluoranthene	580	2700	--	590 J	--	--	230 J	--	--	--	--
Benzo(k)fluoranthene	660	740 J	--	730	--	2600	--	--	1400J	--	--
Benzo(a)pyrene	640	1900	2300	540 J	--	1700J	230 J	--	900J	--	--
Indeno(1,2,3-cd)pyrene	230 J	1400	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	370 J	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	1700	--	--	--	--	--	--	--	--	--

1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.

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TABLE 15

COMPARISON OF ANALYTICAL RESULTS FOR PESTICIDES AND PCBs IN SEDIMENT

Compound	GC-04 ug/kg 1995	GC-04 ug/kg 1998	GC-01 ug/kg 1989	GC-01 ug/kg 1995	GC-01 ug/kg 1998	GC-02 ug/kg 1989	GC-02 ug/kg 1995	GC-02 ug/kg 1998	GC-03 ug/kg 1989	GC-03 ug/kg 1995	GC-03 ug/kg 1998
alpha-BHC	--	--	600	--	4.1 J	15J	--	--	--	--	--
delta-BHC	--	--	--		2.1 JP	980	--	--	280	--	--
gamma-BHC (Lindane)	--	--	--	--	--	--	--	0.27 JP	--	--	--
Aldrin	--	2.4 J	31J	--	--	13J	--	--	11	--	--
Heptachlor epoxide	--	1.4 JP	--	--	--	--	--	--	--	--	--
Endosulfan I	28	--	480	57	--	--	--	--	--	33	0.63 J
Dieldrin	--	5.5 JP	36J	--	3.2 JP	20J	--	3.7 JP	--	--	--
4,4'-DDE	--	8.6 NJ	140	--	15 NJ	98J	--	7.8 JP	52	--	0.75 JP
Endrin	--	11 NJ	--	--	12 NJ	18J	--	3.8 JP	--	--	2.0 J
4,4'-DDD	--	20	270	--	21 J	160	--	7.3 JP	--	--	0.37 JP
4,4'-DDT	--	12 NJ	230	--	26 NJ	78J	--	--	59	--	--
alpha-Chlordane	--	13 NJ	89J	--	9.8 NJ	48J	--	4.4 JP	25	--	0.64 JP
gamma-Chlordane	--	13	140J	16	13	71J	--	3.2 JP	36	--	--
Aroclor-1254	--	69 J	--	--	240 J	--	--	90 NJ	--	--	--

NOTES:
1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate
3. P = A pesticide/Aroclor compound had a greater than 25 percent difference for the detected concentrations between two gas chromatograph columns.
4. NJ = Presumptive evidence indicates that the compound is present at the concentration listed. The level reported is approximate.

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TABLE 16

COMPARISON OF ANALYTICAL RESULTS FOR TUNGSTEN IN SEDIMENT

	GC-04 mg/kg 1995	GC-04 mg/kg 1998	GC-01 mg/kg 1989	GC-01 mg/kg 1995	GC-01 mg/kg 1998	GC-02 mg/kg 1989	GC-02 mg/kg 1995	GC-02 mg/kg 1998	GC-03 mg/kg 1989	GC-03 mg/kg 1995	GC-03 mg/kg 1998
Tungsten	70	18	N/A	210	110	N/A	160	33	N/A	97 J	<5

NOTES:
1. N/A = Not analyzed

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TABLE 17

COMPARISON OF ANALYTICAL RESULTS FOR METALS IN SURFACE WATER

	GC-04 ug/l 1995	GC-04 ug/l 1998	GC-01 ug/l 1989	GC-01 ug/l 1995	GC-01 ug/l 1998	GC-02 ug/l 1989	GC-02 ug/l 1995	GC-02 ug/l 1998	GC-03 ug/l 1989	GC-03 ug/l 1995	GC-03 ug/l 1998
Aluminum	210	129 B	279	220	58.6 B	--	170 J	--	205T	270	82.2 B
Antimony	--	--	--	--	--	--	--	--	--	--	--
Barium	--	29.4 B	--	--	10.2 B	--	--	7.4 B	--	--	7.6 B
Cadmium	--	7.4	--	--	3.4 B	--	--	--	--	--	--
Calcium	300000	95800	171000	310000	228000	161000	140000	231000	177000	290000	225000
Cobalt	51	--	--	55	--	--	--	--	--	40 J	--
Copper	5	--	--	58.7	--	--	--	--	--	--	--
Chromium	--	--	19.4JT	--	--	--	--	--	--	--	--
Iron	430	591	--	250	276	--	340	151	--	260	234
Magnesium	900000	271000	588000	960000	742000	552000	420000	748000	661,000	960000	731000
Manganese	75	80.9	110J	55	58.7	97.9J	52	36.4	74.8J	51	39.5
Mercury	--	--	0.23	--	--	--	--	--	--	--	--
Potassium	280000	89400	204000	290000	256000	191000	120000	250000	210,000	270000	242000
Silver	--	--	--	--	--	9.5	--	--	--	--	--
Sodium	710000000	2360000	5330000	75000000	7540000	4700000	3800000	739000	5530000	7800000	7620000
Thallium	--	5.1B	--	--	5.8 B	11.5	--	5.6 B	--	--	4.9 B
Zinc	17	16.1 B	--	--	16.7 B	--	29	9 B	--	52	--

NOTES:
1. -- = Compound was not detected.
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.

TABLE 18

COMPARISON OF ANALYTICAL RESULTS FOR VOLATILE ORGANICS IN SURFACE WATER

COMPOUND	GC-04 ug/l 1995	GC-04 ug/l 1998	GC-01 ug/l 1989	GC-01 ug/l 1995	GC-01 ug/l 1998	GC-02 ug/l 1989	GC-02 ug/l 1995	GC-02 ug/l 1998	GC-03 ug/l 1989	GC-03 ug/l 1995	GC-03 ug/l 1998
Methylene Chloride	1.8 JB	5 JB	--	1.5 JB	5 JB	--	--	4 JB	--	1.0 J	--
Acetone	--	--	--	--	--	--	8.6 JB	--	--	--	--
2-Butanone	--	--	--	--	--	--	6.5 JB	--	--	--	--
Bromodichloromethane	--	--	0.2J	--	--	1.0J	--	--	1.0	--	--
Trichloroethene	--	--	--	--	--	0.6J	--	--	0.3J	--	--
Dibromochloromethane	--	--	--	--	--	0.6J	--	--	0.6J	--	--
Trans-1,2-dichloroethene	--	--	2.0	--	--	0.8J	--	--	0.4J	--	--
Chloroform	--	--	--	--	--	0.7J	--	--	0.6J	--	--
2-Hexanone	--	--	--	--	--	--	0.41 J	--	--	--	--
Tetrachloroethene	--	16	5.0	--	--	3.0J	--	--	1.0J	--	--
Chlorobenzene	0.62 J	6 J	--	--	--	--	--	--	--	--	--

NOTES:
1. -- = Compound was not detected
2. J = Compound was detected at levels below the practical quantitation limit. The level reported is approximate.
3. B = Analyte detected in associated blank as well as the sample. It indicates possible/probable blank contamination.

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6.0 CONCLUSIONS

Overall there is a general decreasing trend in contaminant concentrations in Glen Cove Creek surface water and sediments over the past nine years. This decline of a vast majority of chemical contaminants may be due wholly or in part to the partial dredging of the Creek in early 1997 by the Corps of Engineers. Dredging began at the mouth of the Creek and proceeded upstream to the vicinity of sampling location GC-02 (see Figure 1). Three notable exceptions to this general trend were: 1) increasing contaminant levels for some contaminants in upstream (GC-04) sediments; 2) the first appearance of low concentrations of PCBs at three locations in sediments; and, 3) the first appearance of pesticides in surface water samples. Each of these will be discussed in greater detail within the individual subsections that follow.

It should be noted that there were differences in the analyses performed for the 1989 samples versus the 1995 and 1998 samples. The 1989 metals analyses on surface water were performed for total (unfiltered) and dissolved (filtered) TCL metals. The remaining sample rounds were only analyzed for total TAL metals. Also, no tungsten analyses was performed in 1989, and no samples were collected from GC-04 (furthest upstream) in 1989. In addition, detection limits for most PCBs have decreased substantially during each successive sampling round. Table 19 provides a comparison of the practical quantitation limits for each sediment sampling round. Regardless, there is sufficient data to make general conclusions about contamination trends in Glen Cove Creek.

6.1 TAL METALS IN SEDIMENTS

Based on the 1989 RI report, the heavy metals of concern include arsenic, cadmium, cobalt and mercury. As Table 12 shows, concentration levels of these metals have fluctuated and generally declined at sampling locations downstream of the Mattiace Petrochemical Superfund site during the 1989 to 1998 period. This is particularly apparent at locations GC-03 and GC-02, and to a lesser extent, at location GC-01. However, there has been an increase in concentrations from 1995 to 1998 for arsenic and cadmium (plus all other metals except cobalt, manganese, mercury, selenium and silver) at the furthest upstream sampling location (GC-04), and for cadmium (plus selenium) at location GC-02.

The decline of most metal contaminants, particularly at location GC-03 and to a lesser extent GC-02, may be due in part to the partial dredging of the Creek in early 1997 by the Corps of Engineers. Dredging began at the mouth of the Creek and proceeded upstream to the vicinity of GC-02. This dredging may account for the dramatic decline noted for all metal constituents at location GC-03, except for manganese, and the fluctuating values for numerous other metals at varying locations, since the dredging operations may have exposed or redistributed sediment contaminated with numerous heavy metals from other areas of Glen Cove Creek.

Changes in concentration levels for arsenic, cadmium, cobalt and mercury from the 1989 to 1998 sampling events at each individual sampling location (1995 to 1998 for location GC-04) proceeding from the furthest upstream to the furthest downstream location are discussed in the text that follows. At sampling location GC-04, arsenic has increased from 0.42 to 5.9 mg/kg,

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cadmium has increased from non-detect to 2.7 mg/kg; cobalt has decreased from 2.8 mg/kg to non-detect; and mercury has remained non-detected since 1995. At sampling location GC-01, arsenic has decreased from 22 to 15.9 mg/kg, cadmium has decreased from 10.0 to 5.2 mg/kg; cobalt has decreased from 46.5 to 24.8 mg/kg; and mercury has decreased from 1.7 to 0.32 mg/kg since 1989. At sampling location GC-02, arsenic has decreased from 35.4 to 13.8 mg/kg, cadmium has increased from 10.0 to 51.5 mg/kg; cobalt has decreased from 28.2 to 11.8 mg/kg; and mercury has decreased from 2.5 to 0.51 mg/kg since 1989. At sampling location GC-03, arsenic has decreased from 17.5 to 1.4 mg/kg, cadmium has decreased from 11.3 to 0.49 mg/kg; cobalt has decreased from 34.2 mg/kg to non-detect; and mercury has decreased from 2.0 mg/kg to non-detect since 1989.

Among Glen Cove Creek sampling locations within each specific sampling interval, the greatest concentrations for all these metals (and Ba, Cr, Pb, Ni, Se, Ag, V and Zn as well) typically occurred at location GC-01 immediately adjacent and slightly downstream from the Li Tungsten facility or GC-02 further downstream. This suggests that the Li Tungsten facility may be the source area for the elevated contaminant concentrations present within the Glen Cove Creek sediment.

6.2 VOLATILE ORGANICS IN SEDIMENTS

There have been significant reductions in the total number (six to one) and concentrations (up to two orders of magnitude) of VOCs within the sediments of Glen Cove Creek since the initial 1989 sampling event. As shown in Table 13, only acetone was currently found in the 1998 sediment samples, and its presence within these samples may be caused entirely by intra-laboratory method blank contamination. Although the methylene chloride, acetone, trans-1,2-dichloroethene, trichloroethene, chloroform, carbon disulfide, and possibly toluene data collected in 1989 suggested the Li Tungsten facility as a probable source of these compounds in Glen Cove Creek sediments, subsequent sampling events showed no indication of volatile contaminants in sediment originating from the facility.

6.3 SEMI-VOLATILE ORGANICS IN SEDIMENTS

The current sampling results indicate a significant decreasing trend in the number and concentrations of semi-volatile compounds at sample points GC-01 through GC-03 (see Table 14) from 1989 to 1998. These observed reductions, particularly in the vicinity of sampling locations GC-02 and GC-03, may be related to the dredging operations that occurred in 1997. However, at location GC-04, the furthest upgradient sample point is showing an increase in semi-volatile organic constituents and their concentrations from 1995 to 1998. Considering most of the semi-volatile compounds present are typical constituents of petroleum products (i.e., gasoline, fuel/lubricating oils, grease) or components of plastics/carrier bases of pigments/paints (e.g., phthalate esters), their presence in Glen Cove Creek sediments is not unexpected, especially due to the highly industrialized/urban surrounding area. Thus, the semi-volatile organic compounds present in Glen Cove Creek are most probably associated with non-point source (e.g., road runoff and/or storm sewer discharges, etc.) and/or other past historical releases (e.g., oil spills, etc.), not one specific source area.

TABLE 19

COMPARISON OF SEDIMENT PQLs FOR PCBs

TARGET COMPOUND LIST PESTICIDES AND PCBs					
1998 - Sample Designation					
Compound	MPRS-SD01-02	MPRS-SD02-02	MPRS-SD02-02	MPRS-SD03-02	MPRS-SD04-02
Aroclor-1016	80 U	92 U	97 U	46 U	63 U
Aroclor-1221	160 U	190 U	200 U	93 U	130 U
Aroclor-1232	80 U	92 U	97 U	46 U	63 U
Aroclor-1242	80 U	92 U	97 U	46 U	63 U
Aroclor-1248	80 U	92 U	97 U	46 U	63 U
Aroclor-1254	240	92 U	90 N	46 U	69 J
Aroclor-1260	80 U	92 U	97 U	46 U	63 U

TARGET COMPOUND LIST PESTICIDES AND PCBs					
1995 - Sample Designation					
Compound	MPRS-SD01-01	MPRS-SD02-01	MPRS-SD02-01	MPRS-SD03-01	MPRS-SD04-01
Aroclor-1016	88 U	100 U	100 U	190 U	57 U
Aroclor-1221	88 U	100 U	100 U	190 U	57 U
Aroclor-1232	88 U	100 U	100 U	190 U	57 U
Aroclor-1242	88 U	100 U	100 U	190 U	57 U
Aroclor-1248	88 U	100 U	100 U	190 U	57 U
Aroclor-1254	88 U	100 U	100 U	190 U	57 U
Aroclor-1260	88 U	100 U	100 U	190 U	57 U

TARGET COMPOUND LIST PESTICIDES AND PCBs					
1989 - Sample Designation					
Compound	MP-GC01-SD01	MP-GC02-SD01		MP-GC03-SD01	MP-GC03-SD02 (Dup. of MP-GC03-SD01)
Aroclor-1016	410 U	520 U		400 U	350 U
Aroclor-1221	410 U	520 U		400 U	350 U
Aroclor-1232	410 U	520 U		400 U	350 U
Aroclor-1242	410 U	520 U		400 U	350 U
Aroclor-1248	410 U	520 U		400 U	350 U
Aroclor-1254	820 U	1000 U		800 U	700 U
Aroclor-1260	820 U	1000 U		800 U	700 U

1. All results expressed in micrograms per kilogram (ug/kg).
2. U - Compound was analyzed for but not detected. The preceeding number is the practical quantitation limit for the compound.

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6.4 PESTICIDES AND PCBs IN SEDIMENTS

Thirteen pesticides have been detected at one time or another during the 1989 to 1998 period at the various sampling locations within Glen Cove Creek. In general, most pesticides have exhibited reductions in concentration levels over time at all sampling locations (see Table 15), although sporadic occurrences at concentration levels usually below 35 ug/kg were not atypical. However, for the first time, PCBs (Aroclor 1254) were detected in 1998 at the three furthest upstream locations (GC-04, GC-01, GC-02) in low concentrations (69 ug/kg, 240 ug/kg and 90 ug/kg, respectively). It should be noted that detection limits for most PCBs have decreased during each successive sampling round which may account, especially for the 1989 sampling round, for their only being detected in the latest sampling event (see Table 19 for a comparison of PCB practical quantitation limits for each sampling round). While the distribution pattern for Aroclor 1254 suggests the Li Tungsten facility may be a probable source, its presence could also be related to the 1997 dredging operations which may have exposed or redistributed sediment contaminated with this PCB from other areas of Glen Cove Creek.

6.5 TUNGSTEN IN SEDIMENTS

No tungsten analyses were performed in 1989. However, since 1995, tungsten concentrations have decreased greatly in Glen Cove Creek sediments from 70 mg/kg to 18 mg/kg at GC-04, from 210 mg/kg to 110 mg/kg at GC-01, from 160 mg/kg to 33 mg/kg at GC-02, and from 97 mg/kg to non-detect at GC-03. Irrespective of sampling round, the highest concentration of tungsten in sediment was always present at location GC-01, which is directly adjacent and slightly downstream of the Li Tungsten Superfund Site, and the distributional pattern for tungsten present among the creek sampling locations indicates the Li Tungsten facility as the potential source area of this metal contaminant.

6.6 TAL METALS IN SURFACE WATER

Metals concentrations in the Glen Cove Creek surface water have exhibited numerous fluctuations during the past nine years (see Table 16). The primary contaminants of concern, manganese and thallium, as indicated by the 1989 Risk Assessment, were present in all 1998 samples. Manganese concentrations appear to be decreasing at sampling locations GC-01, GC-02 and GC-03 over time, whereas at sampling location GC-04, the furthest upstream location, manganese and thallium levels were comparable and have increased, respectively, in the 1995 to 1998 interval.

Changes in concentration levels for manganese and thallium from the 1989 to 1998 sampling events at each individual sampling location (1995 to 1998 for location GC-04) proceeding from the furthest upstream to the furthest downstream location are discussed in the text that follows. At GC-04, manganese has increased slightly from 75 to 80.9 ug/l. At GC-01, GC-02 and GC-03, manganese has decreased from 110 to 58.7 ug/l, 97.9 to 36.4 ug/l, and 74.8 to 39.5 ug/l, respectively. Thallium has decreased from 11.5 to 5.6 ug/l since 1989 at GC-02, and has increased from non-detect to ranging between 4.9 to 5.8 ug/l at all other sampling locations.

Based upon the distribution of metals concentrations among sampling locations within each specific sampling interval. the data suggest that any potential source area for the heavy metals seen in surface water is unknown and exists farther upgradient of the furthest upstream sampling location.

6.7 VOLATILE ORGANICS IN SURFACE WATER

In general, volatile organic contaminants in surface water have declined dramatically in the 1989 to 1998 period irrespective of sampling location within Glen Cove Creek. The primary contaminants of concern in 1989, bromodichloromethane and tetrachloroethene, along with trans-1,2-dichloroethene, exhibited a distributional pattern during the 1989 sampling event that suggested the Li Tungsten facility as a probable source area of these compounds. However, all of these contaminants were present at low levels (i.e., <6 ug/l) and none of these compounds were detected at adjacent and/or downstream sample locations GC-01 through GC-03 in subsequent sampling events in 1995 or 1998. In 1998, tetrachloroethene was only present upstream at location GC-04 at a concentration of 16 ug/l, suggesting a possible further upstream source. Methylene chloride and chlorobenzene were also present at low concentrations (i.e., <7 ug/l) only at upstream location GC-04 in 1998 as shown in Table 18; however, the methylene chloride is probably related to intra-laboratory contamination since it was also present in the laboratory method blanks. Aside from acetone and 2-butanone detected in 1995, which also appear to be laboratory introduced, the low levels (i.e., <1 ug/l) of contaminants present in earlier sampling events (i.e., trichloroethene, dibromochloromethane and chloroform in 1989, and 2-hexanone in 1995) were not detected in Glen Cove surface water in subsequent sampling events.

One possible cause of the dramatic decline in volatile organic contaminants in surface water may be the observed similar reductions in the underlying Glen Cove Creek sediments (see Section 6.2).

6.8 SEMIVOLATILE ORGANICS IN SURFACE WATER

No target list semi-volatile compounds were detected in any of the surface water samples in 1989 and 1995. This was also the case in 1998 for the two sampling locations immediately adjacent (GC-01) and just downstream (GC-02) of the Li Tungsten facility. However, in the 1998 sampling event, 2,4-dinitrophenol was present at the furthest downstream (GC-03) and upstream (GC-04) locations at concentrations of 280 ug/l and 26 ug/l, respectively. Additionally in 1998, several tentatively identified semi-volatile compounds were detected in the GC/MS library search at three out of the four sampling locations. One tentatively identified semi-volatile compound was detected at location GC-02 at a concentration of 2 JB and at a concentration of 3 JB in this location's duplicate sample. A tentatively identified semi-volatile compound was also detected at location GC-03 at a concentration of 3 JB, and three tentatively identified semi-volatile compounds were also present at location GC-04 at concentrations of 2 JB each. The potential source of these compounds is currently unknown, however the distribution of these compounds in the surface water does not suggest the Li Tungsten facility as a probable source.

6.9 PESTICIDES AND PCBs IN SURFACE WATER

Analyses of surface water performed in 1989 and 1995 showed no pesticides in Glen Cove Creek. However, the May 1998 surface water results indicated the presence of four pesticides (Heptachlor, Dieldrin, DDD and Methoxychlor) at very low concentrations (i.e., <0.60 ug/l) with no apparent distributional pattern except that Heptachlor and Dieldrin were only present at 0.02 ug/l directly adjacent and slightly downstream of the Li Tungsten facility at location GC-01, and Methoxychlor levels were uniform (~ 0.56 ug/l) among all sampling locations (see Table 9). However, these distributional patterns of pesticides in surface water do not indicate the Li Tungsten facility as a probable source. Instead, underlying sediments within Glen Cove Creek may serve as the source of the pesticides seen in surface water (see Section 6.4). PCBs were not detected in Glen Cove Creek surface water at any prior or current sampling event.

6.10 TUNGSTEN IN SURFACE WATER

Analyses of Glen Cove Creek surface water performed in 1995 and 1998 showed no detectable concentrations of tungsten. Therefore, the Li Tungsten facility does not appear to be impacting the water quality of Glen Cove Creek. No tungsten analyses were performed in 1989.

TE NAME: Ft Longste [illegible]
PROJECT #: 8001 202
[illegible] R-S CASE NO(s): 35847, [illegible]
LAB NAME: Southwest Laboratory of Oklahoma Inc

AQUEOUS

Sample ID No	LT-GA-MP-20	LT-GA-MP-22D	LT-GA-3S	LT-GA-MP-2S	LT-GA-MP-6	LT-GA-MP-20	LT-GA-GM-1	LT-GA-MP-11D	LT-GA-GM-11	LT-GA-MP-18D	LT-GA-MP-18	LT-GA-MP-16S
Lab ID No	35847 02	35847 03	35847 04	35847 [illegible]	35863 03	35863 01	35863 [illegible]	35884 02	35884 03	35884 04	35884 05	[illegible]
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1	1
	*10 x dilution					*2.5 x dilution						
VOLATILES												
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Vinyl Chloride	*310	10 U	10 U	10 U	10 U	15 E	10 U	10 U	10 U	54	10 U	10
Chloroethane	130	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Methylene Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	18 U	4
Acetone	10 UJ	10 U	42 E	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	12 E	9 J	10
Carbon Disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 J	10 U	10 U	10 U	10
1,1-Dichloroethene	5 J	10 U	10 U	10 U	10 U	10 U	2 J	10 U	10 U	1 J	10 U	10
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	22	10 U	10
1,2-Dichloroethene (total)	*1100	2 J	2 J	10 U	10 U	*250	9 J	10 U	10 U	72	3 J	10
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 J	10
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	7 J	10 U	10 U	9 J	1 J	10
2-Butanone	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 UJ	10
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Carbon Tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Trichloroethene	*650	10 U	10 U	10 U	10 U	170 E	9 J	10 U	10 U	11	4 J	10
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	39	10 UJ	10 UJ	7 J	10 U	10
Benzene	14	10 U	10 U	10 U	10 U	2 J	10 U	10 U	10 U	2 J	10 U	10
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10
4-Methyl-2-Pentanone	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10
2-Hexanone	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10
Tetrachloroethene	*390	10 U	10 U	10 U	13	*250	9 J	10 U	10 U	10 U	3 J	10
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 J	10 U	10
Toluene	10 U	10 U	1 J	10 U	10 U	10 U	10 U	10 U	10 U	2 J	2 J	10
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5 J	10
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10
Xylene (Total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4 J	25	10

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400593

ITE NAME Lt Tungste... ...ien Cove NY
ROJECT # 8001 202
Non-RAS CASE NO(s) 35847 and 35910
AB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS																								
ample ID No	LT-GW-MP-16D		LT-GW-GM 8		LT-GW-EMW1		LT-GW-MP-5		LT-GW-GM 13		LT-GW-MP-19L		LT-GW-GM-14B		LT-GW-GM-10		LT-GW-MW-8S		LT-GW-MW-8D		LT-GW-MW 10	
ab ID No	35910 03		35920 02		35920 03		35951 02		35951 03		35951 04		35951 05		35964 03		35964 04		35964 05		35964 06	
nits	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
ilution Factor	1		1		2		1		1		1		1		1		1		10		1	
																	*20 x dilution		*500 x dilution		*1000 x dilution	
VOLATILES																						
hloromethane	U	10	U	10	U	20	UJ	10	U	10	U	10	U	10	UJ	10	U	10	U	100	UJ	10	UJ
romomethane	U	10	U	10	UJ	20	U	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ	100	U	10	UJ
inyl Chloride	U	10	U	10	U	20	UJ	10	U	10	U	10	U	10	UJ	10	U	10	U	57	J	5	J
hloroethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
Methylene Chloride	J	3	J	10	U	15	J	10	U	10	U	10	U	2	J	10	U	24		480	E	980	E
Acetone	UJ	10	UJ	10	UJ	19	J	10	UJ	10	UJ	10	UJ	45	E	10	UJ	10	UJ	*5400	J	540	E
arbon Disulfide	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
1-Dichloroethene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	9	J	51		220		210	E
1-Dichloroethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	28		*310		*3600	J	1500	E
2-Dichloroethene (total)	U	10	U	10	U	200		10	U	6	J	10	U	1	J	140		*3300		*60000		*78000	
hloroform	U	10	U	~~10~~	UR	20	U	~~10~~	UR	~~10~~	UR	~~10~~	UR	10	U	~~10~~	U	10	J	25	J	*2100	J
2-Dichloroethane	U	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	51	J	58	E
Butanone	U	10	U	10	UJ	20	UJ	10	UJ	10	UJ	10	UJ	13	E	10	UJ	10	UJ	*3300	J	10	UJ
1,1-Trichloroethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	180		*1700		*7100		*8200	J
arbon Tetrachloride	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
romodichloromethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
2-Dichloropropane	UJ	10	UJ	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
s-1,3-Dichloropropene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
richloroethene	U	10	U	10	U	110		10	U	10	U	10	U	1	J	77		*860		*6200		*34000	
ibromochloromethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
1,2-Trichloroethane	UJ	10	UJ	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	17	J	230	E
enzene	U	10	U	~~10~~	UR	20	U	~~10~~	UR	~~10~~	UR	~~10~~	UR	10	U	~~10~~	U	16	E	140		350	E
ans-1,3-Dichloropropene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
romoform	UJ	10	UJ	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
Methyl-2-Pentanone	UJ	10	UJ	10	UJ	20	U	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ	780		10	UJ
Hexanone	UJ	10	UJ	10	UJ	20	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	100	UJ	10	UJ
etrachloroethene	U	10	U	10	U	300		10	U	10	U	76		1	J	96		*240		1400		*4400	J
1,2,2-Tetrachloroethane	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
luene	U	10	U	10	U	20	U	10	U	10	U	10	U	1	J	10	U	6	J	*34000		*74000	
hlorobenzene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	12	J	10	UJ
thylbenzene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	1500		*3500	J
rene	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	100	U	10	UJ
lene (Total)	U	10	U	10	U	20	U	10	U	10	U	10	U	10	U	10	U	10	U	*11000		*22000	

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400594

ITE NAME Lt Tungsten [illegible] Site No
ROJECT # 8001-202
n-RAS CASE NO(s) 35847 and 35910
AB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS																								
mple ID No	LT-GW-MP-4D		LT-GW-GM-12		LT-GW-GM-25		LT-GW-EMW-4		LT-GW-KOH		LT-GW-FB-01		LT-GW-FB-02		LT-GW-FB-03		LT-GW-FB-04		LT-GW-FB-05		LT-GW-TB-01		LT-GW-TB-02	
ab ID No	36014 06		36014 09		36014 1		36014 03		36014 04		35847 05		35884 05		35970 04		35964 02		36014 02		35847 01		35863 01	
nits	ug/l		ug/l		ug/L		ug/l		ug/L		ug/L		ug/l		ug/L		ug/l		ug/l		ug/L		ug/l	
ilution Factor	1		1		1		1		1		1		1		1		1		1		1		1	
VOLATILES																								
loromethane	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
romomethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ	10	U	10	U	10	U
nyl Chloride	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
loroethane	10	UJ	10	UJ	10	U	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
ethylene Chloride	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
etone	10	U	10	U	12	E	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
arbon Disulfide	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Dichloroethene (total)	10	U	10	U	2	J	10	U	26		10	U	10	U	10	U	10	U	10	U	10	U	10	U
loroform	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UR	10	UR	10	U	10	U	10	U
2-Dichloroethane	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Butanone	10	U	10	U	10	UJ	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
1,1-Trichloroethane	10	U	10	U	1	J	10	U	3	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U
rbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
omodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
s 1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
chloroethene	1	J	1	J	3	J	10	U	3	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U
romochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
nzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UR	10	UR	10	U	10	U	10	U
ns-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
omoform	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
Hexanone	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	UJ	10	UJ
trachloroethene	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
2,2-Tetrachloroethane	10	UJ	10	UJ	10	U	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	U	10	U	10	U
luene	4	J	4	J	9	J	10	U	15		10	U	10	U	10	U	10	U	10	U	10	U	10	U
lorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
ylbenzene	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
rene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
ene (Total)	3	J	3	J	10	U	10	U	4	J	2	J	10	U	10	U	10	U	10	U	10	U	10	U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400595

ITE NAME Li Tungste... Glen Cove NY
ROJECT # 8001-202
lon-RAS CASE NO(s) 35847 and 35919
AB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS

ample ID No	LT-GA-TB-03		LT-GA-TB-04		LT-GA-TB-05		LT-GA-TB-06		LT-GA-TB-07		LT-GA-TB-08		LT-GA-TB-09	
ab ID No	35884-01		35910-01		35920-01		35951-01		35954-01		36014-09		36014-01	
nits	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
ilution Factor	1		1		1		1		1		1		1	
VOLATILES														
hloromethane	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ
romomethane	10	U	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U
inyl Chloride	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ
hloroethane	10	U	4	J	10	U	10	U	10	U	10	UJ	10	UJ
lethylene Chloride	2	J	10	UJ	10	U	10	U	10	U	10	U	10	U
cetone	10	UJ	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U
arbon Disulfide	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2 Dichloroethene (total)	10	U	10	U	10	U	10	U	10	U	10	U	10	U
hloroform	10	U	10	U	10	UR	10	UR	10	UR	10	U	10	U
2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Butanone	10	U	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U
1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
arbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
romodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Dichloropropane	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	U
s-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
richloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
ibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Trichloroethane	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	U
enzene	10	U	10	U	10	UR	10	UR	10	UR	10	U	10	U
ans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
romoform	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	U
Methyl-2-Pentanone	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	U
Hexanone	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
etrachloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	UJ	10	UJ
luene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
hlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
hylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
rene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
lene (Total)	10	U	10	U	10	U	10	U	10	U	10	U	10	U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400596

SITE NAME: Li Tungsten, Glen Cove, NY
PROJECT #: 8001-202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma, Inc

AQUEOUS

Sample ID No	LT-GW-MP-2D	LT-GW-MP-22D	LT-GW-3S	LT-GW-MP-22S	LT-GW-MP-6	LT-GW-MP-20	LT-GW-GM-1
Lab ID No	35847 02	35847 03	35847 04	35863 02	35863 03	35863 04	35863 05
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	1	1	1	1
		*2 x dilution	*2 x dilution				
SEMI-VOLATILES							
Phenol	10 U	*110	*110	10 U	10 U	10 U	3 J
bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
4-Methylphenol	10 U	22	24	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	0.6 J	0.6 J	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	6 J	6 J	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	12	12	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	1 J	1 J	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ	25 UJ
Dibenzofuran	10 U	1 J	1 J	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	1 J	1 J	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
N-nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	0.9 J	0.9 J	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	1 J	10 U	10 UJ	10 UJ	10 UJ	10 UJ
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ
3,3'-Dichlorobenzidine	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ
Di-n-octylphthalate	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400597

SITE NAME Li Tungsten, Glen Cove, NY
PROJECT # 8001-202
Non-RAS CASE NO(s) 35847 and 35910
LAB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS

Sample ID No	LT-GW-MP-11D	LT-GW-[illegible]	LT-GW-MP-18D	LT-GW-MP-18S	LT-GW-MP-16S	LT-GW-MP-16D	LT-GW-GM-8
Lab ID N	35884 02	35884 [illegible]	35884 04	35884.06	35910 02	35910 03	35920 02
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	1	1	1	1
				*2 x dilution			
SEMI-VOLATILES							
Phenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1 3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1 4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1.2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.2'-oxybis(1-Chloropropane)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	1 J	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	2 J	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1.2.4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	39	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	*94	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.4.6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.4.5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2.6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	5 J	10 U	10 U	10 U
2 4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Dibenzofuran	10 U	10 U	10 U	8 J	10 U	10 U	10 U
2 4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	7 J	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4 6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
N-nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U	6 J	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3 3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	27 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1.2.3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400598

SITE NAME: Li Tungsten Glen Cove, NY
PROJECT # 8001-202
Non-RAS CASE NO(s) 35847 and 35910
LAB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS

Sample ID No	LT-GW-EMW1	LT-GW-MP-5	LT-GW-GM-13	LT-GW-MP-19D	LT-GW-GM-14B	LT-GW-GM-10	LT-GW-MW-8S
Lab ID No	35920.03	35951.02	35951.03	35951.04	35951.05	35964.03	35964.04
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	2	1	1	1	1	1	1
					*5 x dilution		
SEMI-VOLATILES							
Phenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	1 J	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	2 J	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	*150	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	2 J	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	0.6 J	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	0.7 J	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	0.5 J	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	1 J	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U	25 U	25 U
N-nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	0.6 J	25 U	25 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400599

SITE NAME: Li Tungsten, Glen Cove, NY
PROJECT # 8001-202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma, Inc

AQUEOUS

Sample ID No	LT-GW-MW-8D	LT-GW-MW-10	LT-GW-MP-4D	LT-GW-GM-12	LT-GW-GM-25	LT-GW-EMW-4	LT-GW-KON
Lab ID No	35964 05	35964 06	36014 06	36014 09	36014 1	36014 03	36014 04
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	5	1	1	1	1	1	1
		**20 x dilution					
SEMI-VOLATILES							
Phenol	130 U	54	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)Ether	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	50 U	10 U	10 U	10 U	10 U	10 U	10 U
1 3-Dichlorobenzene	13 J	12	10 U	10 U	10 U	10 U	10 U
1.4-Dichlorobenzene	28 J	40	10 U	10 U	10 U	10 U	10 U
1.2-Dichlorobenzene	260	**450	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	88	**140 J	10 U	10 U	10 U	10 U	10 U
2.2'-oxybis(1-Chloropropane)	50 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	160	**140 J	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	5 J	54	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2 4-Dimethylphenol	50 U	67	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2.4-Dichlorophenol	50 U	10 U	10 U	10 U	10 U	10 U	10 U
1 2 4-Trichlorobenzene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	280	**760	10 U	10 U	0.7 J	10 U	10 U
4-Chloroaniline	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	13 J	26	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2 4 6-Trichlorophenol	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2 4 5-Trichlorophenol	120 U	25 U	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	120 U	25 U	25 U	25 U	25 U	25 U	25 U
Dimethylphthalate	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2 6-Dinitrotoluene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	120 U	25 U	25 U	25 U	25 U	25 U	25 U
Acenaphthene	50 U	0.8 J	10 U	10 U	10 U	10 U	10 U
2 4-Dinitrophenol	120 U	25 U	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	120 U	25 U	25 UJ	25 UJ	25 U	25 U	25 U
Dibenzofuran	50 U	10 U	10 U	10 U	10 U	10 U	10 U
2 4-Dinitrotoluene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	50 U	43	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	50 U	0.7 J	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	120 U	25 U	25 U	25 U	25 U	25 U	25 U
4 6-Dinitro-2-methylphenol	120 U	25 U	25 U	25 U	25 U	25 U	25 U
N-nitrosodiphenylamine	50 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl-phenylether	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	120 U	1 J	25 U	25 U	25 U	25 U	25 U
Phenanthrene	50 U	1 J	10 U	10 U	10 U	10 U	10 U
Anthracene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	150	**230	10 U	30	44	10 U	0.8 J
Fluoranthene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	50 U	4 J	10 U	10 U	0.8 J	10 U	10 U
3 3'-Dichlorobenzidine	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	50 U	**830	10 U	0.8 J	10	10 U	10 U
Di-n-octylphthalate	50 U	6 J	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	50 U	10 U	10 UJ	10 UJ	10 U	10 U	10 U
Benzo(k)fluoranthene	50 U	10 U	10 UJ	10 UJ	10 U	10 UJ	10 UJ
Benzo(a)pyrene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	50 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	50 U	10 U	10 U	10 U	10 U	10 U	10 U

U - non-detect
J - estimated below CRQL
B - estimated above CRQL
JN - estimated presumptive
R - rejected

400600

SITE NAME Li Tungsten Glen Cove, NY
PROJECT # 8001-202
Non-RAS CASE NO(s) 35847 and 35910
LAB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS

Sample ID No	LT-GW-FB-01	LT-GW-FB-02	LT-GW-FB-03	LT-GW-FB-04	LT-GW-FB-05
Lab ID No	35847 05	35884 05	35920 04	35964 02	36014 02
Units	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	1	1
SEMI-VOLATILES					
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1 3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1 4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1 2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 UJ	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2 4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1 2 4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 UJ	10 U	10 U	10 U	10 U
2 4 6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U
Dimethylphthalate	0.6 J	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U
2 4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	25 UJ	25 U	25 U	25 U	25 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U
2 4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	4 J	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U
4 6-Dinitro-2-methylphenol	25 U	25 U	25 U	25 U	25 U
N-nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	1 JB	0.5 JB	0.6 JB	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	0.6 J	10 U	10 U
3 3'-Dichlorobenzidine	10 UJ	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	1 JB	6 JB	5 JB	10 U	6 J
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 UJ	10 U	10 U	10 U	10 UJ
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400601

SITE NAME: LT Tungsten Glen Cove, NY
PROJECT #: 8001-202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma, Inc

AQUEOUS											
Sample ID No	LT-GW-MP-2D	LT-GW-MP-22D	LT-GW-3S	LT-GW-MP-22S	LT-GW-MP-6	LT-GW-MP-[illegible]	LT-GW-GM-1	LT-GW-MP-11D	LT-GW-GM-11	LT-GW-MP-18D	LT-GW-MP-18S
Lab ID No	35847 02	35847 03	35847 04	35863 02	35863 03	35863 04	35863 05	35884 02	35884 03	35884 04	35884 06
Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
PESTICIDES/PCBs											
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC (lindane)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.4
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.022 J	0.05 U	0.05 U	0.33 E
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.34 E
Heptachlor epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.025 J	0.05 U	0.035 J	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.77 E
4,4'-DDE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.91
Endosulfan II	0.1 U	0.1 U	0.1 U	0.047 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.68 R
Endosulfan sulfate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.83
Methoxychlor	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Endrin ketone	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U	0.05 U	0.031 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Toxaphene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Aroclor-1016	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1221	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Aroclor-1232	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1242	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1248	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1254	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1260	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400602

SITE NAME: LI Tungsten Glen Cove NY
PROJECT #: 8601 202
Non RAS SE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma Inc

AQUEOUS

Sample ID No	LT GW MP 16S	LT GW MP 16D	LT GW GM 9	LT GW EM-1	LT GW MP 5	LT GW GM 13	LT GW MP 19D	LT GW GM-14B	LT GW GM 10	LT GW MW 8S	LT GW MW 8D
Lab ID No	35910 02	35910 03	35920 02	35920 03	35951 02	35951 03	35951 04	35951 05	35964 03	35964 04	35964 05
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	2	1	1	1	1	1	1	1
PESTICIDES/PCBs											
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
gamma-BHC (lindane)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.029 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.11 R
4,4'-DDE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.19 E
Endosulfan II	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
4,4'-DDD	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.22 E
Endosulfan sulfate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Methoxychlor	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
Endrin ketone	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U
alpha-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Toxaphene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U
Aroclor-1016	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Aroclor-1221	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U	2 U
Aroclor-1232	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Aroclor-1242	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Aroclor-1248	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Aroclor-1254	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Aroclor-1260	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JH - estimated presumptive
R - rejected

400603

SITE NAME: LT Tungsten Glen Cove, NY
PROJECT #: 8001-202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma, Inc

AQUEOUS											
Sample ID No	LT-GW-MW-10	LT-GW-MW-40	LT-GW-GM-12	LT-GW-GM-25	LT-GW-EMW-4	LT-GW-FC-01	LT-GW-FB-01	LT-GW-FB-02	LT-GW-FB-03	LT-GW-FB-04	LT-GW-FB-05
Lab ID No	35964 06	36014 06	36014 09	36014 1	36014 03	36014 04	35847 05	35884 05	35920 04	35964 02	36014 02
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
PESTICIDES/PCBs											
alpha-BHC	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
beta-BHC	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
delta-BHC	~~0 062~~ R	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
gamma-BHC (lindane)	0 11 E	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Heptachlor	0 05 U	0 05 U	0 014 J	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Aldrin	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Heptachlor epoxide	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Endosulfan I	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Dieldrin	0 1 U	0 1 U	0 1 U	0 038 J	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
4 4'-DDE	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
Endrin	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
Endosulfan II	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
4 4'-DDD	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
Endosulfan sulfate	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
4 4'-DDT	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
Methoxychlor	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Endrin ketone	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
Endrin aldehyde	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U	0 1 U
alpha-Chlordane	0 22 EN	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
gamma-Chlordane	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U
Toxaphene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Aroclor-1016	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1221	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Aroclor-1232	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1242	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1248	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1254	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor-1260	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

U - non-detect
J - estimated below CRQL
E - estimated above CRQL
JN - estimated presumptive
R - rejected

400604

SITE NAME: LI Tungsten Glen Cove NY
PROJECT #: 8001-202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma Inc

AQUEOUS		Filtered			Filtered		Filtered		Filtered		Filtered		Filtered
Sample ID No	LT-GW-MP-2D	LT-GW-MP-2D	LT-GW-MP-22D	LT-GW-MP-22D	LT GW-3S	LT-GW-3S	LT-GW-MP 22S	LT-GW-MP-22S	LT-GW-MP-6	LT-GW-MP-6	LT-GW-MP-20	LT-GW-MP-20
Lab ID No	35847 02	35847 06	35847 03	35847 07	35847 04	35847 08	35863 02	35863 06	35863 03	35863 07	35863 04	35863 08
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/l
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1	1
Aluminum	58 6 J	12 U	848	671	739	664	290	140 J	1250	1120	89 J	12
Antimony	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 3
Arsenic	5 9 J	2 2 J	18 6	15 4	10 2 E	12 9 E	96 9 E	83 2	3 4 J	2 U	2 U	2
Barium	28 1 J	26 5 J	953	881	866	874	38 J	36 9 J	28 3 J	28 7 J	52 8 J	53 1
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1
Cadmium	1 U	1 U	1 U	1 U	1 U	1 U	2 2 J	1 9 J	14 2	14 9	1 U	1
Calcium	42600	43200	359000	329000	324000	326000	53700	54600	62600	54800	105000	104000
Chromium	5 J	1 U	4 1 J	2 3 J	2.9 J	2 9 J	13.3	8.2 J	2 2 J	1 U	1 3 J	1 1
Cobalt	609	583	2 U	2 U	2 U	2 U	183	168	31 9 J	28 4 J	9 J	9
Copper	44 5	9 4 J	2 U	2 U	2 U	2 U	174	95 1	37 2	25.1	3 1 J	3 3
Iron	11500	6650	112	73 2 J	97.9 J	71 8 J	2010	1090	1560	591	196	102
Lead	~~1 0~~ JR	1 U	1 UR	1 U	1 UR	1 U	1 UR	1 U	~~1 6~~ JR	1 U	1 UR	1
Magnesium	13900	13800	73 1 J	76 2 J	64.3 J	85 9 J	5840	5940	12700	12000	8380	8260
Manganese	2270	2210	7 2 J	1 7 J	4 4 J	1 6 J	615	610	4390	3880	4800	4680
Mercury	0 1 U	0 1 UJ	0 1 U	0 1 J	0.1 U	0 1 J	0 21	0.13 J	0 1 U	0 1 UJ	0 1 U	0 1
Nickel	2820	2690	74 2	69 3	67.2	68 6	253	226	71 9	66 3	7 7 J	9 1
Potassium	6220	5950	86500	90400	89200	88500	8360	8490	4120 J	4070 J	2470 J	2630
Selenium	3 U	3 U	60 1 E	58 6 E	63 5 E	55 9 E	41.3 E	34 1 E	3 U	3 U	3 U	3
Silver	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2
Sodium	43900 E	44700 E	313000 E	317000 E	303000 E	310000 E	37100 E	38600 E	40100 E	38600 E	26700 E	28000
Thallium	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2
Vanadium	1 U	1 U	2 2 J	1 7 J	1 9 J	1 9 J	11 4 J	12.6 J	1 U	1 U	1 U	1
Zinc	94 1	84 1	5 6 J	12 1 J	10 9 J	10 2 J	157	153	743	751	64 7	69 9
Cyanide	2 U	NR	2 U	NR	2 U	NR	2 U	NR	2 U	NR	2 U	NR

400605

SITE NAME: Ft Tungsten Glen Cove Rd
PROJECT #: 8001-202
Non-RAS CASE NO(s): 35847 or 35910
LAB NAME: Southwest Laboratory of Oklahoma Inc

AQUEOUS																								
			Filtered					Filtered					Filtered					Filtered					Filtered	
Sample ID No		LT-GW-GM-1		LT-GW-GM-1		LT-GW-MP-11D		LT-GW-MP-11D		LT-GW-GM-11		LT-GW-GM-11		LT-GW-MP-18D		LT-GW-MP-18D		LT-GW-MP-18S		LT-GW-MP-18S		LT-GW-MP-16S	
Lab ID No		35863 05		35863 09		35884 02		35884 07		35884 03		35884 08		35884 04		35884 09		35884 06		35884 12		35910 02	
Units		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1		1		1		1	
Aluminum	U	62 3	J	22 9	J	788		711		1020		999		301		26 8	J	7180		6910		14 7	
Antimony	J	3	U	3	U	4	U	4	U	4	U	4	U	45	J	20 4	J	18 4	J	20 9	J	4	
Arsenic	U	2	U	2	U	4	U	4	U	4	U	4	U	7	J	7 4	J	154	E	147		4	
Barium	J	112	J	110	J	115	J	107	J	71 5	J	70 8	J	1	U	1	U	1	U	1	U	33 6	
Beryllium	U	1	U	1	U	1	U	1	U	1 2	J	1 3	J	1	U	1	U	4 3	J	4 4	J	1	
Cadmium	U	1	U	1	U	1	U	1	U	2 9	J	3 1	J	11 3	E	12 5	E	4 1	J	4 6	J	1	
Calcium		71900		71300		83100		75700		12100		12100		374000		374000		441000		430000		14000	
Chromium	J	1 5	J	1 1	J	23 2		1	U	1 4	J	2 1	J	1	U	1	U	9 7	J	2 4	J	6 9	
Cobalt	J	19 3	J	19	J	4 5	J	2	U	5 2	J	4 8	J	532		535		99 3		97 8		2 1	
Copper	J	4 5	J	5 7	J	5 6	J	4 8	J	129		122		65 5		68 3		11.6	J	12 6	J	4 6	
Iron		1390		1250		240		190	U	77.8	J	~~86 7~~	JR	1590000		1590000		192000		175000		1430	
Lead	U	~~2 9~~	JR	3 1		2	UR	2	U	2	UR	2	U	~~10 4~~	R	16 8		~~6 9~~	R	5 7		2	
Magnesium		19300		18800		99 2	J	72	U	6350		6420		127000		130000		9730		9770		4330	
Manganese		14400		14100		14 1	J	10	U	1100		1040		59000		59400		4160		3700		215	
Mercury	UJ	0 1	U	0 1	UJ	0 1	U	0 1	UJ	0 1	U	0 1	UJ	0 18	J	0 1	UJ	0 1	U	0 1	UJ	0 1	
Nickel	J	131		128		25 6	J	8	J	15	J	15 4	J	312		313		154		147		6 6	
Potassium	J	33100	E	36800	E	15400	E	23000	E	582	J	580	J	27000		27100		17100		16500		5080	
Selenium	U	3	U	3	U	4	UJ	4	U	4	UJ	4	UJ	20	E	21 7	E	5 6	E	9 2	E	4	
Silver	U	2	U	2	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	
Sodium	E	102000	E	103000	E	38300	E	979000	E	13900	E	14000	E	19400	E	1410000	E	41600	E	193000	E	8850	
Thallium	U	2	U	2	U	6	U	6	U	6	U	6	U	90 5		94 1		14 6		14 4		6	
Vanadium	U	1	U	1	U	2 8	J	3 1	J	2	U	2	U	2	U	2	U	2	U	2	U	2	
Zinc		31 5	E	34 4	E	15 4	J	12 7	J	123		106		2930		2930		2280		2230		42 2	
Cyanide		2	U	NR		2	U	NR		2	U	NR		2	U	NR		2	U	NR		2	

400606

SITE NAME: Livingston Glenn Site No
PROJECT #: 8001 202
Non-RAS CASE NO(s): 35847 and 35910
LAB NAME: Southwest Laboratory of Oklahoma Inc

AQUEOUS		Filtered			Filtered			Filtered			Filtered			Filtered			Filtered	
Sample ID No		LT-GW-MP-16S		LT-GW-MP-16D		LT-GW-MP-16D		LT-GW-GM-8		LT-GW-GM-8		LT-GW-EM-W1		LT-GW-8MW1		LT-GW-MP-5		LT-GW-MP-5		LT-GW-GM-13		LT-GW-GM-13
Lab ID No		35910 06		35910 03		35910 07		35920 02		35920 05		35920 03		35920 06		35951 02		35951 06		35951 03		35951 07
Units		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		1		1		1		1		1		1		1		1		1		1		1
Aluminum	J	11 1	J	26 2	J	9	U	152	J	86 8	J	621		450		88	J	9	U	631		9 4	J
Antimony	U	4	U	4	U	4	U	4 7	J	6 9	J	4	U	4	U	4	U	4	U	6 5	J	4 3	J
Arsenic	U	4	U	4	U	4	U	4	U	4	U	17 2		6 5	J	4	U	4	U	4	U	4	U
Barium	J	30 6	J	35 6	J	32 7	J	4	J	30 2	J	36 5	J	35 5	J	96.6	J	86 4	J	49 3	J	42	J
Beryllium	U	1	U	1	U	1	U	30	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1 87	J	1 3	J
Calcium		13600		33900		32800		31400		31400		48500		50500		51200		48000		56300		54600
Chromium	J	1 5	J	2 1	J	1	U	1	U	1	U	2 8	J	1	U	3.4	J	1	U	15 2		1 6	J
Cobalt	J	2	U	2	U	2	U	2 1	J	2 8	J	5 4	J	5 5	J	2	U	2	U	6 4	J	5 1	J
Copper	J	1 9	J	3 9	J	1	U	45 5	E	51 6	E	18 8	J	7 6	J	2 1	J	1	U	26 2		13 3	J
Iron		614	R	3870		2300		39	J	26.2	J	9150		7700		12200		5150		2840		662	
Lead	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	10 8		2	U
Magnesium	J	4300	J	7750		7600		13500		13600		13700		14700		16400		15600		16500		15900	
Manganese		169		973		922		116		120		1780		1860		969		890		3290		3430	
Mercury	U	0 1	U	0 14	J	0 1	U	0 1	UJ	0.12	J	0 1	U	0 1	U	0 1	UJ	0 1	U	0 1	UJ	0 1	U
Nickel	J	4 1	J	2 1	J	1 5	J	1 9	J	3 2	J	6 8	J	6 1	J	2.9	J	2 5	J	18 2	J	5 9	J
Potassium		5020	E	10300		9780	E	5190		5150	E	7410		7780	E	3280	J	3210	J	3510	J	3490	J
Selenium	UR	4	U	4	UR	4	U	4	UR	4	U	4	UR	4	U	4	UR	4	U	4	UR	4	U
Silver	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Sodium		8480		13300		12900		33300		33600		39300		41200		31700		30100		31000		31100	
Thallium	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U
Vanadium	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Zinc		29 6	R	7 7	J	3 3	R	16 1	J	18 7	R	53 1		48 4	R	6 4	J	3 0	R	45 5		32 0	R
Cyanide	U	NR		2	U	NR		3 3	J	NR		2 3	J	NR		2	U	NR		2	U	NR	

400607

Lab Name: Southwest Laboratory of Oklahoma, Inc.

AQUEOUS		Filtered		Filtered		Filtered			Filtered		Filtered	
Sample ID No	LT-GW-MP-19D	LT-GW-MP-19D	LT-GW-GM-14B	LT-GW-GM-14B	LT-GW-GM-10	LT-GW-GM-10	LT-GW-MW-8S	LT-GW-MW-8S	LT-GW-MW-8D	LT-GW-MW-8D	LT-GW-MW-10
Lab ID No	35951 04	35951 08	35951 05	35951 09	35964 03	[illegible]	35964 04	35964 09	35964 05	35964 1	35964 06
Units	ug/l	ug/L	ug/l	ug/L	ug/L	ug/L	ug/L	ug/l	ug/L	ug/l	ug/l
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Aluminum	181 J	21 8 J	5480	2180	891	508	23 4 J	61 9 J	171 J	100 J	106 J
Antimony	4 U	4 U	889	739	4 U	4 U	4 U	4 U	4 5 J	4 U	4 U
Arsenic	4 U	4 U	5750	5520	4 U	4 U	4 U	4 U	16 2	15	4 U
Barium	94 2 J	57 5 J	38 3 J	32 9 B	64 8 J	58 1 J	42 5 J	43 6 J	38 4 J	33 9 J	163 J
Beryllium	1 U	1 U	5 5	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	1 U	1 U	1 U	1 U	1 3 J	1 U	1 U	1 U	1 U	1 U	110
Calcium	56500	54300	40200	39800	22000	20100	11400	12200	46300	45700	66200
Chromium	3 3 J	1 J	127	94 5	10 8	3 1 J	2 5 J	1 U	10 1	1 U	5 9 J
Cobalt	402	62 8	50 6 E	58 5 E	25 4 J	23 J	84 7	77 1	13 1 J	5 J	49 4 J
Copper	5 4 J	2 J	198	146	3 7 J	2 1 J	3 8 J	2.2 J	7 2 J	5 1 J	36 2
Iron	477	33.3 J	0640	4240	461	40 2 J	23000	20500	85400	83500	74100
Lead	2 2 J	2 U	55.9	52 3	2 U	2 U	2 U	2 U	2 U	2 U	3 4
Magnesium	14400	14200	3330 J	2980 J	15300	14000	6730 E	7510 E	10900	10700	25000
Manganese	1420	69 4	257	223	627	552	3780	3350	3080	2880	12000
Mercury	0 1 UJ	0 1 U	0 3	0 22	0 1 UJ	0 1 U	0 1 UJ	0 1 U	0 1 U	0 1 U	0 66 E
Nickel	147	95 5	55 2	37 3 J	47.8	42 9	8 6 J	12 5 J	11 3 J	1 6 J	19 8 J
Potassium	5650	5110 E	8710	7670 E	1460 J	1370 J	1140 J	1170 J	2150 J	2180 J	12100
Selenium	4 UR	4 U	55 E	66 3 E	4 UJ	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Sodium	38700	37400	5550000	5490000	11700	10700	11200	11000	21600	20900	57800
Thallium	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 2 J	7 8 J	6 U
Vanadium	2 U	2 U	400	409	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Zinc	59 1	44 R	52 5	36 2	103	89 5	16 7 J	19.7 J	16 8 J	10 9 J	23 E
Cyanide	2 U	NR	16 4	NR	2 U	NR	2 U	NR	2 U	NR	5 7 J

400608

SITE NAME Li Tungsten Glen Cove NY
PROJECT # 8001-202
Non-RAS CASE NO(s) 35847 and 35910
LAB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS	Filtered		Filtered		Filtered		Filtered		Filtered		Filtered	
Sample ID No	LT-GW-MW-10	LT-GW-MP-4D	LT-GW-MP-4D	LT-GW-GM-12	LT-GW-GM-12	LT-GW-GM-25	LT-GW-GM-25	LT-GW-EMW-4	LT-GW-EMW-4	LT-GW-KON	LT-GW-KON	LT-GW-FB-01
Lab ID No	35964 11	36014 06	36014 14	36014 09	36014 17	36014 1	36014 18	36014 03	36014 12	36014 04	36014 13	35847 05
Units	ug/L	ug/L	ug/L	ug/L	ug/l	ug/L	ug/l	ug/l	ug/l	ug/l	ug/L	ug/l
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1	1
Aluminum	9 4 J	3 1 E	69 7 J	9 U	9 U	9 U	9 U	64500 E	64300	78 J	9 U	12 U
Antimony	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 6 J	13 6 J	4 U	4 U	3 U
Arsenic	4 U	4 U	4 U	7.1 J	8 4 J	8 1 J	8 4 B	694	79 5	4 U	4 U	2 U
Barium	168 J	94 5 J	90.9 J	84 J	88.1 J	85 5 J	83 9 B	26.2 J	27 2 J	26 4 J	23 7 J	1 U
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 8	10 6	1 U	1 U	1 U
Cadmium	111	1 U	1 U	1 U	1 U	1 U	1 U	77.8	77.1	1 U	1 U	1 U
Calcium	68900	54600	53000	96800	102000	99200	97500	575000	578000	35000	34500	86 1 J
Chromium	2.2 J	1 4 J	1 U	1 U	1.2 J	1 U	1 U	12.1	8.1 J	3 3 J	1 7 J	1 U
Cobalt	50 7	18 3 J	9 J	2 U	2 U	2 6 J	2 U	380	380	8 6 J	7 4 J	2 U
Copper	5.1 J	1 3 J	1 U	1.7 J	1 U	1 8 J	1 U	1490	1490	2.2 J	1 U	2 U
Iron	77800	912	786	11000	11800	11400	11200	83900	65200	255	29 9 J	49 3 J
Lead	2 U	2 U	2 U	2 U	2 U	2 U	2 U	39.3	35.8	2 U	2 U	4 UR
Magnesium	26400	12000	11800	15000	15900	15400	15300	96600	96300	7300	7140	22 U
Manganese	12600	8240	8050	3520	3780	3600	3610	11800	11800	72 7	8 3 J	1 U
Mercury	0 1 U	0 14 J	0.1 U	0 1 U	0 16 J	0.1 U	0 1 U	0.22	0.1 U	0.14 J	0 1 U	0 1 U
Nickel	12 2 J	45 3	43.5	1 9 J	1.4 J	1 7 J	1 U	520	513	4 1 J	3 J	2 6 J
Potassium	12800 E	9150	9000	4540 J	4520 J	4470 J	4390 B	12700	13100	8410	8340	128 U
Selenium	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 7 J	4 U	3 U
Silver	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4.2 J	3 U	3 U	3 U	2 U
Sodium	65000	109 0	10300	37900	37900	38400	36700	240250	144000	134000	133000	154 J
Thallium	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	9 4 J	6 U	6 U	2 U
Vanadium	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 2 J	4 1 J	2 U	2 U	1 U
Zinc	26 8 E	73 7 E	55	4 U	6 7 J	4 U	2 U	8640	7820	4 U	2 5 J	15 7 J
Cyanide	NR	2 4 J	NR	2 U	NR	3 7 J	NR	2 U	NR	2 U	NR	2 U

400609

SITE NAME LT Tungsten Glen Cove NY
PROJECT # 8001 202
Non-RAS CASE NO(s) 35884 and 35910
LAB NAME Southwest Laboratory of Oklahoma Inc

AQUEOUS																
			Filtered				Filtered				Filtered				Filtered	
Sample ID No	LT-GW-FB-02		LT-GW-FB 02		LT-GW-FB-03		LT-GW-FB 03		LT-GW-FB-04		LT-GW-FB-04		LT-GW-FB-05		LT-GW-FB-05	
Lab ID No	35884 05		35884 11		35920 04		35920 07		35964 02		35964 07		36014 02		36014 11	
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor	1		1		1		1		1		1		1		1	
Aluminum	9	U	9	U	23	J	9	U	9	U	9	U	9	U	9	U
Antimony	4	U	4	U	6 2	J	4	U	4	U	4	U	4	U	4	U
Arsenic	4	U	4	U	4	U	4	U	4	U	4	U	4	U	4	U
Barium	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Calcium	88 2	J	37	J	56 3	J	35 9	J	58 4	J	72 9	J	13	U	13	U
Chromium	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cobalt	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Copper	1 1	J	1 1	J	1 5	J	1	U	1 6	U	1 1	J	1	U	1	U
Iron	152		45 8	J	19	U	19	U	19	U	19	U	19	U	19	U
Lead	2	UR	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Magnesium	72	U	72	U	72	U	72	U	72	U	72	U	72	U	72	U
Manganese	5 2	J	1 3	J	1	U	1	U	1	U	1	U	1	U	1	U
Mercury	0 1	U	0 1	U	0 1	UJ	0 1	U	0 1	U	0 1	U	0 15	J	0.1	U
Nickel	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Potassium	39 5	J	39 2	J	36	U	45 8	J	36	U	43 9	J	65 4	J	36	U
Selenium	4	UJ	4	U	4	UR	4	U	4	U	4	U	4	U	4	U
Silver	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U
Sodium	425	J	333	J	135	J	149	J	1580	J	725	J	287	J	115	J
Thallium	6	U	6	U	6	U	6	U	6	U	6	U	6	U	7 5	J
Vanadium	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Zinc	6	J	6	JR	4	J	3 5	R	3.1	J	3 3	J	4	U	2	U
Cyanide	2	U	NR		2	U	NR		2	U	NR		2	U	NR	

400610

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO : NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES								
Sample ID No.	LT-GW-MP-2D		LT-GW-MP-4D		LT-GW-MP-5		LT-GW-MP-6	
Lab Number	980977-02		981025-02		981011-02		980982-03	
Matrix	WATER		WATER		WATER		WATER	
Units	pCi/l		pCi/l		pCi/l		pCi/l	
Uranium 238	< 0.104		0.081 +/- 0.091	E	< 0.132		< 0.239	
Radium 226	0.143 +/- 0.109		< 0.628		0.225 +/- 0.194	E	0.406 +/- 0.205	
Radium 228	2.22 +/- 0.660		< 0.469		1.06 +/- 1.41		< 0.469	
Thorium 230	1.06 +/- 0.316		0.828 +/- 0.309		0.380 +/- 0.159	E	1.05 +/- 0.485	
Thorium 232	1.03 +/- 0.334	E	< 0.375		0.212 +/- 0.134		0.094 +/- 0.130	E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

RADIONUCLIDES				
Sample ID No.	LT-GW-MP-11D	LT-GW-MP-16S	LT-GW-MP-16D	LT-GW-MP-18S
Lab Number	981001-02	981005-02	981005-03	981001-06
Matrix	WATER	WATER	WATER	WATER
Units	pCi/l	pCi/l	pCi/l	pCi/l
Uranium 238	< 0.098	0.669 +/- 0.255	< 0.366	< 0.083
Radium 226	0.461 +/- 0.187	0.066 +/- 0.071 E	0.356 +/- 0.306	0.887 +/- 0.451
Radium 228	2.51 +/- 0.687	< 0.469	< 0.469	1.72 +/- 0.760 E
Thorium 230	0.90 +/- 0.340	0.651 +/- 0.267	0.784 +/- 0.229	0.682 +/- 0.223
Thorium 232	< 0.354	< 0.468	0.042 +/- 0.090 E	0.140 +/- 0.137 E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES								
Sample ID No.	LT-GW-MP-18D		LT-GW-MP-19D		LT-GW-MP-20		LT-GW-MP-22S	
Lab Number	981001-04		981011-04		980982-04		980982-02	
Matrix	WATER		WATER		WATER		WATER	
Units	pCi/l		pCi/l		pCi/l		pCi/l	
Uranium 238	0.099 +/- 0.113		0.153 +/- 0.190	E	0.249 +/- 0.136		1.39 +/- 0.459	
Radium 226	< 0.172		0.419 +/- 0.231	E	0.122 +/- 0.112	E	0.271 +/- 0.151	
Radium 228	0.13 +/- 0.536	E	< 0.469		3.17 +/- 0.620		1.31 +/- 0.723	E
Thorium 230	0.731 +/- 0.201		0.171 +/- 0.129	E	0.588 +/- 0.175		0.745 +/- 0.189	
Thorium 232	0.067 +/- 0.123	E	< 0.141		0.077 +/- 0.079	E	0.246 +/- 0.128	E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES								
Sample ID No.	LT-GW-MP-22D		LT-GW-GM-1		LT-GW-GM-8		LT-GW-GM-10	
Lab Number	980977-03		980982-05		981009-02		981017-03	
Matrix	WATER		WATER		WATER		WATER	
Units	pCi/l		pCi/l		pCi/l		pCi/l	
Uranium 238	0.198 +/- 0.118	E	< 0.484		0.186 +/- 0.250	E	0.262 +/- 0.152	E
Radium 226	1.12 +/- 0.408		0.378 +/- 0.228		0.367 +/- 0.255		0.581 +/- 0.383	
Radium 228	2.62 +/- 0.759		< 0.469		< 0.469		5.98 +/- 1.16	
Thorium 230	1.54 +/- 0.286		0.868 +/- 0.369		0.636 +/- 0.227		0.723 +/- 0.228	E
Thorium 232	< 0.198		0.402 +/- 0.266	E	0.144 +/- 0.121		0.122 +/- 0.099	E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

400614

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES							
Sample ID No.	LT-GW-GM-11		LT-GW-GM-12		LT-GW-GM-13	LT-GW-GM-14B	
Lab Number	981001-03		981025-05		981011-03	981011-05	
Matrix	WATER		WATER		WATER	WATER	
Units	pCi/l		pCi/l		pCi/l	pCi/l	
Uranium 238	0.274 +/- 0.164		0.053 +/- 0.074	E	0.576 +/- 0.378	56.8 +/- 5.52	
Radium 226	0.362 +/- 0.218		0.402 +/- 0.221	E	< 0.317	0.908 +/- 0.415	
Radium 228	2.84 +/- 0.591		0.26 +/- 1.22		< 0.469	< 0.469	
Thorium 230	1.61 +/- 0.395		0.460 +/- 0.168	E	1.15 +/- 0.386	1.53 +/- 0.496	
Thorium 232	1.18 +/- 0.361	E	0.288 +/- 0.144		0.190 +/- 0.225	1.25 +/- 0.467	

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES								
Sample ID No.	LT-GW-GM-25		LT-GW-EMW-1		LT-GW-EMW-4		LT-GW-MW-8S	
Lab Number	981025-06		981009-03		981030-03		981017-04	
Matrix	WATER		WATER		WATER		WATER	
Units	pCi/l		pCi/l		pCi/l		pCi/l	
Uranium 238	0.145 +/- 0.122	E	0.130 +/- 0.129	E	0.110 +/- 0.124	E	0.120 +/- 0.110	E
Radium 226	< 0.098		0.286 +/- 0.148		0.318 +/- 0.168	E	0.308 +/- 0.179	E
Radium 228	1.31 +/- 1.35		< 0.469		< 0.469		< 0.469	
Thorium 230	1.07 +/- 0.357		0.546 +/- 0.197	E	1.47 +/- 0.394		1.08 +/- 0.309	
Thorium 232	< 0.294		0.029 +/- 0.055	E	1.02 +/- 0.340		0.181 +/- 0.140	

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES								
Sample ID No.	LT-GW-MW-8D		LT-GW-MW-10		LT-GW-KON		LT-GW-3S	
Lab Number	981017-05		981017-06		981030-04		980977-04	
Matrix	WATER		WATER		WATER		WATER	
Units	pCi/l		pCi/l		pCi/l		pCi/l	
Uranium 238	< 0.458		0.178 +/- 0.175	E	0.118 +/- 0.132	E	0.152 +/- 0.196	
Radium 226	0.243 +/- 0.178	E	0.781 +/- 0.282		0.187 +/- 0.129	E	1.14 +/- 0.322	
Radium 228	< 0.469		< 0.469		1.75 +/- 1.29		0.33 +/- 0.516	E
Thorium 230	0.930 +/- 0.287		0.795 +/- 0.241		0.562 +/- 0.183	E	0.669 +/- 0.191	
Thorium 232	0.258 +/- 0.154		0.170 +/- 0.119		0.222 +/- 0.136	E	0.096 +/- 0.089	E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

400617

SITE NAME: Li Tungsten
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Outreach Laboratory

RADIONUCLIDES	
Sample ID No.	
Lab Number	
Matrix	
Units	
Uranium 238	
Radium 226	
Radium 228	
Thorium 230	
Thorium 232	

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect
NA - Not Analyzed

SUMMARY OF ESTIMATED IN-SITU REMEDIATION VOLUMES FOR ALTERNATIVES LS-1 THROUGH LS-4 AND CS-1 THROUGH CS-4

In-Situ Remediation Volumes presented in cubic yards (cy)

Parcel/Area	Volume of Radioactive Soils Above PRGs (cy)	Volume of Nonradioactive Metals-Contaminated Soils Above PRGs (cy)	Total Volume (cy)
Li Tungsten - Parcel A	1,000	700	1,700
Li Tungsen - Parcel B	11,400	600	12,000
Li Tungsten - Parcel C	9,200	1,000	10,200
Li Tungsten - Dickson Warehouse	3,131	n/a	3,131
Li Tungsten Subtotal	24,731	2,300	27,000
Captain's Cove - Area A	13,300	7,600	20,900
Captain's Cove - Area G	7,000	2,800	9,800
Captain's Cove Subtotal	20,300	10,400	30,400

NOTE: n/a = not applicable

ALTERNATIVE LS-1
PARCELS A, B, C and DICKSON WAREHOUSE

No Action

Capital Cost

None $0

TOTAL CAPITAL COST	$ 0

TOTAL ANNUAL O&M COSTS	$ 0

ALTERNATIVE LS-2
PARCELS A, B, C and DICKSON WAREHOUSE

Excavation and Off-Site Disposal of Radioactive and Nonradioactive Metals-Contaminated Soils

---

Capital Costs

Parcel A- Remediation to Risk-based PRGs

1. Excavate Contaminated Soil: 1,700 cy @ $2.75/cy $4,700

2. Load Radioactive and Nonradioactive Metals-Contaminated Soil for Off-Site Disposal:
   1,700 cy x 1.3[1] x $3.80/cy $8,400

3. Transportation and Disposal of Non-Radioactive Soil at a Subtitle D facility[2]:
   700 cy x 1.5 tons/cy x $115/ton $121,000

4. Rail Transportation of Radioactive Soil[3]: 1,000 cy x 1.3[1] x $200/cy $260,000

5. Disposal of Radioactive Soil[4]: 1,000 cy x 1.3[1] x $166.60/cy $217,000

PARCEL A SUBTOTAL **$611,100**

Parcels B and C and Dickson Warehouse - Remediation to NYS TAGMs or Cleanup Levels Established for State Superfund Cleanup at Captain's Cove

6. Excavate Contaminated Soil: 25,331 cy @ $2.75/cy $69,700

7. Load Radioactive and Nonradioactive Metals-Contaminated Soil for Off-Site Disposal:
   25,331 cy x 1.3[1] x $3.80/cy $125,000

8. Transportation and Disposal of Nonradioactive Metals-Contaminated Soil at a Subtitle D facility[2]:
   1,600 cy x 1.5 tons/cy @ $115/ton $276,000

9. Rail Transportation of Radioactive Soil[3]: 23,731 cy x 1.3[1] x $200/cy $6,170,000

10. Disposal of Radioactive Soil[4]: 23,731 cy x 1.3[1] x $166.60/cy $5,140,000

PARCELS B and C AND DICKSON WAREHOUSE SUBTOTAL **$11,781,000**

Other

11. Building Demolition[5] $212,000

12. Clean out Storm Sewer Drains[6] $30,000

13. Surface Water Treatment[7] $100,000

SUBTOTAL **$12,734,000**

ALTERNATIVE LS-2
PARCELS A, B, C and DICKSON WAREHOUSE
(continued from previous page)

Engineering (7% Estimated Lump Sum)	$891,000
Construction Management (10%)	$1,273,000
Contingencies (15%)	$1,856,000

LS-2 - TOTAL CAPITAL COSTS	**$ 16,754,000**

LS-2 - PRESENT WORTH	**NA (No Long Term Costs Identified)**

Notes:

Ex-situ handling of excavated soils increases soil volume by a (swell or bulking) factor of 1.3.

2 Transportation and disposal cost for Subtitle D landfill of $115/ton is based on cost data from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.). Estimated cost includes 150 mile haul to disposal facility ($1.76 per mile per 18-ton truckload), disposal of 90% of the material at a non-hazardous cost of $78.89/ton, and off-site solidification and disposal of the remaining 10% of the material at a cost of $294.42/ton.

3 Rail transportation to Utah is based on a written quote from MHF Logistical Solution, Inc., and includes truck transportation from the site to a Wooster, MA transfer facility; roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah; tracing/expediting/destination/scheduling services; and one liner per gondola car.

4 Disposal of radioactive soils based on rate for USEPA Region II/USACOE at Envirocare of Utah, Inc.

5 Demolition of 4 on-site structures at a cost of $0.085/CF for masonry and metal structures and $0.17/CF for wood structures. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

6 Sewer jet cleanout of storm sewers on Parcels A and C. Estimated cost based on cleanout of 1,400 LF of 12" diameter sewer pipe, 400 LF of 15" diameter pipe and 1,300 LF of 24" diameter pipe at unit costs of $2.20-$3.35 per LF plus mobilization. Cost assumes collection of up to 5,000 gallons of washwater in a tank truck ($400), transportation (up to 150 miles) to a permitted disposal facility ($300), and disposal ($18,000). Unit costs from R.S. Means *Site Work and Landscape Cost Data* (1999 ed.) and *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

7 Assumes collection of up to 60,000 gallons of surface water in tank trucks, transportation to a permitted disposal facility (up to 150 miles) and disposal. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

It is assumed that remediation areas where only inorganic contamination (toxic metals only, no radionuclides above PRGs) was detected will be segregated for disposal at a chemical waste landfill.

ALTERNATIVE LS-3
PARCELS A, B, C and DICKSON WAREHOUSE

Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Stabilization and On-Site Containment of Other Nonradioactive Metals-Contaminated Soils

---

Capital Costs

Parcel A - Remediation to Risk-based PRGs

1. Excavate Contaminated Soil: 1,700 cy x $2.75/cy $4,700
2. Volume Reduction Treatment for Radioactive Soil[1]: 1,000 cy x 1.3[2] x $55/cy $72,000
3. Load Radioactive Soil for Off-site Disposal: 650 cy x $3.80/cy $2,500
4. Rail Transportation of Radioactive Soil[3]: 650 cy x $200/cy $130,000
5. Disposal of Radioactive Soil[4]: 650 cy x $166.60/cy $108,000
6. Load Nonradioactive Metals-Contaminated Soil for Stabilization:
   (500 + 700) cy x 1.3[2] x $3.80/cy $6,000
7. Stabilization of Nonradioactive Metals-Contaminated Soil[5]:
   (1,200 x 1.03 cy) x 1.5 tons/cy x $16/ton $30,000
8. Placement of Stabilized Soil in On-Site Landfill: 1,236 cy x 1.3 x $3.80/cy $6,100

SUBTOTAL - PARCEL A **$360,000**

Parcels B and C and Dickson Warehouse- Remediation to NYS TAGMs or Cleanup Levels Established for State Superfund Cleanup at Captain's Cove

9. Excavation of Contaminated Soil: 22,200 cy @ $2.75/cy $61,000
10. Volume Reduction Treatment for Radioactive Soil[1]: 22,200 cy x 1.3[2] @ $55/cy $1,587,000
11. Load Radioactive Soil for Off-site Disposal: (14,500 cy + 3,131 cy) x $3.80/cy $67,000
12. Rail Transportation of Radioactive Soil[3]: 17,631 cy @ $200/cy $3,526,000
13. Disposal of Radioactive Soil[4]: 17,631 cy @ $166.60/cy $2,937,000
14. Load Nonradioactive Metals-Contaminated Soil for Stabilization:
    (1,600 cy + 14,500 cy) x 1.3[2] x $3.80/cy $79,000
15. Stabilization of Nonradioactive Metals-Contaminated Soil[5]:
    (16,100 cy x 1.03) x 1.5 tons/cy @ $16/ton $398,000
16. Placement of Stabilized Soil in On-Site Landfill: 16,600 cy @ $3.80/cy $63,000

PARCELS B and C and DICKSON WAREHOUSE SUBTOTAL **$8,718,000**

ALTERNATIVE LS-3
PARCELS A, B, C and DICKSON WAREHOUSE
(continued from previous page)

On-Site RCRA Landfill Construction

17. Construction of On-site RCRA Capping System[6]: 0.9 ac with 10-foot cell depth @ $430,000 ac $387,000

Other Components

18. Building Demolition[7] $212,000

19. Clean out Storm Sewer Drains[8] $30,000

20. Surface Water Treatment[9] $100,000

SUBTOTAL	$9,317,000
Engineering (10%)	$932,000
Construction Management (10%)	$932,000
Contingencies (15%)	$1,398,000

LS-3 - TOTAL CAPITAL COSTS	**$ 12,579,000**

Annual Operation & Maintenance

Allow for Annual Maintenance of RCRA Cap ($60,000 per year for 30 year period) $1,800,000

LS-3 - O&M COST PRESENT WORTH	**$ 1,355,000**

LS-3 - TOTAL PRESENT WORTH	**$ 14,379,000**

Notes:

1 Cost for volume reduction using Segmented Gate System (SGS) from literature. Volume reduction estimated at 50% by SGS vendor ThermoNuTech (11/4/98 correspondence to MPI).

2 Ex-situ handling of excavated soils increases soil volumes by a (swell or bulking) factor of 1.3. For example, 1,700 cy increases to 2,200 cy; 22,200 cy increases to 28,800 cy.

3 Rail transportation to Utah is based on a written quote from MHF Logistical Solution, Inc., and includes truck

transportation from the site to a Wooster, MA transfer facility; roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah; tracing/expediting/destination scheduling services; and one liner per gondola car.

4 Disposal of radioactive soils based on rate for USEPA Region II/USACOE at Envirocare of Utah, Inc.

5 Cost for stabilization from Solucorp Molecular Bonding System literature. Increase in volume due to stabilization estimated as a factor of 1.03.

6 Cap construction cost based on MPI experience on similar projects.

7 Demolition of 4 on-site structures at a cost of $0.085/CF for masonry and metal structures and $0.17/CF for wood structures. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

8 Sewer jet cleanout of storm sewers on Parcels A and C. Estimated cost based on cleanout of 1,400 LF of 12" diameter sewer pipe, 400 LF of 15" diameter pipe and 1,300 LF of 24" diameter pipe at unit costs of $2.20-$3.35 per LF plus mobilization. Cost assumes collection of up to 5,000 gallons of washwater in a tank truck ($400), transportation (up to 150 miles) to a permitted disposal facility ($300), and disposal ($18,000). Unit costs from R.S. Means *Site Work and Landscape Cost Data* (1999 ed.) and *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

9 Assumes collection of up to 60,000 gallons of surface water in tank trucks, transportation to a permitted disposal facility (up to 150 miles) and disposal. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

ALTERNATIVE LS-4
PARCELS A, B, C and DICKSON WAREHOUSE

Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Off-Site Disposal of Other Nonradioactive Metals-Contaminated Soils

Capital Costs

Parcel A- Remediation to Risk-based PRGs

1. Excavate Contaminated Soil: 1,700 cy @ $2.75/cy $4,700

2. Volume Reduction Treatment for Radioactive Soil[1]: 1,000 cy x 1.3[2] @ $55/cy $72,000

3. Load Radioactive Soil for Off-Site Disposal:
   650 cy x 1.3[2] x $3.80/cy $3,200

4. Rail Transportation of Radioactive Soil[3]: 650 cy x 1.3[2] x $200/cy $169,000

5. Disposal of Radioactive Soil[4]: 650 cy x 1.3[2] x $166.60/cy $141,000

6. Load Nonradioactive Soil for Off-Site Disposal:
   (700 cy - 500 cy) x 1.3[2] x $3.80/cy $8,400

7. Transportation and Disposal of Nonradioactive Metals-Contaminated Soil at a Subtitle D facility[5]:
   1,200 cy x 1.5 tons/cy x $115/ton $207,000

PARCEL A SUBTOTAL **$605,300**

Parcels B and C and Dickson Warehouse - Remediation to NYS TAGMs or Cleanup Levels Established for State Superfund Cleanup at Captain's Cove

8. Excavate Contaminated Soil: 22,200 cy @ $2.75/cy $150,000

9. Volume Reduction Treatment for Radioactive Soil[1]: 20,600 cy x 1.3[2] @ $55/cy $1,473,000

10. Load Radioactive Soil for Off-Site Disposal:
    (13,400 + 3,131 cy) x $3.80/cy $12,000

11. Rail Transportation of Radioactive Soil[4]: 16,531 cy x $200/cy $3,304,000

12. Disposal of Radioactive Soil[5]: 16,531 cy x $166.60/cy $2,752,000

13. Load Nonradioactive Soil for Off-Site Disposal:
    (13,400 + 1,600 cy) x $3.80/cy $6,000

14. Transportation and Disposal of Non-Radioactive Soil at a Subtitle D facility[5]:
    11,900 cy x 1.5 tons/cy @ $115/ton $2,053,000

PARCELS B and C AND DICKSON WAREHOUSE SUBTOTAL **$9,750,000**

ALTERNATIVE LS-4
PARCELS A, B, C and DICKSON WAREHOUSE
(continued from previous page)

Other

15. Building Demolition[6]	$212,000
16. Clean out Storm Sewer Drains[7]	$30,000
17. Surface Water Treatment[8]	$100,000
SUBTOTAL	**$10,700,000**
Engineering (10% Estimated Lump Sum)	$1,070,000
Construction Management (10%)	$1,070,000
Contingencies (15%)	$1,605,000
LS-4 - TOTAL CAPITAL COSTS	**$ 14,445,000**
LS-4 - PRESENT WORTH	**NA (No Long Term Costs Identified)**

Notes:

1. Cost for volume reduction using Segmented Gate System (SGS) from literature. Volume reduction estimated at 50% by SGS vendor ThermoNuTech (11/4/98 correspondence to MPI).

2. Ex-situ handling of excavated soils increases soil volume by a (swell or bulking) factor of 1.3.

3. Transportation and disposal cost for Subtitle D landfill of $115/ton is based on cost data from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.). Estimated cost includes 150 mile haul to disposal facility ($1.76 per mile per 18-ton truckload), disposal of 90% of the material at a non-hazardous cost of $78.89/ton, and off-site solidification and disposal of the remaining 10% of the material at a cost of $294.42/ton.

4. Rail transportation to Utah is based on a written quote from MHF Logistical Solution, Inc., and includes truck transportation from the site to Wooster, MA transfer facility, roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah, tracing/expediting/destination/scheduling services and one liner per gondola car.

5. Disposal of radioactive soils based on rate for USEPA Region II/USACOE at Envirocare of Utah, Inc.

6. Demolition of 4 on-site structures at a cost of $0.085/CF for masonry and metal structures and $0.17/CF for wood structures. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

7. Sewer jet cleanout of storm sewers on Parcels A and C. Estimated cost based on cleanout of 1,400 LF of 12" diameter sewer pipe, 400 LF of 15" diameter pipe and 1,300 LF of 24" diameter pipe at unit costs of $2.20-

ALTERNATIVE LS-4
PARCELS A, B, C and DICKSON WAREHOUSE
(continued from previous page)

$3.35 per LF plus mobilization. Cost assumes collection of up to 5,000 gallons of washwater in a tank truck ($400), transportation (up to 150 miles) to a permitted disposal facility ($300), and disposal ($18,000). Unit costs from R.S. Means *Site Work and Landscape Cost Data* (1999 ed.) and *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

Assumes collection of up to 60,000 gallons of surface water in tank trucks, transportation to a permitted disposal facility (up to 150 miles) and disposal. Unit costs from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.).

It is assumed that remediation areas where only inorganic contamination (toxic metals only, no radionuclides above PRGs) was detected will be segregated for disposal at a chemical waste landfill.

ALTERNATIVE CS-1
CAPTAIN'S COVE

No Action

Capital Cost

None $0

CS-1 - TOTAL CAPITAL COST	$ 0

CS-1 - TOTAL ANNUAL O&M COSTS	$ 0

ALTERNATIVE CS-2
CAPTAIN'S COVE

Excavation and Off-Site Disposal of Radioactive and Nonradioactive Metals-Contaminated Soils

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Capital Costs

Areas A, G and B/C - Remediation to NYS TAGMs or Cleanup Levels Developed for State Superfund Cleanup at Captain's Cove

1. Excavate Contaminated Soil: 30,700 cy @ $2.75/cy $84,000

2. Load Radioactive and Nonradioactive Metals-Contaminated Soil for Off-Site Disposal: 30,700 cy x 1.3[1] @ $3.80/cy $152,000

3. Rail transportation of Radioactive Soil[2]: 20,300 cy x 1.3[1] @ $200/cy $5,278,000

4. Disposal of Radioactive Soil[2]: 20,300 cy x 1.3[1] @ $166.60/cy $4,400,000

5. Transport and Dispose of Nonradioactive Metals-Contaminated Soil at a Subtitle D Facility[2]: 10,400 cy x 1.5 tons/cy x $115/ton $1,800,000

SUBTOTAL	**$11,714,000**
Engineering (7% Estimated Lump Sum)	$820,000
Construction Management (10%)	$1,171,000
Contingencies (15%)	$1,760,000

CS-2 TOTAL CAPITAL COSTS	**$15,465,000**

CS-2 PRESENT WORTH	**NA (No Long Term Costs Identified)**

Notes:

[1] Ex-situ handling of excavated soils increases soil volume by a (swell or bulking) factor of 1.3.

[2] Rail transportation to Utah is based on a written quote fom MHF Logistical Solutions, Inc. and includes truck transportation from the site to a Wooster, MA transfer facility; roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah; tracing/expediting/scheduling services; and one liner per gondola car.

ALTERNATIVE CS-2
CAPTAIN'S COVE
(continued from previous page)

- Disposal of radioactive soils based on rate for USEPA Region II USACOE at Envirocare of Utah, Inc.

- Transportation and disposal cost for Subtitle D landfill of $115/ton is based on cost data from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.). Estimated cost includes 150 mile haul to disposal facility ($1.76 per mile per 18-ton truckload), disposal of 90% of the material at a non-hazardous cost of $78.89/ton, and off-site solidification and disposal of the remaining 10% of the material at a cost of $294.42/ton.

400631

ALTERNATIVE CS-3
CAPTAIN'S COVE

Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Stabilization and On-Site Containment of Other Nonradioactive Metals-Contaminated Soils at the Li Tungsten Facility

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Capital Costs

Areas A, G and B/C - Remediation to NYS TAGMs or Cleanup Levels Developed for State Superfund Cleanup at Captain's Cove

1. Excavate Contaminated Soil: 30,700 cy @ $2.75/cy $84,000
2. Volume Reduction Treatment for Radioactive Soil[1]: 20,300 cy x 1.3[2] @$55/cy $1,451,000
3. Load Radioactive Soil for Off-Site Disposal: 13,200 @ $3.80/cy $50,000
4. Rail Transportation of Radioactive Soil[3]: 13,200 @ $200/cy $2,640,000
5. Disposal of Radioactive Soil[3]: 13,200 cy @ $166.60/cy $2,200,000
6. Load Nonradioactive Metals-Contaminated Soils for Stabilization:
   (10,150 + 10,400) cy x 1.3[2] x $3.80/cy $102,000
7. Stabilization of Nonradioactive Metals-Contaminated Soil[5]:
   (20,550 x 1.03 cy) x 1.5 tons/cy @ $16/ton $508,000
8. Placement of Stabilized Soil in Li Tungsten Site Landfill: 21,200 cy x 1.3 @ $3.80/cy $105,000

On-Site RCRA Landfill Construction

9. Construction of RCRA Capping System[7] at Li Tungsten: 1.36 ac with 10' cell depth @ $430,000/ac .. $586,000

SUBTOTAL	$7,726,000
Engineering (10%)	$773,000
Construction Management (10%)	$773,000
Contingencies (15%)	$1,160,000

CS-3 TOTAL CAPITAL COSTS	**$10,432,000**

Annual Operation and Maintenance

Allow $60,000 per year for annual maintenance of RCRA Cap (30 year term)

400632

ALTERNATIVE NO. CS-3
CAPTAIN'S COVE
(continued from previous page)

CS-3 O&M COST PRESENT WORTH	$1,355,000

CS-3 PRESENT WORTH	$11,787,000

Notes:

1. Cost for volume reduction using Segmented Gate System (SGS) from literature. Volume reduction estimated at 50% by SGS vendor ThermoNuTech (11/4/98 correspondence to MPI).

2. Ex-situ handling of excavated soils increases soil volume by a (swell or bulking) factor of 1.3.

3. Rail transportation to Utah is based on a written quote fom MHF Logistical Solutions, Inc. and includes truck transportation from the site to a Wooster, MA transfer facility; roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah; tracing expediting/scheduling services; and one liner per gondola car.

4. Disposal of radioactive soils based on rate for USEPA Region II/USACOE at Envirocare of Utah, Inc.

   Transportation and disposal cost for Subtitle D landfill of $309/ton is based on cost data from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.). Estimated cost includes 150 mile haul to disposal facility ($1.76 per mile per 18-ton truckload) and off-site solidification and disposal of the material at a cost of $294.42/ton.

6. Cost for stabilization from Solucorp Molecular Bonding System literature. Increase in volume due to stabilization estimated as a factor of 1.03.

7. Cap construction cost based on MPI experience with similar projects.

400633

ALTERNATIVE CS-4
CAPTAIN'S COVE

Excavation with Radioactive Waste Volume Reduction, Off-Site Radioactive Waste Disposal and Off-Site Disposal of Other Nonradioactive Metals-Contaminated Soils

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Capital Costs

Areas A, G and B/C - Remediation to NYS TAGMs or Cleanup Levels Developed for State Superfund Cleanup at Captain's Cove

1. Excavation of Contaminated Soil: 30,700 cy @ $2.75/cy $84,000
2. Volume Reduction Treatment for Radioactive Soil[1]: 20,300 cy x 1.3[2] @$55/cy $1,451,000
3. Load Radioactive Soil for Off-Site Disposal: 13,200 cy @ $3.80/cy $50,000
4. Rail transportation of Radioactive Soil[3]: 13,200 cy @ $200/cy $2,640,000
5. Disposal of Radioactive Soil[4]: 13,200 @ $166.60/cy $2,200,000
6. Load Nonradioactive Metals-Contaminated Soil for Off-Site Disposal:
   (10,150 + 10,400) cy x 1.3[2] @ $3.80/cy $102,000
7. Transportation and Disposal of Nonradioactive Metals-Contaminated Soil at a Subtitle D Facility[5]:
   (10,150 + 10,400) cy x 1.5 tons/cy x $115/ton $3,545,000

SUBTOTAL	**$10,072,000**
Engineering (10%)	$1,007,000
Construction Management (10%)	$1,007,000
Contingencies (15%)	$1,511,000

CS-4 TOTAL CAPITAL COSTS	**$13,597,000**

CS-4 PRESENT WORTH	**NA (No Long Term Costs Identified)**

Notes:

1. Cost for volume reduction using Segmented Gate System (SGS) from literature. Volume reduction estimated at 50% by SGS vendor ThermoNuTech (11/4/98 correspondence to MPI).
2. Ex-situ handling of excavated soils increases soil volume by a (swell or bulking) factor of 1.3.

ALTERNATIVE NO. CS-4
CAPTAIN'S COVE
(continued from previous page)

Notes (continued)

3 Rail transportation to Utah is based on a written quote fom MHF Logistical Solutions, Inc. and includes truck transportation from the site to a Wooster, MA transfer facility; roundtrip covered gondola car transportation from Wooster, MA to Clive, Utah; tracing/expediting/scheduling services; and one liner per gondola car.

4 Disposal of radioactive soils based on rate for USEPA Region II/USACOE at Envirocare of Utah, Inc.

5 Transportation and disposal cost for Subtitle D landfill of $115/ton is based on cost data from R.S. Means *Environmental Remediation Cost Data - Assemblies* (1999 ed.). Estimated cost includes 150 mile haul to disposal facility ($1.76 per mile per 18-ton truckload), disposal of 90% of the material at a non-hazardous cost of $78.89/ton, and off-site solidification and disposal of the remaining 10% of the material at a cost of $294.42/ton.

ALTERNATIVE LW-1
No Action

Capital Cost

None (use existing monitoring well network)

TOTAL CAPITAL COST	**$0**

Operation & Maintenance

Quarterly Sampling of select wells for first two years 16 wells x 4 times per year for 2 years	$67,000
Annual sampling for remaining 28 years (16 wells)	$235,000
Well Replacement	$22,000
Laboratory Analysis for the first two years (4 times yr for 2 yrs @ $1,100 analytical set x 16 wells)	$141,000
Annual Sampling for 28 years @ $1,100 per set x 16 sets	$493,000
SUBTOTAL	**$958,000**

LW-1 - AVERAGE ANNUAL O & M	**$ 32,000**

LW-1 - O&M PRESENT WORTH	**$ 722,000**

ALTERNATIVE LW-2
PARCEL C
LW-2:
Interceptor Trench/Extraction Wells with On-Site Treatment and Disposal

Capital Cost

Inorganic Compounds Parcel C

Installation of 1-300 foot of interceptor trench, 15 feet deep backfill, sump collection system and backfill	$75,000
Three (3) low-flow extraction wells	$12,000
Pre-treatment equalization holding tank and ancillary equipment to pipe water to treatment facility	$30,000
Prefabricated building for the treatment system	$15,000
Filtration/chemical precipitation/pH adjustment pumps, mixers, tanks	$80,000
Installation of 200 linear feet of infiltration galleries upgradient of source pumps and piping and ancillary equipment	$30,000
SUBTOTAL OF CAPITAL COSTS	**$242,000**
Engineering (20%)	$49,000
Construction Management (10%)	$24,000
Contingencies (15%)	$36,000
LW-2 TOTAL CAPITAL COSTS	**$351,000**

Operation and Maintenance

Quarterly Sampling of select wells for first two years 16 wells x 4 times per year for 2 years	$67,000
Annual sampling for remaining 28 years (16 wells)	$235,000
Well Replacement	$22,000
Laboratory Analysis for the first two years (4 times/yr for 2 yrs @ $1,100/analytical set x 16 wells)	$141,000
Annual Sampling for 28 years @ $1,100 per set x 16 sets	$493,000
Power (operating equipment, lighting, heat)	$108,000
Chemicals/GAC replacement and disposal	$400,000

ALTERNATIVE LW-2 (Cont'd)
PARCEL C

LW-2:

Maintenance	$750,000
Disposal	$300,000
SUBTOTAL O&M	**$2,516,000**

LW-2 AVERAGE ANNUAL O & M COSTS	**$84,000**

LW-2 O&M COSTS PRESENT WORTH	**$1,896,000**

LW-2 TOTAL PRESENT WORTH	**$2,247,000**

ALTERNATIVE LW-3
PARCEL C

LW-3:

Interceptor Trench/Extraction Wells with Off-Site Treatment and Reinjection at the Nearby Mattiace Superfund Site Treatment Facility

Capital Cost

Inorganic Compounds Parcel C

Installation of 300 linear feet of interceptor trench X 15 feet deep backfill, sump collection system and backfill	$75,000
Three (3) low flow extraction wells	$12,000
Pre-treatment equalization holding tank and ancillary equipment	$30,000
Connection to the Four (4) inch force main to Mattice plant	$2,000
Furnish and install pump station	$10,000
Installation of three (3) downgradient monitoring wells @ $4,500/well including oversight labor	$14,000
SUBTOTAL OF CAPITAL COSTS	**$143,000**
Engineering (20%)	$29,000
Construction Management (10%)	$14,000
Contingencies (15%)	$22,000
LW-3 TOTAL CAPITAL COSTS	**$208,000**

Operation and Maintenance

Quarterly Sampling of select wells for first two years 10 wells x 4 times per year for 2 years	$50,000
Annual sampling for remaining 28 years	$176,000
Well Replacement	$14,000
Laboratory Analysis for the first two years (4 times/yr for 2 yrs @ $1,100/analytical set)	$88,000
Annual Sampling for 28 years @ $1,100 per set times 10 sets	$308,000
Power (co-operatively shared with Mattiace)	$30,000
Chemicals (co-operatively shared with Mattiace)	$150,000
Maintenance (co-operatively shared with Mattiace)	$300,000

ALTERNATIVE LW-3
PARCEL C
LW-3:

Disposal	$300,000
SUBTOTAL O&M	$1,416,000

LW-3 AVERAGE ANNUAL O & M COSTS	**$47,000**

LW-3 O&M COSTS PRESENT WORTH	**$1,061,000**

LW-3 TOTAL PRESENT WORTH	**$1,269,000**

ALTERNATIVE LW-4
PARCEL C
LW-4:

Reactive Walls with Slurry Walls and In-Well Adsorption

Capital Cost

Inorganic Compounds Parcel C

Installation of 1-300 foot reactive wall, slurry containment wall, and distribution trench	$413,000
Installation of three (3) downgradient monitoring wells @ $4,500/well	$14,000
Installation of three (3) downgradient adsorption wells @ $5,500/well including oversight labor	$17,000
SUBTOTAL CAPITAL COSTS	**$444,000**

Engineering (20%)	$89,000
Construction Management (10%)	$44,000
Contingencies (15%)	$67,000

LW-4 TOTAL CAPITAL COSTS	**$644,000**

Operation and Maintenance

Quarterly Sampling for select wells for first two years 10 wells 4 times per year for 2 years	$50,000
Annual sampling for remaining 28 years	$176,000
Laboratory Analysis for the first two years (4 times/yr for 2 yrs @ $1,100/analytical set)	$88,000
Annual Sampling for 28 years @ $1,100 per set times 10 sets	$308,000
Reactive wall maintenance	$150,000
Disposal	$100,000
SUBTOTAL O&M	**$872,000**

ALTERNATIVE LW-4 (Cont'd)
PARCEL C
LW-4:

LW-4 AVERAGE ANNUAL O & M COSTS	$29,000

LW-4 O&M COSTS PRESENT WORTH	$655,000

LW-4 TOTAL PRESENT WORTH	$1,299,000