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U.S. Environmental Protection Agency
Region II

Response Action Contract

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

JULY 1999

Contract No: 68-W-98-214

FOSTER WHEELER

400643

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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

DRAFT FINAL
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APPENDIX A

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CAPTAIN'S COVE SITE
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Focused Feasibility Study (FFS) is to investigate the overall extent of the radiological contamination at the Captain's Cove portion of the Li Tungsten Superfund Site. The FFS was performed by Malcolm Pirnie, Inc., (Malcolm Pirnie) in accordance with the FFS Draft Final Work Plan (Malcolm Pirnie, 1997) on behalf of the U. S. Environmental Protection Agency (USEPA) Region II under the Alternative Remedial Contracting Strategy (ARCS), Contract No. 68-W9-0051, Work Assignment No. 025-2L4L.

The results of this investigation are considered in the development of the remedial alternatives for the Site. Remedial alternatives are presented in the Draft Final Feasibility Study (FS) Report for the Li Tungsten and Captain's Cove sites (Malcolm Pirnie, 1999) submitted to the USEPA in July 1999.

1.2 SCOPE OF WORK

The scope of work for the FSS was described in the Draft Final Work Plan (Malcolm Pirnie, 1997). The focus of the FFS investigation is concentrated in two main areas and four smaller areas that contain radiological contamination. The areas of contamination were identified by the NYSDEC Radiation Program during their site-wide radiological survey (NYSDEC, 1997). For continuity, the letter designations given by NYSDEC to the areas have been maintained. The Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP) prepared for the Li Tungsten Remedial Investigation/Feasibility Study (RI/FS) (Malcolm Pirnie, 1996a, 1996b) were amended by variance for the field investigation at the Site. The field investigation was conducted in two phases. Phase I was completed in late September - early October 1997. Phase I consisted of providing radiological field screening of subsurface samples collected (during the excavation of test pits and installation of soil borings and monitoring wells) by Roux Associates during the RI; collection and radiological analysis of any samples that were determined to contain higher than background levels of radioactivity; and gamma logging of soil borings.

Phase II field activities were conducted from April - June 1998. Phase II activities included a radiological investigation (sampling with chemical and radiological analysis of samples collected from test pits, soil borings and monitoring wells installation, and gamma logging) in the radiologically contaminated areas of the Site, and sampling and radiological analysis of samples collected in other areas of the Site (wetlands, retention pond, surface water and groundwater) previously sampled by Roux Associates for chemical analysis during the RI. Additional details on the scope of the field investigation are presented in Section 2.0.

1.3 SITE BACKGROUND

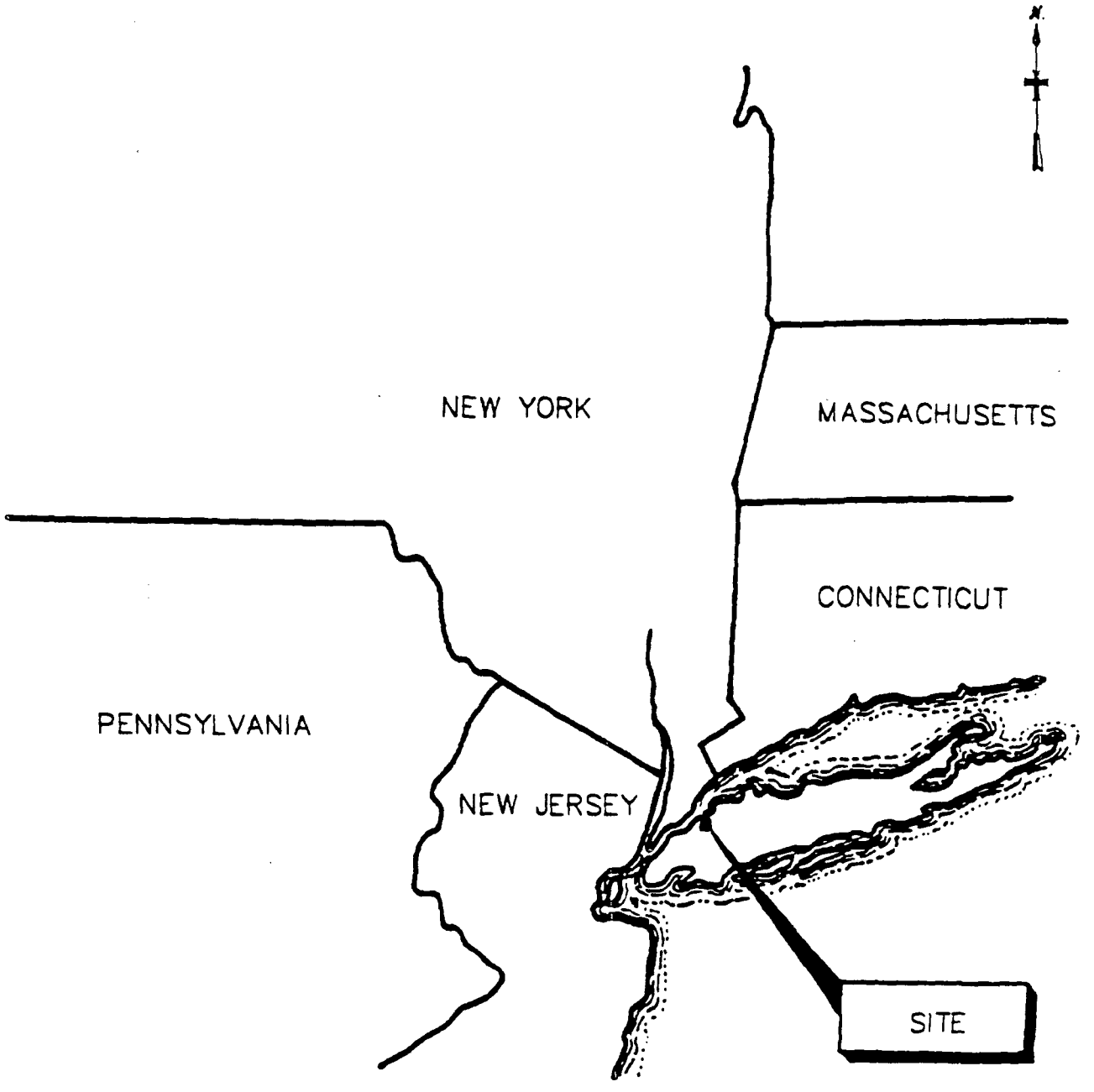
1.3.1 Site Description

The Captain's Cove Site (hereinafter referred to as the Site has been determined by the USEPA to be a non-contigious portion of the Li Tungsten site pursuant to CERCLA Section 104(d)(4). The Site is located approximately 0.5 miles west of the Li Tungsten site. The link between the two sites was made based on evidence obtained by the USEPA in 1995 that the previous owners/operators of the Li Tungsten site disposed of tungsten ore residues at the Site (Ebasco, 1995).

The Site is located on the north shore of Long Island in the City of Glen Cove, Nassau County, New York. Specifically, the 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 location map and site location map are presented in Figures 1-1 and 1-2, respectively. The 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 Site encompasses *23* acres including a four-acre wetland along Glen Cove Creek. A site plan is presented in Figure 1-3.

1.3.2 Site History

The Site was formerly used as a disposal site for, among other wastes, dredge materials from Glen Cove Creek. According to historical records (Hart, 1989a), 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 from 1933-



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

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CAPTAIN'S COVE ADJUNCT FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

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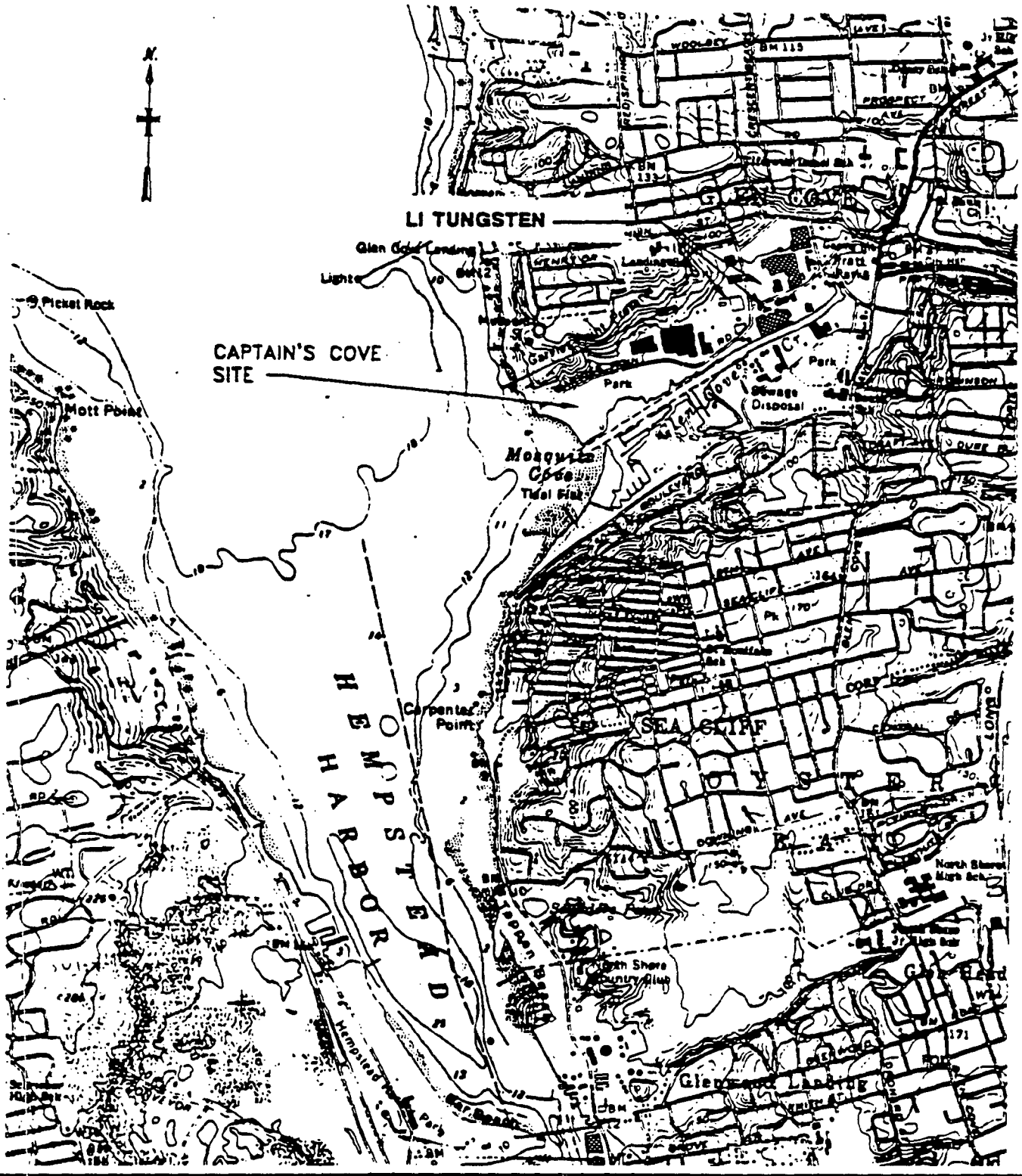

TITLE:	DATE:	FIGURE NO.:
SITE LOCATION MAP	NOV. 1998	FIGURE 1-2

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CAPTAIN'S COVE ADJUNCT FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

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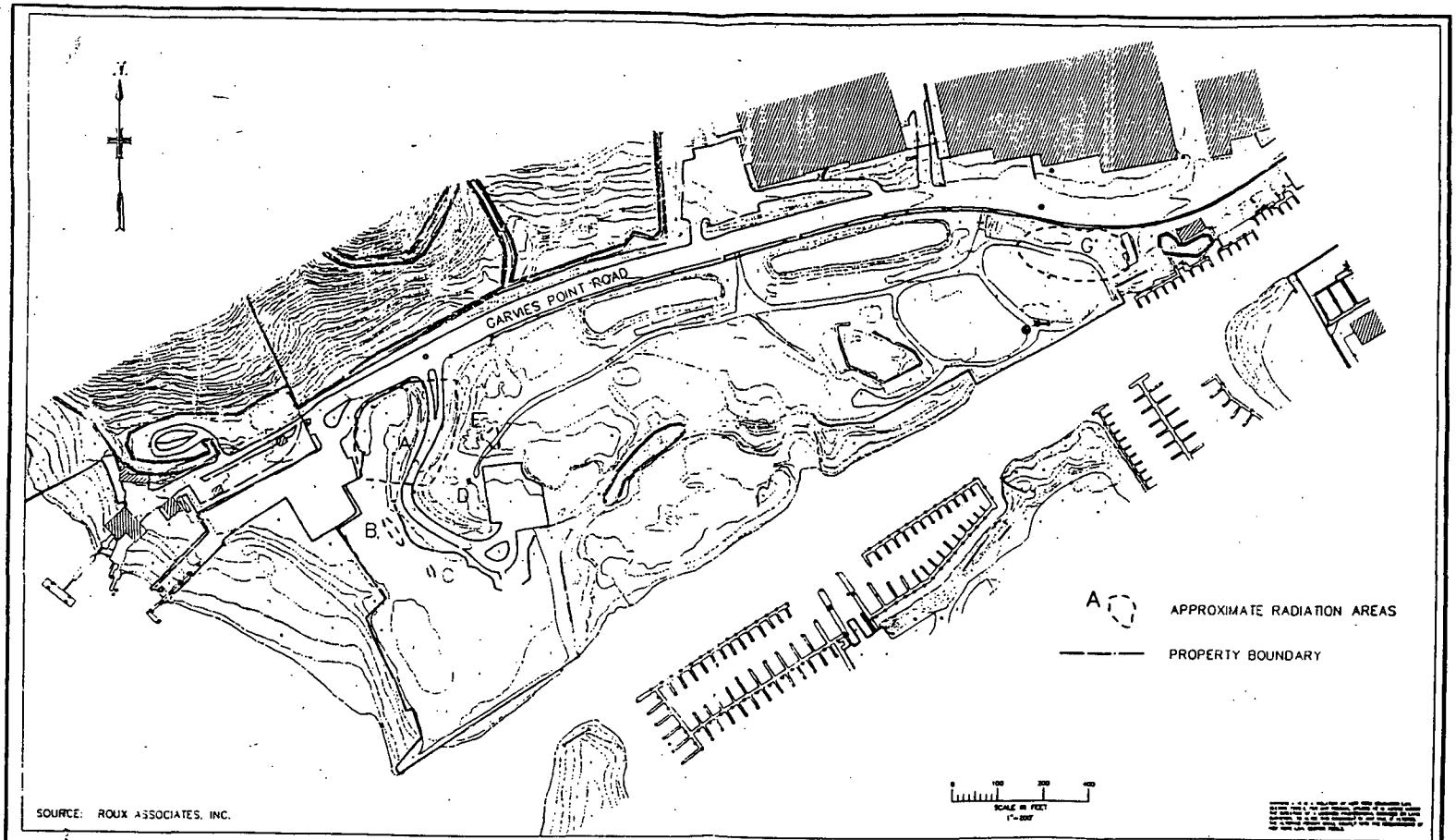

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RADIOLOGICAL AREAS (A-G)

CAPTAIN'S COVE ADJUNCT FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

DATE: NOV. 1998

PROJECT NO.: 8001202

FIGURE NO.: FIGURE 1-3

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1934 and 26,500 cubic yards of material dredged from 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 Site.

From approximately 1956 through the early 1958, the Captain's Cove site was used by the City of Glen Cove as a municipal landfill. Incinerator residues, wastewater treatment plant sludges and street debris were disposed of there (Hart, 1989a). During the period of time that the landfill was operational, waste 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 Site were sold by the City of Glen Cove and by some private owners to Village Green Reality 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. Subsequent to this property transfer, Village Green Reality installed a bulkhead along one-third of the Site border with Glen Cove Creek. The remaining portion of the Site waterfront was left in a natural state to preserve the estuarine habitat of the Site's wetlands. In addition, wooden and concrete piles were driven into the subsurface to provide structural integrity to three foundations for residential four-story condominium units. In 1985, two of the three 4-story concrete shells of the condominiums and the foundation of the third were built.

On January 7, 1986, the NYSDEC placed the Site on the state's list of inactive hazardous waste disposal sites and requested the Village Green Realty to conduct field investigations to determine if inorganic and/or organic constituents were present in soil and groundwater. The results of the investigation showed elevated concentrations of volatile organic compounds in groundwater and prompted the NYSDEC to modify the classification of the Site to Class 2.

Village Green Realty entered into a consent agreement with the NYSDEC in 1988 to conduct a RI/FS to address chemical contamination at the Site. Prior to implementation of the RI, elevated radiological contamination was discovered and all work ceased. In 1997, the City of Glen Cove in cooperation with Village Green Realty performed and implemented the remedial investigation for non-radiological contamination and issued a Draft RI Report

(Roux, 1998). Since the NYSDEC is statutorily precluded from addressing the radioactive materials present on the Site (pursuant to State Superfund law), the state requested that the USEPA address the radioactive contamination at the Site.

1.3.3 Current Conditions

After the Site was purchased by Village Green Realty, bulkheads were built along Glen Cove Creek and the western boundary of the Site bordering Hempstead Harbor. The area behind the bulkhead was backfilled with clean fill. Approximately two-thirds of the waterfront between the 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 site 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 have been driven into the subsurface over much of the Site. The purpose of the piles was to provide structural support to additional planned condominium buildings. Vegetation consists mainly of grasses and weeds which are being replaced along the perimeter of the Site with deciduous trees. Structures on the Site include the remains of the former sales office building, the two poured concrete condominium shells and the poured foundation of a third condominium. In addition, there is an 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 on the Site.

1.4 PREVIOUS INVESTIGATIONS

The Site has been the subject of numerous investigations since 1981 (LKB, 1984; CDM, 1985; FPM Engineers, 1987; Hart, 1989, 1990; Ebasco, 1994; NYSDEC, 1997; Roux, 1998) and samples of surface water, groundwater, soils and sediment have been collected and analyzed for chemical and/or radiological parameters. A remedial investigation/feasibility

study (RI/FS) was recently completed at the Site in those areas that do not exhibit radiological contamination (Roux, 1997). The three investigations that included radiological sampling and/or surveys are summarized below.

1.4.1 Hart Investigations

In 1989, allegations surfaced that some radioactive ore residues from the Li Tungsten *site* (a federal Superfund site approximately 0.5 miles east) were disposed at the Captain's Cove site. A radiological survey was then conducted (Hart, 1989) which detected radiation levels in excess of background in three areas of the Site. One of the areas was located on the western end of the Site near the paved driveway. The other two areas were located on the eastern end of the Site. Soil samples collected in these areas indicated gross alpha activity up to 580 picoCuries per gram (pCi/g) and gross beta up to 520 pCi/g.

A Phase II Radiological Survey was conducted to obtain more detailed information on the vertical and horizontal extent of radioactive materials at the Site (Hart, 1990). The Phase II Survey consisted of a review of aerial photographs, a gamma ray survey and the excavation of 15 test trenches. The results of the Phase II survey confirmed that most elevated levels of uranium (U), thorium (Th) and radium (Ra) were found in fairly discrete zones, four to eight feet below the surface, in the far eastern and western portions of the Site. The material exhibiting the elevated radiation levels consisted of a black powder or granular material.

1.4.2 Ebasco Investigation

In 1994, the NYSDEC officially requested the USEPA to take appropriate action at the site under CERCLA to eliminate potential threats to human health and the environment. In response to NYSDEC's request, a Site Screening Inspection (SSI) was conducted (Ebasco, 1994). Soil samples from the eastern and western portions of the Site indicated concentrations of radioactive isotopes approximately three times background. Based on a technical comparison of radiological data, it was determined that the radioactive materials at the Captain's Cove site were sufficiently similar to those at the Li Tungsten site for the USEPA to address the radioactive contamination at the Site as part of the Li Tungsten investigation.

1.4.3 NYSDEC Investigation

The NYSDEC conducted a surficial radiation survey of the site using the Ultrasonic Ranging and Data System (USRADS) which combines positional accuracy and high data point density to delineate the aerial extent of near surface radioactivity. Results of this survey confirmed that surficial contamination at the site is limited to two primary areas: the northwest corner (Area A) and the extreme eastern end (Area G). Additional smaller areas of contamination were also identified (Areas B, C, D and E). Maximum activities of ^{232}Th (44 pCi/g), ^{234}U (84 pCi/g) and ^{238}U (173 pCi/g) were collected from a sample in the northwest corner of the site (Area A).

1.5 FFS REPORT ORGANIZATION

The FFS Report is organized into eight sections of text including references. A brief description of each section follows:

Section 1.0, INTRODUCTION, presents the purpose of the FFS, the background of the site including the location, history and current conditions.

Section 2.0, STUDY AREA INVESTIGATIONS, presents a description of the work performed during the field investigation phase including the surface features investigation, subsurface soil investigation, surface water/sediment and wetlands investigation, groundwater investigation and radiological characterization.

Section 3.0, PHYSICAL CHARACTERISTICS OF STUDY AREA, presents a description of the surface features, meteorology, regional and site geology and hydrogeological characteristics.

Section 4.0, NATURE AND EXTENT OF CONTAMINATION, presents the nature and extent of the radiological contamination in the subsurface soil, groundwater, surface water and sediment.

Section 5.0, RISK ASSESSMENT, presents the chemical and radiological risk assessment for the site.

Section 6.0, SUMMARY AND CONCLUSIONS, presents the summary and conclusions of the FFS.

Section 7.0, REFERENCES, presents the general references for this report.

Section 8.0, GLOSSARY, presents the abbreviations, acronyms, radiological and baseline risk assessment terms.

SECTION 2

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2.0 STUDY AREA INVESTIGATIONS

2.1 SURFACE FEATURES INVESTIGATION

2.1.1 Surveying

Surveyed locations of all new and existing monitoring wells, soil borings, test pits was performed in May 1998 (Figure 2-1). Horizontal control points are based on New York State Plane Coordinates (NAD 1927) using horizontal control points KU4736 and KU4756 as shown on the existing base map. Vertical control is based on National Geodetic Vertical Datum (NGVD) 1929 using vertical control KU4736 located at the Glen Cove Fire Department Building. Vertical accuracy are ±0.01 foot for well casings (inner and outer) and ±0.1 foot for ground surface elevations. The new coordinate points were added to an existing topographic base map prepared by Dvirka and Bartilucci on November 11, 1997 (Figure 2-2). The base map shows significant physical features such as surface water bodies, wetlands, roads, buildings, fence lines and existing structures. Wetland and surface water samples collected as part of this investigation are shown in their approximate positions as determined by field measurements. The base map, with a two foot contour interval, was used in preparing the Site maps presented in this appendix.

2.2 SUBSURFACE SOIL INVESTIGATION

2.2.1 Test Pits

Seven test pits (TP-1 through TP-7) were excavated between April 13 through the 15, 1998. Five test pits were located in Area A and two were located in Area G. The purpose of the test pits was to define the horizontal and vertical limits of the surface radiological contamination identified during the NYSDEC survey and to aid in determining the placement of soil borings. The location of all test pits are shown in Figure 2-1.

Test pits were excavated to the water table. Test pits in Area A (TP-1, TP-2, TP-3, TP-4 and TP-7) were terminated at depths that ranged from 8 to 10 feet below grade; test pits in Area G (TP-5 and TP-6) were terminated at depths that ranged from 7 to 8 feet. Prior to

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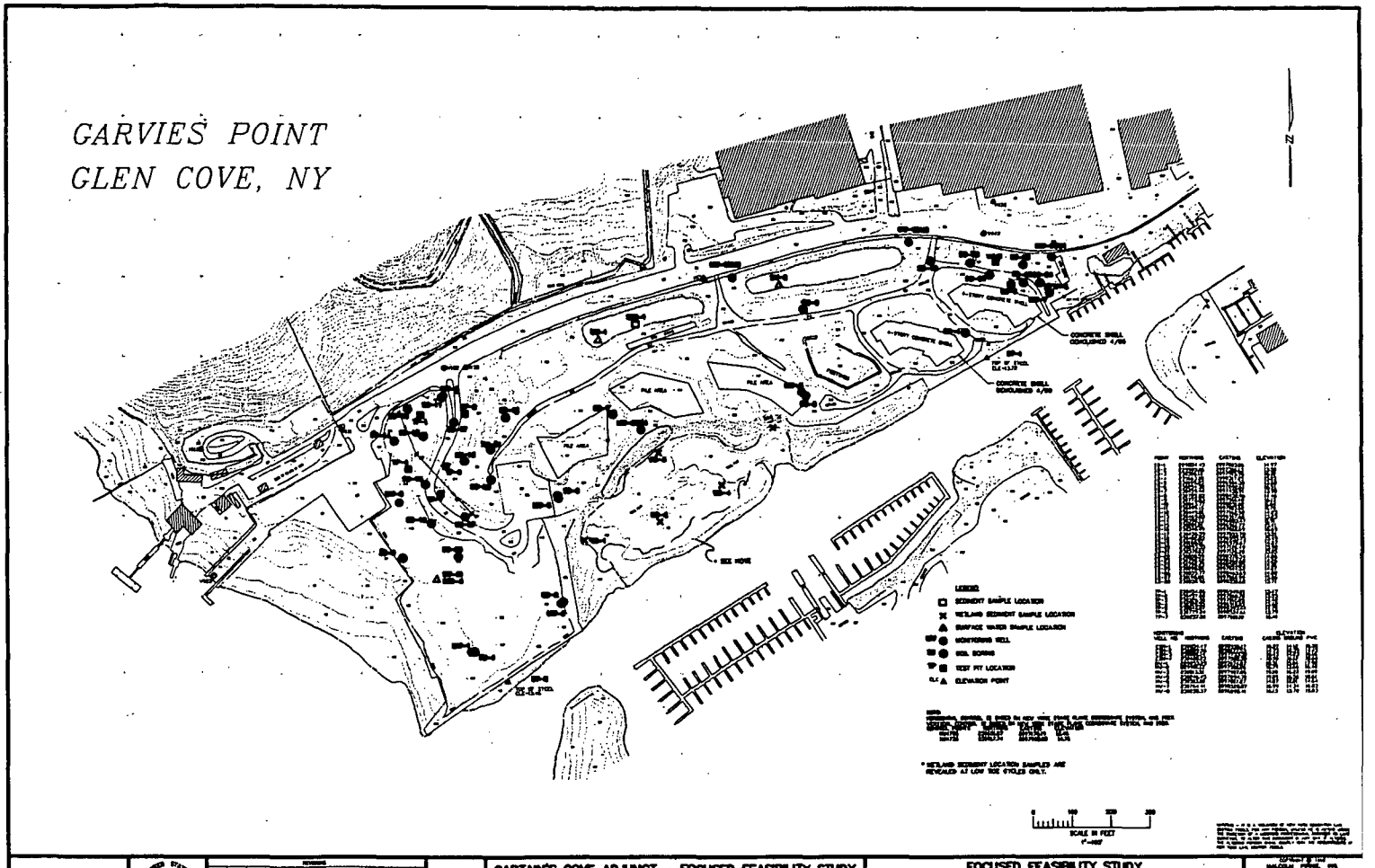

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CAPTAIN'S COVE ADJUNCT – FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

FOCUSED FEASIBILITY STUDY
SAMPLE LOCATIONS – TEST PITS
SOIL BORINGS & MONITORING WELLS
SCALE AS NOTED

JUNE 1989

FIGURE 2-1

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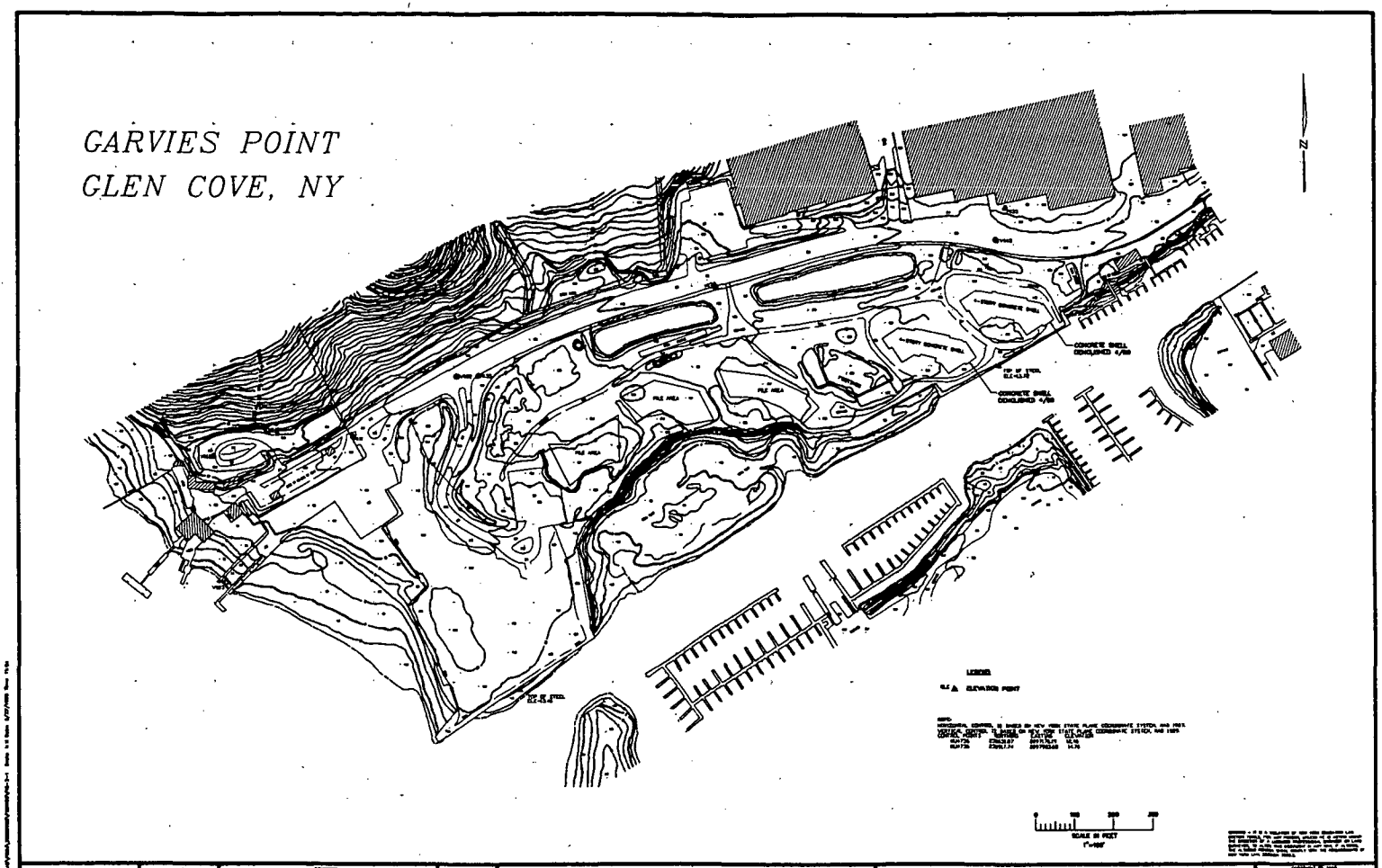

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FOCUSED FEASIBILITY STUDY
TOPOGRAPHIC BASE MAP

JUNE 1989

FIGURE 2-2

excavation, both the backhoe and backhoe bucket were decontaminated. Test pit excavations measured approximately 10 feet long and two feet wide. Test pits were excavated in one foot increments. Each one foot increment of excavated soil was field screened for volatiles with a HNu photoionization detector (PID) and for radioactivity with a GM pancake detector[1]. A stainless steel bowl and trowel was used to collect the soil sample directly from the backhoe bucket. Samples exhibiting the highest field screening readings or samples containing visible evidence of contamination were selected for laboratory analyses. Test pit samples were analyzed for TAL/TCL compounds, cyanide and radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th ^{232}Th and ^{234}U, ^{235}U and ^{238}U). In addition, a soil sample from TP-3 (2-3 feet) was collected for TCLP analysis and a soil samples from TP-3 (7-8 feet) was collected for physical property testing.

After sampling was completed, all test pits were backfilled with excavated material. Test pit analytical data are discussed in Section 4. Test pit logs are formulated in tabular form and presented in Table 2-1. Test pit logs include a description of the soils or fill materials encountered with depth, radiological field measurements, samples selected for analysis and general comments.

In Areas A test pits (TP-1 through TP-4 and TP-7), fill materials were primarily observed within the first three feet of the surface. The fill materials consisted of a light brown silt mixed with debris fragments (e.g., brick, wood, rags, rubber and plastic). Traces of fill were also observed below three feet. Below three feet, elevated radiological measurements (approximately 2 times background) were recorded from approximately 3.5 feet to the water table (approximately 8 feet below grade). These measurements were detected primarily in a dark gray compacted silt with sand. This material was darker in color in test pits excavated along the east edge of the asphalt road (TP-2, TP-3 and TP-7) and exhibited generally higher radiological field screening measurements from approximately 4 to 8 feet below grade. In addition, large concrete boulders, wood logs and charred wood fragments and ash were observed in TP-2. Refer to Table 2-2 for a summary of field screening results with the GM pancake detector.

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[1]The GM pancake detector responds to alpha, beta, and gamma radiation. The background response ranges from 0.02 to 0.05 KCPM.

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

Test Pit I.D.	Description of Material	Sample Depth (ft. bgs)	GM Pancake Detector Scan (KCPM)	Comments
TP-01	Brn. vf-m sandy-silt w/some organics (roots)	0-1'	.12	
	S.A.A.	1-2'	.12	Brick fragments/wood fragments present.
	Fill Material-Brn. Sand w/silt & fill	2-3'	.12	Fill Material consists of rag, wood, and plastic fragments
	S.A.A.	3-4'	.14	
	S.A.A.	4-5"	.24	
	Dk. brn.-dk. lt. Grey silty-sand w/some organics	5-6'	.24	Glass fragments present; Collected sample for radiological analysis
	Rd/dk grey clay w/some sand	6-7'	.15	Collected sample for radiological analysis
	Dk. grey clay w/some silt& sand	7-8'	.15	Collected sample for chemical analysis
	S.A.A.	8-9'	NA	Encountered groundwater @ 8.5'
TP-02	Brn gry. Sandy-silt w/trace clay	0-1'	.12	
	S.A.A.	1-2'	.15	Glass/Wood fragments

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

				present
(TP-02)	Fill materials/ w dk. black silt & sand-tr.clay	2-3'	.15	Encountered Large concrete boulders, wood logs/poles and charred wood fragments & incinerator ash
	S.A.A.	4-5'	.15	Collected sample for radiological and chemical analysis
	S.A.A.	5-6'	.15	
	S.A.A.	6-7'	.15	
	S.A.A.	7-8'	.15	
	S.A.A.	8-10'	.20	Collected sample for radiological analysis; encountered groundwater @ 9'
TP-03	Brn.-Gry. sandy-silt w organics (roots)	0-1'	.02	
	S.A.A. with m-dk.bl. sand	1-2'	.05	
	Dk. bl. m-sand with (fill) wood and rock fragments	2-3'	1.2	Collected sample for radiological and TCLP analysis
	S.A.A.	3-4'	1.2	
	S.A.A.	4-5'	1.5	
	S.A.A.	5-6'	1.5	Collected sample for radiological and chemical analysis

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

	S.A.A.	6-7'	.12	Contact for change of material @ 7 feet.
(TP-03)	Lt. gry. to dk. bl. vf silty sand	7-8'	.12	Collected sample for physical parameters; encountered groundwater @8.1'
TP-04	Brn. Vf-m silty sand w/some gravel & organics;	0-1'	.17	Brick & glass fragments present. Collected sample for radiological analysis
	S.A.A.	1-2'	.17	Additional debris (metal fragments, rubber, brick, glass, wood, fabric) present
	S.A.A.	2-3'	.12	
	S.A.A.	3-4'	.13	
	Dk.brn. Vf-m silty sand w/some gravel & trace debris & trace clay	4-5'	.13	Contact @ 4' between fill material above & Dk. brown silty sand
	S.A.A.	5-6'	.17	
	Tan vf-c sand w/some gravel	6-7'	.12	
	S.A.A.	7-8'	.17	
	S.A.A.	8-9'	.11	Groundwater encountered at 8' depth
	S.A.A	9-10'	NA	
TP-05	Brn vf-m silty sand w/trace gravel & organics	0-1'	0.10	Collected sample for radiological analysis

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

	S.A.A. w/some wood fragments	1-2'	.09	
(TP-05)	S.A.A.	2-3'	.07	
	Tan-brn vf-m silty sand w/some gravel; tr. glass & wood	3-4'	.15	
	Brn. Vf-m silty sand w/trace gravel	4-5'	.24	Collected sample for radiological analysis
	Brn. Vf-m silty sand w/trace clay& gravel	5-6'	.15	Observed 36" C.M.P storm pipe @ 5.5' depth going through pit running parallel to Garvies Point Road.
	S.A.A.	6-7'	.12	Encountered groundwater at 7'; Collected sample for chemical & radiological analysis
	S.A.A.	7-8'	.12	
	S.A.A.	8-9'	.05	
TP-06	Brn vf-m silty sand w/organics (roots) & tr. gravel	0-1'	0.10	
	S.A.A.	1-2'	0.10	some brick fill present
	Org.-brn. vf-m silty sand	2-3'	0.13	Uncovered old sheet piling in trench @ 36" to top of piles

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

	S.A.A.	3-4'	0.13	
(TP-06)	Dk. brn. vf-m silty sand w/some gravel & fill material (bricks/stones)	4-5'	.23	Collected sample for radiological analysis
	Dk. brn./black clayey silt w/trace vf-m sand & gravel	5-6'	0.25	Collect sample for chemical and radiological analysis & MS/MSD
	S.A.A.	6-7'	0.25	Groundwater seeping into test pit @ 6 feet
	S.A.A.	7-8'	NA	Terminated test pit @ 8 feet
TP-07	Lt. tan-clayey-silt w organics (roots)	0-1'	.05	
	S.A.A.	1-2'	.10	
	Lt. brn. m-sand tr-silt	2-3'	.15	
	Dk. bl. silt & m-sand	3-4'	.20	3.5' contact of top of black silt layer
	S.A.A.	4-5'	.20	
	S.A.A	5-6'	.20	
	S.A.A.	6-7'	.20	
	S.A.A.	7-8'	.20	
	S.A.A.	8-9'	NA	

Notes:
1. KCPM= Counts per Minute x 1,000
2. TP= Test Pit
3. Depth of Soil Samples are in Feet (>) below existing grade

Table 2-1
Captain's Cove Adjunct
Test Pit Logs

4. Light Shading=indicates elevated field screening results (approximately > 2X background (.02-.05 KCPM) based on scanning of soil samples with GM Pancake Probe
5. NA= Not Applicable
6. SAA=Same As Above

TABLE 2-2
CAPTAIN'S COVE ADJUNCT
FIELD SCREENING RESULTS (KCPM=CPM X 1,000)

Area	Boring/TP I.D.	0-2'	2-4'	4-6'	6-8'	8-10'	10-12'	12-14'
Area A	SB-11	.05	.06	.14	.24	.13	.10	.06
	SB-13	.05	.05	.05-.10	.10-1.4	.05-.06	.04-.05	.04-.05
	SB-14	.05	.4-.5	.2	.04-.05	.05	.03-.05	.05
	SB-15	.03-.04	.50	.10-.11	.11	.09	.10-.11	.09
	SB-16	.13	.06-.15	.10-.60	.60	.25	.15	.06
	SB-17	.70	.12	.15	NR	.22	.40	.12
	SB-18	.04-.08	.04-.07	2.4	.2	NR	.13	NR
	TP-1	.12	.12-.14	.24	.15	NA	NA	NA
	TP-2	.12	.15	.15	.15	.2	NA	NA
	TP-3	.02-.05	1.2	1.5	.12	NA	NA	NA
	TP-4	.17	.12-.13	.13-.17	.12-.17	.11	NA	NA
	MW-8	.03-.06	.03-.06	.03-.05	.03-.05	.03-.05	.03-.05	.03-.05
Area B&C	SB-1	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05
	SB-2	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05	.02-.05
	SB-5	.06-.08	.06-.08	NR	.03-.04	.03-.04	.03-.04	.03-.04
	SB-19	.04	.09-.10	.04-.05	.05	.05	.04	.04
	SB-25	.04-.05	.04-.05	.04-.05	.04-.05	.04-.05	.04-.05	.04-.05
	SB-27	.03-.05	.03-.05	.03-.04	.03-.05	.03-.05	.03-.05	.03-.05
	TP-7	.05-.10	.15	.15-.20	.15-.20	NA	NA	NA
Area D&E	SB-6	.09-.10	.08	.10	.08	.08	NR	.05
	SB-7	.04	.04-.05	NR	.05	.05	.05	.05
	SB-12	.10	.10	.10	NR	NR	.05	.05

TABLE 2-2
CAPTAIN'S COVE ADJUNCT
FIELD SCREENING RESULTS (KCPM=CPM X 1,000)

Area	Boring/TP I.D.	0-2'	2-4'	4-6'	6-8'	8-10'	10-12'	12-14'
	SB-20	.05	.05	.05	.05	.05	.05	.05
	SB-21	.05-.07	.05-.09	.07	.07	.05-.07	.05	.05
Area G	SB-8	.07-.12	.07	.20-.24	.1	.05-.08	.06	.06
	SB-10	.04	.05	.05	.06	.07	.04	.04
	SB-22	.13	.13	.16	.09	.05	.08	.05
	SB-23	.10	.11	.45	.70	.15	.13	.10
	SB-24	.13	.13	.10-.24	.40	.05	.08	.10
	SB-26	.06	.50	.15	.12	.12	.12	.05
	SB-28	.05	.07	NR	.07-.09	.05	.05	.05
	TP-5	.10	.07-.15	.15-.24	.12	.05	NA	NA
	TP-6	.10	.10-.13	.23-.25	.25	NA	NA	NA
	MW7	.05	.05	.05	.05	.05	.05	.05
Adj. G	SB-3	.01	.01	.01	.01	.12	.01	.01
	SB-4	.01	.01	.01	.01	.01	.01	.01
	SB-9	.06	.05	.04	.05	.04	.02	.02

Notes:
1. NR=No Recovery
2. KCPM=Counts per Minute x 1,000
3. TP=Test Pit
4. NA=Not Applicable (TP terminated at water table).
5. Depth of Soil Samples are in Feet (>) below existing grade.
6. Light Shading=indicates elevated field screening results (approximately >2X background (.02-.05 KCPM) based on scanning soil samples with Pancake Probe).
7. Results from field screening should be used in conjunction with Gamma Log Profiles and analytical data to determine depths and limits of contamination.
8. All field screening measurements collected with a GM Pancake Detector.

In Area G, elevated radiological readings were recorded in TP-5 and TP-6 from 3 to 8 feet and 2 to 7 feet below existing grade, respectively. Soil types exhibiting elevated radiological readings consisted of a brown very fine to medium silty sand with clay (TP-5) and a clayey silt (TP-6). Soil types observed in TP-6 were similar in appearance to test pit soils in Area A at similar depths (5 to 8 feet below grade), however additional clay was present in Area G test pits. The former bulkhead and sheet piles were also uncovered in TP-6 (approximately 15 feet north of the bulkhead). Groundwater was encountered at shallower depths in Area G test pits (<7 feet below grade) compared to Area A test pits. It is possible that the old sheet piles and/or clay deposits may be causing a localized groundwater mounding effect in this area.

2.2.2 Soil Borings

Twenty-eight soil borings and two monitoring well borings were drilled between April 20 and May 6, 1998. The purpose of the soil borings was to provide information to characterize the vertical and horizontal extent of subsurface radiological contamination.

Six soil borings were drilled in and around Area A (SB-13 through SB-18). An additional boring, SB-12, was placed to define the eastern limit of Area A. SB-19 and SB-25 were located in Area B and Area C, respectively; SB-20 and SB-21 were located in Area D and E, respectively. Seven soil borings were drilled in and around Area G (SB-8, SB-10, SB-22, SB-23, SB-24, SB-26 and SB-28). SB-24, SB-26 and SB-28 were drilled to provide general coverage of Area G. Three additional borings (SB-8, SB-22 and SB-23) were positioned to define the southern limit of the area which exhibited elevated gamma exposure rates near the northeast wall and foundation of the eastern-most condominium shell. SB-10 was drilled to define the western limit of the area which exhibited elevated gamma exposure rates in Area G. SB-4 was placed near the west wall of the western-most condominium shell.

Five soil borings were drilled adjacent to existing monitoring wells installed during the RI conducted by Roux Associates (SB-1, SB-2, SB-3, SB-6 and SB-11). Two borings (SB-7 and SB-9) were located to provide general sitewide information. Two borings were also drilled for the installation of two new monitoring wells (MW-7 and MW-8). The locations of all soil borings and monitoring well borings are shown on Figure 2-1.

Continuous split-spoon soil samples were collected from the ground surface to a depth of fifteen feet for soil borings and up to a depth of 19 feet for monitoring well borings. One or two soil samples per boring were selected for radiological and/or chemical analysis based upon field screening measurements. Analytical parameters included TAL/TCL compounds, cyanide, radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U and ^{238}U).

Soil samples from SB-16 (Area A) and SB-24 (Area G) (from 6-8 feet and 4-6 feet, respectively) were also analyzed for TCLP Parameters. Sample collection procedures were consistent with those presented in the variance to the Field Sampling Plan (FSP) for the Li Tungsten site (Malcolm Pirnie, 1996).

Area A (SB-11, SB-13, SB-14, SB-15, SB-16, SB-17 and SB-18)

Soil borings (SB-11 and SB-13 through SB-18) were located in Area A and drilled to a maximum depth of 15 feet to facilitate gamma logging of each borehole. Two samples were collected from SB-13, SB-14, SB-16, SB-17 and SB-18 for radiological analysis; one sample was collected from SB-11 and SB-15 for radiological analysis. Field screening measurements with a GM pancake detector indicated slightly elevated count rates (approximately 2 times background) in all soil borings. The most elevated readings were observed between existing grade and a depth of 12 feet in soil borings SB-15, SB-16, SB-17 and SB-18, and from 2 to 6 feet in SB-14. In addition, one sample from SB-13 (6 to 8 feet) exhibited elevated radiological readings 28 times background. Elevated radiological readings corresponded with a compacted dark black to brown very fine to medium silt detected in borings along the asphalt road in SB-17, SB-16 and SB-27. Field screening results are presented in Table 2-2.

One sample analysis from SB-13, SB-14, SB-15, SB-16, SB-17 and SB-18 was submitted for chemical based on field screening measurements. All samples exhibited background PID readings. One sample from SB-16 (6-8 feet) was submitted for TCLP analysis.

Area G (SB-4, SB-8, SB-10, SB-22 through SB-24, SB-26, SB-28)

Soil borings (SB-8, SB-10, SB-22 through SB-24, SB-26 and SB-28) were located in

Area G. SB-4 was located adjacent to the east wall of the western-most condominium shell. Borings were drilled to a maximum depth of 15 feet and downhole gamma logging was performed following the installation of each boring. Two samples per boring were collected from SB-8, SB-22 and SB-24. One sample per boring was collected from SB-10, SB-23, SB-26, SB-28 and SB-4. Field screening measurements with a GM pancake probe resulted in slightly elevated count rates (approximately 2 times background) in all soil borings except SB-10 and SB-28. The most elevated readings were recorded in SB-22 through SB-26 between 2 and 8 feet. Visible evidence of contamination was associated with a compacted dark black to brown very fine to medium silty sand or sandy silt detected in borings SB-8, SB-22, SB-23, SB-24 and SB-26.

One sample from SB-22 (2-4 feet), SB-23 (4-6 feet), SB-24 (6-8 feet) and SB-26 (6-8 feet) was collected for chemical analysis. Two samples for chemical analysis were collected from SB-4 (2 to 4 and 4 to 6 feet) based on elevated field screening measurements corresponding with a PID reading of 3 to 7 ppm. All other samples exhibited PID readings at approximately background.

Adjacent to Existing Monitoring Wells (SB-1, SB-2, SB-3, SB-6, and SB-11)

Soil borings SB-1, SB-2, SB-3, SB-6 and SB-11 were drilled adjacent to existing monitoring wells to a depth of approximately 15 feet. Based on field screening measurements, all soil samples exhibited count rates within the range of natural background, excluding SB-11 as previously discussed. Samples submitted for radiological analysis included SB-1 (6-8 feet), SB-2 (2-4 feet), SB-3 (0-2 feet), SB-6 (0-2 feet and 4-6 feet) and SB-11 (6-8 feet).

Area B (SB-19), Area C (SB-25, SB-5), Area D (SB-20), and Area E (SB-21)

Soil borings in Areas B, C, D and E did not indicate any elevated concentrations of radioactive material based on field screening measurements. One sample for radiological analysis was collected from SB-5 (2 to 4 feet), SB-19 (4 to 6 feet), SB-25 (4 to 6 feet), SB-20 (0 to 2 feet) and SB-21 (0 to 2 feet). One sample for chemical analysis was also collected from each boring.

Site-Wide Soil Borings (SB-7 and SB-9)

Soil samples collected from the two site-wide borings exhibited radiological count rates within the range due to natural background. One radiological sample was collected from both SB-7 (4-6 feet) and SB-9 (0-2 feet).

2.3 SURFACE WATER, SEDIMENT AND WETLANDS INVESTIGATION

2.3.1 Surface Water Investigation

Three surface water samples (SW-1, SW-2 and SW-3) were collected on April 16, 1998. SW-1 and SW-2 were collected from the east and west retention ponds, respectively, located in the north-central section of the Site adjacent to Garvies Point Road. SW-3 was collected from the topographic depression in the southwestern portion of the Site near Area C. Surface water sampling locations are shown on Figure 2-1. Surface water sampling procedures were consistent with procedures presented in the variance to the FSP. Samples were analyzed for TAL/TCL compounds, cyanide and radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U and ^{238}U).

Field measurements for the surface water investigation are summarized in Table 2-3. The pH ranged from 6.19 to 6.72 in the three surface water samples measured. The temperature of the samples ranged from 12.4°C (SW2) to 13.5°C (SW3) and conductivity ranged from 0.086 μmhos/cm (SW-1) to 0.370 μmhos/cm (SW-3).

2.3.2 Sediment Investigation

Five wetland sediment samples (WS-1 through WS-5) and two sediment samples from the topographic depression (SED-3) and west retention pond (SED-1) were collected on April 16, 1998. The sediment samples collected from the wetlands were analyzed for radiological parameters since samples collected previously from these areas were only for TAL/TCL compounds. Sediment samples collected from the west retention pond and the topographic depression were analyzed for full TAL/TCL and radionuclides. The purpose of the sediment sampling was to supplement previous sampling events with radiological information and to characterize other areas. In general, sediment samples were collected at or

TABLE 2-3
CAPTAIN'S COVE ADJUNCT
Glen Cove, New York
Surface Water Parameters, April 1998

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Sample I.D.	Location	pH (S.U.)	Turbidity (NTUs)	Temp. (°C)	Dissolved Oxygen (mg/l)	Conductivity (UMHO/cm)
SW-1	W/Ret. Pond	6.72	11	13.4	11.20	0.086
SW-2	E/Ret. Pond	6.52	201	12.4	11.86	0.359
SW-3	Top. Depress.	6.19	215	13.5	11.16	0.370

near the surface water sample locations. Since insufficient sediment volume was observed in the east retention pond, it was not possible to collect a sample from that location. Sediment and wetland sampling locations are presented on Figure 2-1. Laboratory analytical are discussed in Section 4.

2.4 GROUNDWATER INVESTIGATION

2.4.1 Installation of New Monitoring Wells

Two new monitoring wells (MW-7 and MW-8) were installed on April 28 and May 5, 1998, respectively, in Areas G and A, respectively. MW-7 was placed downgradient of Area G toward the southeast corner of the Site, near the existing bulkhead. MW-8 was installed downgradient of Area A in the northwest portion of the Site.

Drilling for the installation of new monitoring wells was completed using a truck-mounted drilling rig equipped with hollow-stem augers. A ten-foot well screen was installed in the wells to bridge the water table facilitating the detection (if any) of light non-aqueous phase liquids (LNAPLs) that may float on the water table.

Monitoring well design and installation procedures were consistent with those presented in the Draft Final Work Plan and variance to the FSP. The monitoring wells were constructed from four-inch diameter PVC casing and 20-slot size well screen. Morie sand (#1) was placed in the annular space around the well screen to a height of approximately two feet above the top of the screen. A two-foot thick bentonite pellet seal was placed above the sand pack. A cement/bentonite grout seal was placed over the bentonite seal. The surface was sealed with expanding cement. A locking eight-inch diameter steel protective casing or a flush mount cover was placed over the PVC riser pipe and seated into the cement. The cement well apron (approximately 3'x3'x4" thick) was constructed so as to slope away from the well. The PVC riser pipe was topped with an expansion cap and a permanent surveyor's mark was placed on the lip of the PVC riser pipe.

Monitoring well MW-7 was drilled to a depth of 16.5 feet and MW-8 was drilled to 18.2 feet. Groundwater was encountered at depths ranging from 8.9 feet (MW-7) to approximately 11.6 feet below grade (MW-8). Shelby tube samples were not collected since

insufficient clay deposits were encountered at drilling locations. A complete summary of well construction details and groundwater elevation measurements for both existing and new monitoring wells is presented in Table 2-4.

2.4.2 Well Development

New monitoring wells (MW-7 and MW-8) were developed on May 7 and 8, 1998 using a two-inch diameter, stainless steel submersible pump and a centrifugal pump with dedicated discharge hose. The monitoring wells were developed to remove fine-grained material from the formation and the filter pack and to increase the hydraulic connection between the well and the formation. In general, the wells were developed for up to three hours, or until a turbidity measurement goal of 50 nephelometric turbidity units (NTUs) or less was reached. During development, the discharge water was regularly tested for turbidity, pH, dissolved oxygen, temperature and specific conductivity.

A turbidity measurement of less than 50 NTUs was achieved in MW-8 after three hours of development and pumping. A measurement of 137 NTUs was achieved in MW-7 after three hours of development and pumping. Monitoring well development logs, summarizing the volume removed, elapsed time, temperature, pH, conductivity and turbidity are provided in Attachment A. No evidence of free product was found in the wells during development.

2.4.3 Groundwater Sampling

One round of groundwater samples was collected from the 11 monitoring wells (9 existing well and 2 new wells) for full TAL/TCL analysis and radionuclides from May 19 to May 22, 1998. It became necessary to resample (June 9-11, 1998) all monitoring wells for volatile organic compounds (VOCs) because chemical reactions in the sample vials after shipment to the laboratory generated air bubbles. The resampling was performed without preservatives in accordance with FSP procedures.

2.4.3.1 Sample Collection Method

Prior to the collection of groundwater samples, a minimum of three well volumes was

LE 2-4
CAPTAIN'S COVE ADJUNCT
GLEN COVE, NEW YORK
MONITORING WELL DETAILS

Well	WELL INSTAL-LATION	DATE OF INSTALL-ATION	GROUND ELEV.	WELL DEPTH	WELL DEPTH ELEV.	SCREEN INTERVAL (B.G.)		SCREEN INTERVAL ELEV.		SCREEN LENGTH	MEAS-URING POINT	STEEL CASING ELEV.	DEPTH TO G.W. 6/9/98	G.W. ELEV. 6/9/98	DEPTH TO G.W. 5/18/98	G.W. ELEV. 5/18/98
						TOP	BOT.	TOP	BOT.							
CDM-1	CDM	11/18/85	14.12	15.50	-1.38	2.5	12.5	11.62	1.62	10	16.30	16.37	13.54	2.760	13.14	3.160
CDM-2	CDM	11/19/85	12.39	14.00	-1.61	2.00	12.00	10.39	0.39	10	14.45	14.73	4.38	10.070	3.98	10.470
CDM-3	CDM	11/18/85	14.23	12.00	2.23	8.00	18.00	6.23	-3.77	10	16.16	16.45	5.06	11.100	5.48	10.680
CDM-4	CDM	11/18/85	16.12	16.00	0.12	4.00	24.00	12.12	-7.88	10	18.66	18.96	13.32	5.340	12.13	6.530
MW-1	DBCE	9/23/97	15.04	18.25	-3.21	8.25	14.00	6.79	1.04	10	17.92	18.31	16.20	1.720	15.62	2.300
MW-2	DBCE	9/23/97	13.66	18.25	-4.59	6.50	16.50	7.16	-2.84	10	16.40	16.74	13.79	2.610	13.26	3.140
MW-3	DBCE	9/26/97	16.22	19.00	-2.78	9.00	19.00	7.22	-2.78	10	19.09	19.18	13.64	5.450	12.26	6.830
MW-5	DBCE	9/24/97	16.56	18.00	-1.44	8.00	18.00	8.56	-1.44	10	18.61	19.09	14.30	4.310	14.16	4.450
MW-6	DBCE	9/24/97	12.01	18.20	-6.19	13.20	18.20	-1.19	-6.19	10	14.64	14.87	11.71	2.930	10.91	3.730
MW-7	MPI	4/28/98	14.34	16.50	-2.16	6.00	16.00	8.34	-1.66	10	16.83	16.99	8.12	8.710	7.05	9.780
MW-8	MPI	5/5/98	13.72	18.20	-4.48	7.70	17.70	6.02	-3.98	10	15.83	16.13	12.52	3.310	11.60	4.230

purged from each of well. The depth to groundwater and the anticipated yield of the well, based on well development observations, determined which type of purging method was used. For this sampling, a centrifugal pump was used to purge the wells since depth to groundwater was less than 20 feet. In all cases, care was taken to avoid pumping the wells to dryness.

Upon completion of the purging, groundwater samples were collected from each well. Dedicated, decontaminated stainless steel bailers attached to Teflon coated stainless steel leaders were used to collect each groundwater sample. Groundwater samples were analyzed for TAL/TCL compounds, cyanide, and radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U and ^{238}U) and both filtered and unfiltered metals. The filtered samples were passed through dedicated 45-micron filters in the field. Samples for volatiles, metals and cyanide were preserved in the field and placed in the appropriate containers in accordance with procedures outlined in the FSP variance. Groundwater samples collected during the resampling round were analyzed for VOCs only.

2.4.3.2 Field Measurements

The temperature, specific conductivity, pH, dissolved oxygen and turbidity of the purge water was measured in the field after each well volume was removed. These data are summarized on the sample collection logs provided in Attachment B.

2.4.3.3 Groundwater Elevation Measurements

Two synoptic rounds of groundwater elevations were collected on May 18, 1998 and June 9, 1998. Depth to groundwater was obtained using an electronic water level indicator relative to the permanent marking on the top of the PVC casing. Groundwater elevation data are presented in Table 2-4. Groundwater elevation contour maps with flow directions were constructed. The groundwater elevation contour map and flow direction are presented and discussed in Section 3.

2.5 RADIOLOGICAL CHARACERIZATION

2.5.1 Exposure Rate Survey

An exposure rate survey was performed by Malcolm Pirnie in June 1998 in areas of the Site that were inaccessible to the NYSDEC during their 1997 radiological survey. Areas that could not be surveyed included the areas in front of both condominium shells, the two retention ponds, inside the west condo shell, inside and outside of the gate and along a steep bank bordering the wetland.

The measurements were collected with a Ludlum model 44-2 1" x 1" NaI gamma scintillation detector coupled to a ratemeter at ten foot intervals along grid lines. Reading were taken at each intersection of grid lines along the surface and at waist level (3 foot height).

The results of the survey revealed no anomalies at the ground surface, except in Area G where a maximum surface exposure rate of 19 μR/h was measured.

2.5.2 Instrument Calibration

In-field calibration of detector used for the gamma exposure rate surveys was performed by collecting a set of exposure rate data with a Reuter Stokes Pressurized Ion Chamber (PIC) Model RSS-112. A total of twelve PIC measurements were collected over a range of exposure rates (i.e., background to high exposure rates). Each PIC data point was calculated by averaging six reading taken along the four sides, top and bottom of the PIC chamber. The responses of the gamma scintillation detector (in CPM) were regressed to the exposure rates measured with the PIC (in μR/h), thereby establishing a functional relationship between the two modes of detector response. The regression curve and field data are included in Attachment C. The curve was used to convert the gamma scintillation detector data from CPM to exposure rate, expressed in μR/h. The exposure rate data were then used to generate isopleths of the surface gamma radiation exposure rates over the entire Site.

2.5.3 Downhole Gamma Logging

Boreholes used to facilitate downhole gamma logging were drilled using the hollow-stem augering method. After completion of the boreholes, a three-inch inside diameter (ID) PVC pipe capped at the bottom, was placed in the open borehole. Gamma logging measurements were collected inside the PVC pipe for thirty-seconds at six-inch intervals from the ground surface to bottom of the borehole (approximately 15 feet). Data were collected with a Ludlum Model 44-2 NaI scintillation detector coupled to a portable Ludlum 2200 ratemeter/scaler. Downhole gamma logging data are presented in tabular and graphical form in Tables 2-5 through 2-9 and Figures 2-3 through 2-9, respectively.

Gamma logging data have been plotted with depth in each of the various geographic areas of the Site. Soil borings have been grouped together by area as follows: Area A (SB-11, SB-13 through SB-18); Area B and C (SB-19, SB-25 and SB-27); Area D and E (SB-12, SB-20 and SB-21), Area G (SB-8, SB-10, SB-22 through SB-24, SB-26 and SB-28) and the area adjacent to Area G (SB-3, SB-4 and SB-9).

In general, elevated gamma logging measurements were observed in Area A borings and in the majority of Area G borings at depths of 2 to 10 and 1.5 to 10 feet, respectively. The highest gamma logging measurements were detected at depths of 4 to 8 feet in both areas. In general, borings in Areas B, C, D, E and adjacent to Area G were approximately within the range due to natural background levels (approximately 1,000 counts per 30 seconds). SB-25 (Area B) and SB-19 (Area C) were the only exceptions as they exhibited elevated count rates. Field screening results collected on soil extracted from the split spoon samplers were generally consistent with the downhole gamma logging data. Results of the downhole gamma logging are discussed below in more detail for each of the Site areas described above.

<u>Area A (SB-11, SB-13 through SB-18)</u>

Gamma logging data for Area A is presented in Table 2-5 and Figure 2-3. The downhole gamma logging data, like the soil screening data, confirmed the presence of a fill area. All borings exhibited elevated gamma counts primarily in the 3 foot to 8.5 foot depth range with the exception of SB-14 and SB-15. SB-14 and SB-15 are located on the west

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GAMMA LOGGING RESULTS - AREA A
CAPTAIN'S COVE ADJUNCT
GLEN COVE, NY

Depth (ft)	GAMMA LOGGING MEASUREMENTS (30 second counts)						
	SB-11	SB-13	SB-17	SB-18	SB-14	SB-16	SB-15
0	1957	4700	3897	3619	5344	3112	1253
0.5	1796	5630	5114	5445	7982	3897	1589
1	1838	5165	6841	6947	10073	4066	1972
1.5	1744	5433	10959	8005	11331	4635	2267
2	1911	4974	19232	8187	16972	5280	2863
2.5	2614	4843	26632	8494	29565	6775	9283
3	3565	5135	30091	9547	40098	9730	8572
3.5	5165	5633	35049	10672	28290	15942	11979
4	6972	6486	42357	11290	19886	28813	7163
4.5	8986	9370	55424	14286	14312	45673	3786
5	13648	15194	67529	30633	8120	58605	3079
5.5	17295	32488	78064	94108	5387	64548	2864
6	21457	73442	79724	84016	3709	65422	2644
6.5	23696	162890	69766	29672	3320	54882	2422
7	24922	139908	57191	13169	2780	34575	1910
7.5	21030	51986	44978	9246	2065	17610	1358
8	16496	21743	31337	8177	1706	9089	1098
8.5	10890	15285	18069	8188	1993	4868	1034
9	6093	9622	10416	10082	1562	3749	1014
9.5	2845	8230	8261	11287	1744	3768	1059
10	1654	5897	6277	8091	1831	2461	1058
10.5	1171	3906	3985	6487	1493	1739	851
11	1216	3535	2741	3696	1663	1616	701
11.5	1276	3220	2386	2031	1464	1456	698
12	1373	3355	1785	1647	1737	1389	690
12.5	1333	2801	1608	1494	1863	1362	668
13	1326	2973	1391	1331	2270	1285	652
13.5	1367	2906	1324	1376	2218	1204	648
14	1043	3595	1667	1785	1996	1173	640
14.5	982	3500	1885	1687	1882	1050	642
15	895	B.O.H.	1890	B.O.H.	B.O.H.	923	645

NOTES: B.O.H. = Bottom of hole

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GAMMA LOGGING RESULTS - AREAS B AND C
CAPTAIN'S COVE ADJUNCT
GLEN COVE, NY

Depth (ft)	GAMMA LOGGING MEASUREMENTS (30 second counts)					
	SB-19	SB-25	SB-5	SB-1	SB-2	SB-27
0	3470	2839	1962	2030	1946	896
0.5	5175	4469	2540	2106	1994	1954
1	6757	4262	2891	2538	2276	1343
1.5	8018	4771	3273	2527	2331	1452
2	8299	4485	3458	2589	2501	1451
2.5	8670	3942	3669	2827	2912	2782
3	8363	3841	3506	2873	2700	2613
3.5	7763	4041	3160	2853	2528	3715
4	6479	3733	2600	3136	2242	4511
4.5	4212	2431	2310	3217	1832	4422
5	3249	2162	1951	3291	1833	1648
5.5	2232	1932	1768	3432	1576	1697
6	2580	1843	1982	3428	1633	2054
6.5	1813	1843	1652	3417	1469	1982
7	1658	2333	1563	3532	1578	1097
7.5	1775	2523	1845	3603	1524	991
8	1785	2616	1548	B.O.H.	1458	875
8.5	1687	2356	1761		1314	873
9	1785	2091	1482		1291	824
9.5	1836	1831	1592		1259	690
10	2226	1757	1606		1623	770
10.5	1807	1772	1330		1567	789
11	1731	1483	1419		1399	645
11.5	1810	1417	1532		1213	791
12	1819	1438	1448		1573	752
12.5	1783	1266	1926		1405	787
13	1867	1121	1404		1310	715
13.5	1657	1292	1411		1284	657
14	1438	1260	1106		1032	789
14.5	1415	1252	1106		931	862
15	B.O.H.	B.O.H.	B.O.H.		B.O.H.	B.O.H.

NOTES: B.O.H. = Bottom of hole

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GAMMA LOGGING RESULTS - AREAS D AND E

CAPTAIN'S COVE ADJUNCT

GLEN COVE, NY

Depth (ft)	GAMMA LOGGING MEASUREMENTS (30 second counts)				
	SB-20	SB-21	SB-12	SB-6	SB-7
0	777	873	903	670	1225
0.5	1160	966	1178	1133	1418
1	1184	1147	1231	1384	2071
1.5	1246	1242	1178	1509	1782
2	1383	1055	1564	1655	1622
2.5	1229	1078	1462	1661	1272
3	1051	1079	1396	1547	1491
3.5	1106	1092	1451	1546	1078
4	1161	1095	1450	1611	1582
4.5	1160	1075	1178	1619	2011
5	996	1221	993	1417	1787
5.5	959	1228	1058	1328	1523
6	936	1333	823	1319	1343
6.5	871	1181	1145	1326	1498
7	950	1010	959	1391	1276
7.5	886	949	1084	1401	1109
8	949	831	1192	1325	1115
8.5	886	809	994	1160	1271
9	829	782	971	1068	1252
9.5	898	695	1054	1012	1144
10	879	587	734	1056	1218
10.5	779	605	715	1114	1042
11	724	629	707	1066	978
11.5	638	653	714	1073	1177
12	717	614	610	986	1122
12.5	759	697	872	903	1088
13	721	575	758	842	1172
13.5	722	590	815	802	1255
14	658	615	1042	788	1201
14.5	590	602	1002	1009	1182
15	583	588	959	1081	1271

NOTES: B.O.H. = Bottom of hole

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GAMMA LOGGING RESULTS - AREA G
CAPTAIN'S COVE ADJUNCT
GLEN COVE, NY

Depth (ft)	GAMMA LOGGING MEASUREMENTS (30 second counts)						
	SB-22	SB-23	SB-24	SB-26	SB-28	SB-10	SB-8
0	2405	3760	4509	1995	1507	578	4377
0.5	3660	3526	4773	2878	1895	801	3616
1	3380	2847	3661	5101	1477	1104	4546
1.5	2785	2812	2578	10782	2236	805	4165
2	2972	3788	2355	20073	2061	1410	5531
2.5	3773	5600	2404	22208	2214	1204	6705
3	5788	6808	3086	15315	1922	1013	8285
3.5	7405	12588	4404	16962	1422	663	10457
4	6891	22112	6995	13897	1266	777	11886
4.5	7127	36616	12124	16311	1210	774	11570
5	8291	47857	19267	23152	1235	751	12026
5.5	9092	52964	27986	16034	1485	827	15778
6	9090	46309	32759	10293	1759	682	21838
6.5	6871	35539	25680	9408	2226	569	34429
7	4420	38666	17671	9487	2367	540	57752
7.5	3100	47395	12108	9246	2351	512	66741
8	2547	45684	10064	8705	2199	575	42303
8.5	2749	36172	9905	8201	1915	546	18270
9	3333	25013	10494	7313	1562	574	10386
9.5	3433	11446	10218	5285	1409	590	8063
10	3084	6346	9876	4544	1112	406	8271
10.5	2493	4797	8450	3951	1242	493	9527
11	2481	3758	6160	3716	1305	487	8555
11.5	2110	3670	4436	3351	1210	507	8537
12	2037	4324	3599	3348	1136	488	7639
12.5	B.O.H.	7428	3358	3135	1052	492	6943
13		9624	3545	2480	1249	515	7031
13.5		9686	3787	2228	1292	522	5133
14		7899	3445	2012	1202	475	5072
14.5		5762	3780	1919	1341	482	4989
15		4135	3690	2096	B.O.H.	469	B.O.H.

NOTES: B.O.H. = Bottom of hole

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GAMMA LOGGING RESULTS - AREA ADJACENT TO G

CAPTAIN'S COVE ADJUNCT

GLEN COVE, NY

Depth (ft)	GAMMA LOGGING MEASUREMENTS (30 second counts)		
	SB-9	SB-3	SB-4
0	667	1310	1213
0.5	776	1507	1593
1	859	1594	1416
1.5	896	1567	1416
2	1028	1443	1408
2.5	1280	1403	1677
3	1216	1491	1919
3.5	1285	1522	1759
4	1203	1567	1819
4.5	1203	1406	1581
5	958	1260	1462
5.5	1146	1217	1312
6	1149	1166	1247
6.5	1134	982	1025
7	1179	1057	1053
7.5	1042	1183	913
8	985	1438	932
8.5	1015	1541	806
9	989	1467	780
9.5	953	1713	662
10	844	1917	689
10.5	957	2091	676
11	976	2277	788
11.5	795	2383	788
12	802	2273	725
12.5	907	2338	739
13	880	2194	896
13.5	872	2125	1045
14	792	2003	1089
14.5	795	1765	1198
15	805	1139	1372
Surface Exposure Rate (uR/h)	1.2	1.3	1.5
Adjusted Surface Exposure Rate (uR/h)			

NOTES: B.O.H. = Bottom of hole

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FIGURE 2-3-GAMMA LOGGING RESULTS AREA A

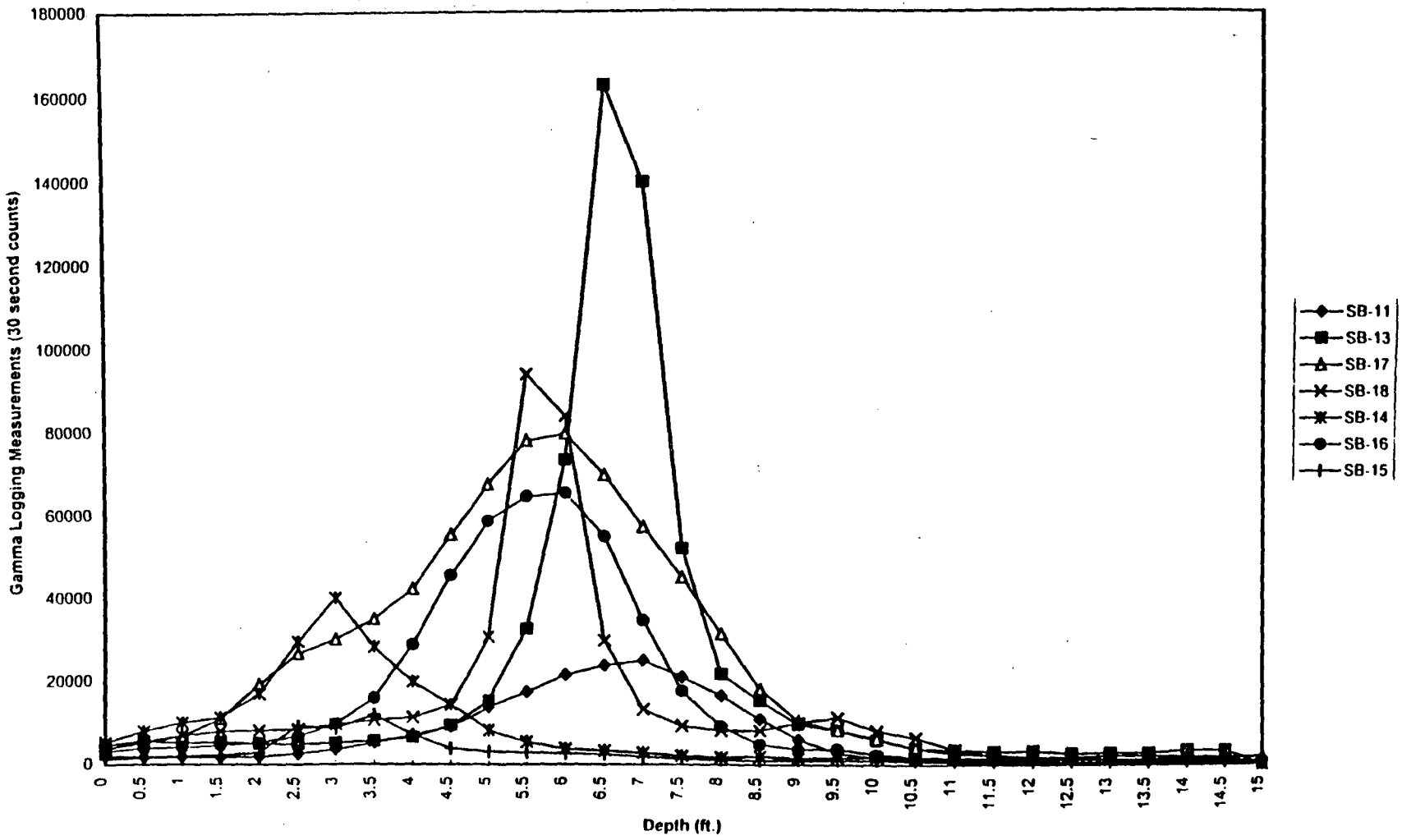

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FIGURE 2-4-GAMMA LOGGING RESULTS - AREA G

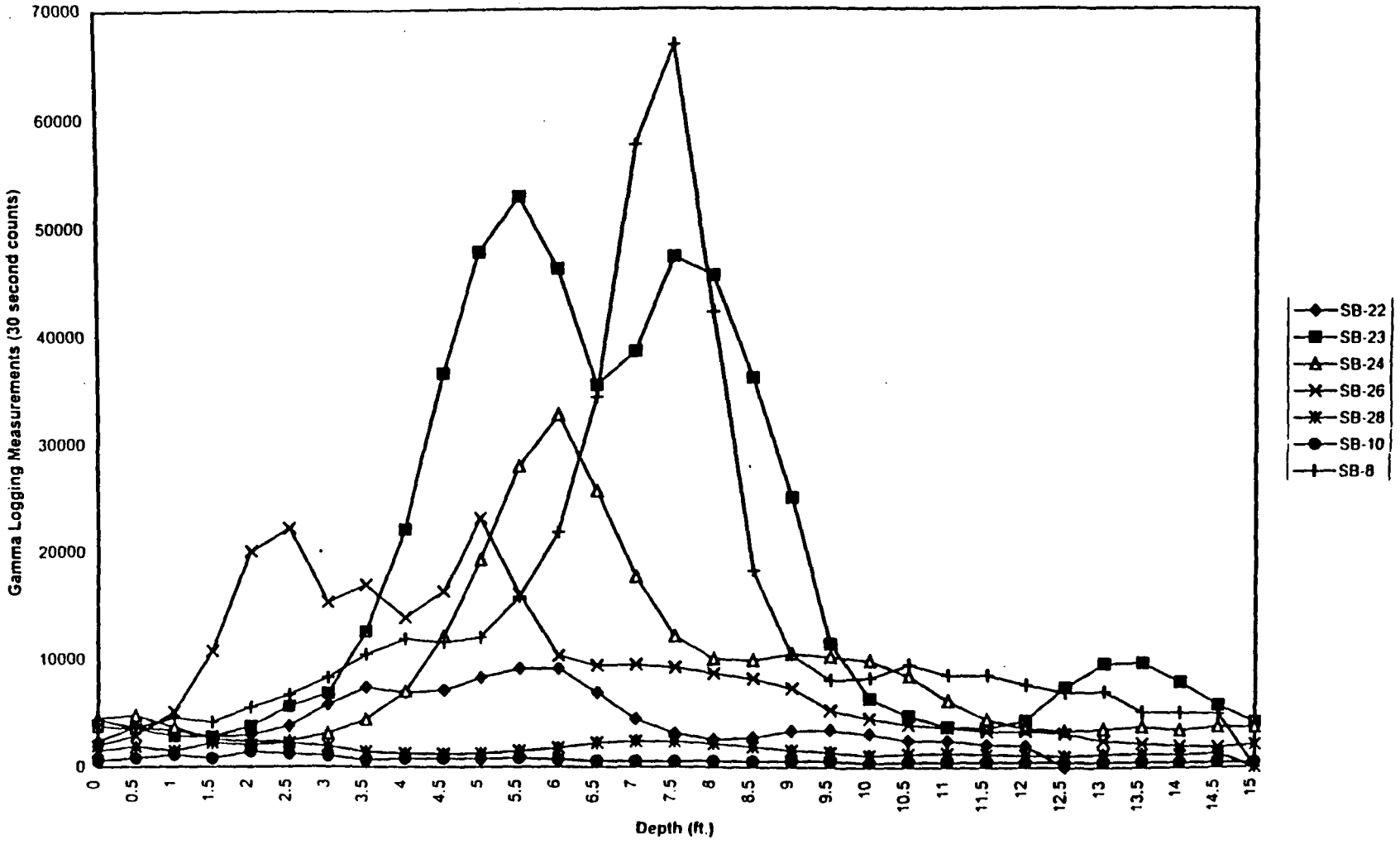

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FIGURE 2-5-GAMMA LOGGING RESULTS AREAS B AND C

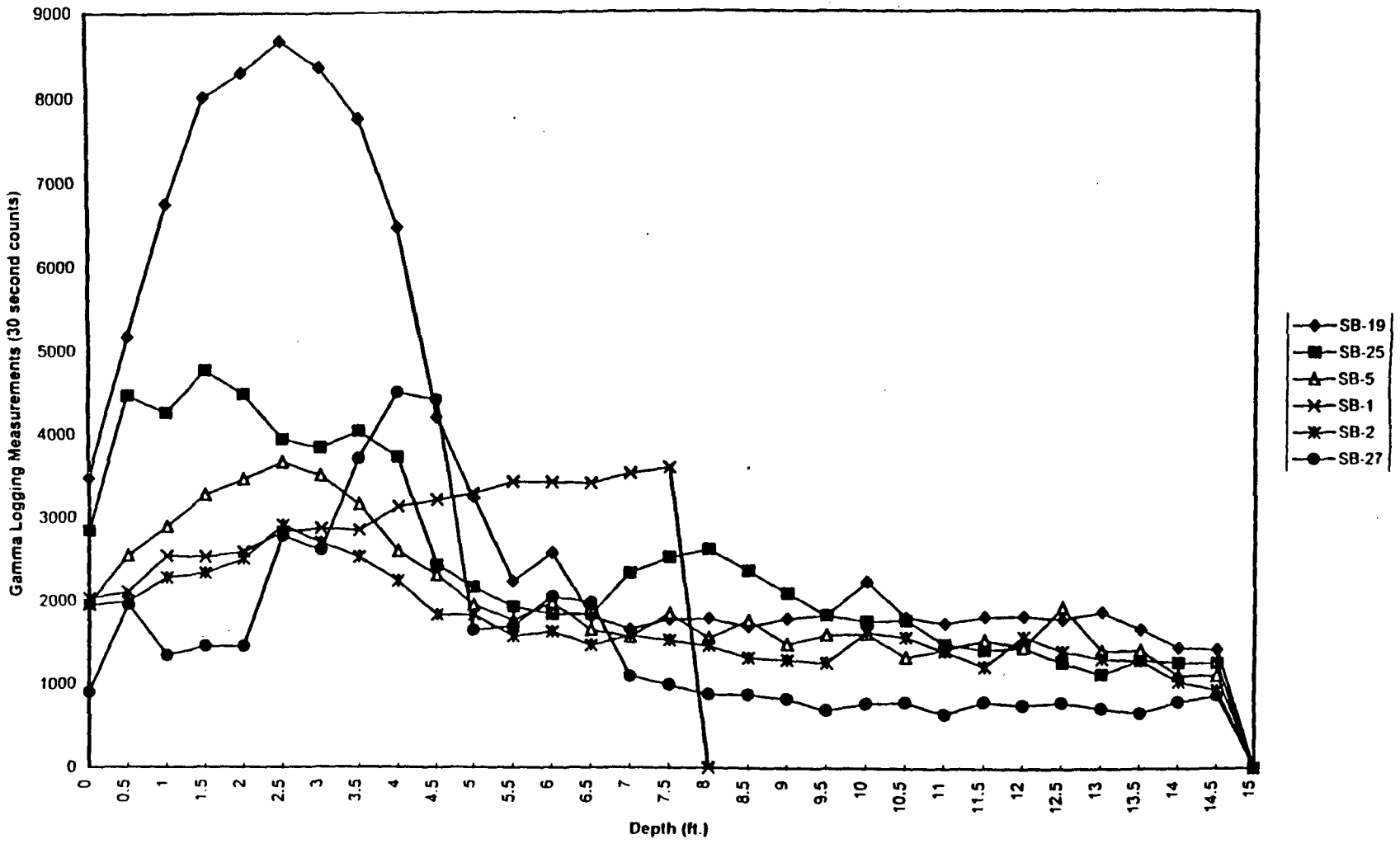

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FIGURE 2-6-GAMMA LOGGING RESULTS - AREAS D AND E

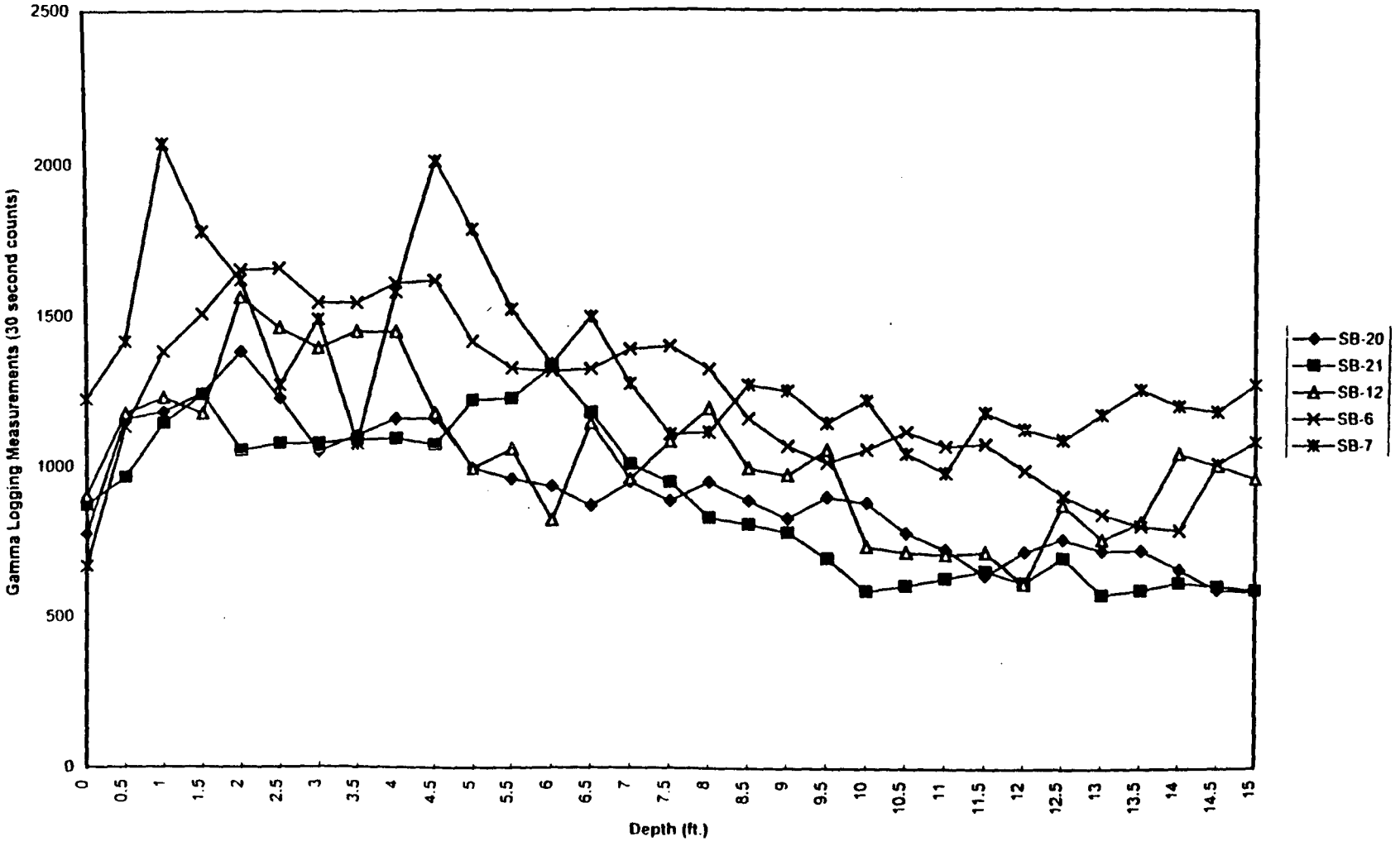

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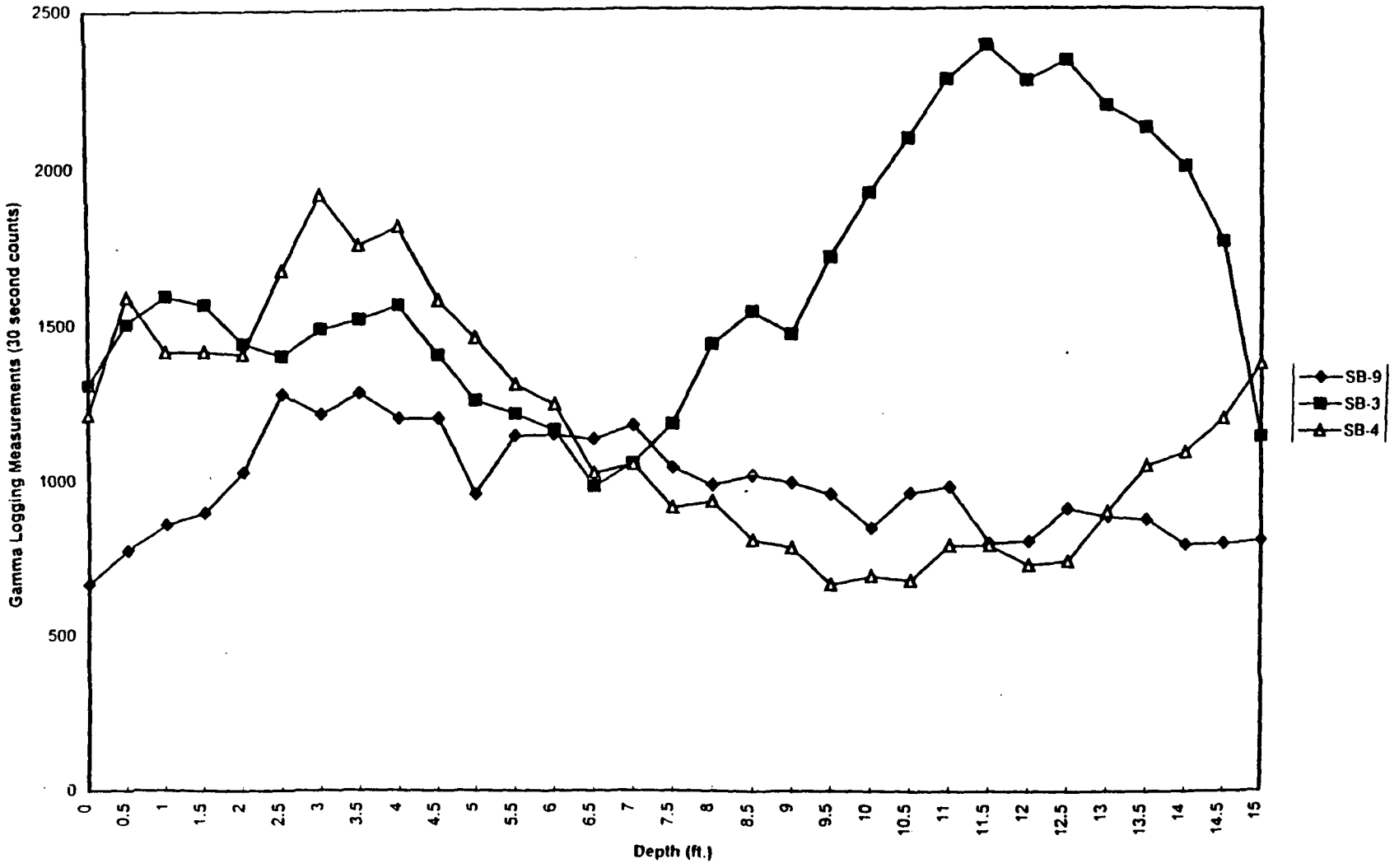
FIGURE 2-7-GAMMA LOGGING RESULTS-AREA ADJACENT TO G



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side of Area A. SB-14 exhibited elevated counts from the 0 to 4.5 foot depth range (5,344 to 14,312 counts) and SB-15 exhibited elevated counts from the 2.5 foot to 4 foot depth range (9,283 to 7,163 counts). SB-13, located in the northeast corner of Area A, exhibited the highest count rate of all borings drilled at the Site (162,890 counts) at 6.5 feet.

Area G (SB-8, SB-10, SB-22 through SB-24, SB-26 and SB-28)

Gamma logging data for Area G is presented in Table 2-8 and Figure 2-4. The downhole gamma logging data, like the soil screening data, confirmed the presence of a fill area in Area G. Elevated gamma counts were observed primarily in the 3 to 10 foot depth range in all Area G soil borings except SB-10 and SB-28. SB-10 and SB-28 are located on the west side of Area G and did not exhibit elevated gamma count rate. SB-8, located at the east wall of the 4-story concrete condominium shell had the highest count rate (66,741 counts for 30 seconds) at 7.5 feet. SB-23, located adjacent to SB-8, also exhibited slightly elevated count rates at 12 to 15 feet.

Areas B and C (SB-1, SB-2, SB-5, SB-19, SB-25 and SB-27)

Gamma logging data for Areas B and C is presented in Table 2-6 and Figure 2-5. The downhole gamma logging data, like the soil screening data, confirmed the presence of a small fill area in Areas B and C, which is contiguous with Area A. The elevated count rates were found in the 0 to 4 foot depth range (SB-19 and SB-25). SB-27, located off the existing asphalt pavement of the main road south of TP-3, also exhibited slightly elevated count rates from 2 to 4.5 feet.

Area D and E (SB-6, SB-7, SB-12, SB-20 and SB-21)

Gamma logging data for Area D and E is presented in Table 2-7 and Figure 2-6. The downhole gamma logging data were slightly elevated with the highest measurement of approximately two times background being detected in SB-7.

Adjacent to Area G (SB-3, SB-4, and SB-9)

Gamma logging data for the area adjacent to Area G is presented in Table 2-9 and Figure 2-7. All data were at or near background.

SECTION 3

400695A

3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

3.1 SURFACE FEATURES

Surface elevations at the Site range from approximately 19 feet above MSL (spot elevation at the elevated landfill pile adjacent to the main entrance) to approximately 13.5 feet at the south-west bulkhead on Glen Cove Creek at the southern boundary of the site (Figure 2-2). In general, the Site is relatively flat with a gentle uniform slope of approximately less than one tenth of one percent across the site. However, two elevated elongated landfill berms exist at the site near Area A. Steep banks (approximately 20% slope) are located in the south-central section of the Site and border the open tidal flat area. Other main site features include two 4-story concrete condominium shells, two retention ponds, and various pile and debris disposal areas. Approximately 90 percent of the Site is unpaved except for an asphalt road running north-south approximately 400 feet and terminating in a 18,000 square foot parking lot. An unpaved roadway runs approximately east-west and connects Areas A and G. Vegetated areas exist throughout the Site.

Surface water run-off follows the site topography. Surface water run-off in the north-west section of the site flows north-south from the existing berm toward the topographic depression near Area C and to Glen Cove Creek. In the north-central section of the Site, surface water and rainwater collects primarily in the two interconnected retention ponds. Standing water also pools in the low lying area of the unpaved roadway in the center of the site. Surface-water run-off in the north-east section of the Site flows north-north-east toward the existing bulkhead and other low lying areas.

3.2 METEOROLOGY

The Site is located along the north shore of Long Island, NY on the Atlantic Coastal Plain. The region is predominantly affected by cold, dry air masses from the northern interior of the continent and warm, humid air masses from the south. In addition, the region is greatly affected by a third air mass that typically flows inland from the North Atlantic

Ocean, providing cool, cloudy and damp conditions. During the winter months, the Atlantic Ocean provides moderating influences on Long Island, with average temperatures around freezing. During the summer months, prevailing southerly winds and maritime flows often provide hot and uncomfortably humid conditions.

3.3 GEOLOGY

3.3.1 Regional Geology

The geology of northwestern Long Island is discussed below with emphasis on the Glen Cove region. The Glen Cove region for the purpose of this discussion is defined as the area surrounding the Site for a distance approximately one mile to the north, east and south, and bounded by Hempstead Harbor to the west. A more detailed discussion regarding regional geology is discussed in several USGS publications. Information presented in the earlier publications (Swarzenski, 1963; USGS, 1946) is superseded by the information presented in the more recent publications (Smolensky et. al., 1989; Kilburn and Krulikas, 1987).

Long Island is the northern most extension of the Atlantic Coastal Plain. The Island is composed of terrestrial deposits of Cretaceous age and Quaternary deposits primarily of glacial origin (Pleistocene). These deposits form a southeastward thickening wedge of sediments which overlie either Paleozoic or Precambrian crystalline bedrock. The bedrock surface and the overlying strata generally dip to the southeast, with the unconsolidated strata thickening in the down-dip direction. In the Glen Cove region, the unconsolidated sediments are 400 to 600 feet thick. The stratigraphic column underlying the northern part of the Town of Oyster Bay, Long Island, which includes the Glen Cove region is presented in Table 3-1.

The Site is located about four miles north of the Harbor Hill terminal moraine, a series of coalescing irregular hills (kames) which form a pronounced ridge trending north-northeast across Long Island. This moraine marks the terminal position of the most recent Pleistocene (late Wisconsin) ice sheet to reach Long Island. The deposits which formed during the glacial recession include outwash sand and gravel deposits, till or ground moraine (a heterogenous mixture of clay, silt, sand and boulders) interlayered with gray clay lenses

Table 3-1

Summary of Geology and Water-Bearing Properties of Deposits
Underlying the Northern Part of Town of Oyster Bay,
Nassau County, New York *

Series	Geologic Unit	Hydrogeologic Unit	Approximate Range in Thickness (ft)	Character of deposits forming geologic unit *(modified from Swarzenski, 1963, and Isbister, 1966)	Water Bearing Properties
QUATERNARY					
Holocene	Undifferentiated artificial fill, salt-marsh and swamp deposits, stream alluvium, and shore deposits	Upper Glacial Aquifer	0 to 50	Sand, gravel, silt, and clay; organic mud, peat, loam, and shells. Colors are gray, green, black, and brown.	Permeable zones near the shore and in stream valleys may yield small quantities of fresh or brackish water at shallow depths. Clay and silt beneath the north-shore harbors retard saltwater encroachment and confine underlying aquifers.
Pleistocene	*Upper Pleistocene deposits*		10 to 380	*Till, composed of unsorted clay, sand, gravel, and boulders. Outwash deposits of stratified brown sand and gravel. May also contains some lacustrine and marine deposits consisting of clay, silt, and sand; locally fossiliferous.*	*Till, relatively impermeable, may cause local conditions of perched water and impede downward percolation of precipitation. Outwash deposits of sand and gravel are highly permeable. Wells screened in glacial outwash deposits yield as much as 1,750 gal/min. Specific capacities of large-capacity wells range from 14 to 175 (gal/min)/ft of drawdown. Water is generally fresh and unconfined but may locally contain saltwater near shores*
CRETACEOUS - QUATERNARY					
Upper Cretaceous, Pleistocene, and Holocene	Deposits of Holocene and Pleistocene age, undifferentiated. May locally include eroded remnants of the clay member of the Raritan Formation	Port Washington Confining Unit	0 to 360	Clay, solid and silty, gray, gray-green, white, red, mottled, and brown, containing lenses or layers of sand or sand and gravel. May locally contain lignite, shells, foraminifera, and other microfossils	Relatively impermeable throughout much of the area. May be moderately to highly permeable in areas adjacent to inferred limit of Magothy aquifer where sand and sand and gravel content may be large. Confines water in underlying Port Washington and Lloyd aquifers but does not prevent movement of water between upper glacial aquifer and Port Washington aquifer. Lenses of sand and sand and gravel provide sources of water with adjacent formations. One large capacity well had a reported yield of 2,000 gal/min with a specific capacity of 43 *(gal/min)/ft of drawdown. Coarser deposits may locally* contain saltwater near shores
	Deposits of Pleistocene age, undifferentiated, and/or local erosal remnants of the Lloyd sand member of the Raritan Formation	Port Washington Aquifer	0 to 170	Sand, fine to coarse, white, yellow, gray, and brown, or gray and gravel with interbedded clay, silt and sandy clay	Moderately to highly permeable. One large capacity well had a reported yield of 1,100 gal/min with a specific capacity of 11 (gal/min)/ft of drawdown. Water is confined under artesian pressure. Generally contains freshwater but may have high iron content
CRETACEOUS					
Upper Cretaceous	Matawan Group Magothy Formation Undifferentiated	Magothy Aquifer	0 to 610	Clay, silt, sand, and sand, fine to medium, clayey, white, gray, yellow, pink, and multicolored, in lenticular beds. May contain lenticular beds of coarse sand and gravel in lower part of unit. Lignite, pyrite and iron oxide concretions may occur throughout the unit.	Moderately to highly permeable. Wells screened in lower part of aquifer yield as much as 1,400 gal/min. Specific capacities of large capacity wells commonly range from 10 to 50 (gal/min)/ft of drawdown but may be as high as 80 (gal/min)/ft. Aquifer is principal source for public supply. Water is generally of excellent quality. Degree of confinement under artesian pressure is variable; however, artesian conditions increase with depth. Hydraulic continuity may exist between the Magothy aquifer and continuous Pleistocene aquifers
	Clay Member (Raritan Formation)	Raritan Clay Confining Unit	0 to 185	Clay, solid and silty, gray, white, red and mottled. May contain lenses or layers of fine to medium sand which may locally contain gravel. Sand layers frequently occur near top of unit. Lignite and pyrite are common	Relatively impermeable. Confines water in underlying Lloyd aquifer but does not prevent movement of water between Magothy and Lloyd aquifers
	Lloyd Sand Member (Raritan Formation)	Lloyd Aquifer	0 to 195	Sand, fine to coarse, white, yellow, or gray, and gravel, commonly in a clayey matrix. Contains lenses and layers of solid or silty clay. Beds are usually lenticular and frequently show great lateral changes in composition	Moderately permeable. Large-capacity wells may yield as much as 1,600 gal/min; specific capacities commonly range from 10 to 19 (gal/min)/ft of drawdown. Water is confined under artesian pressure; some wells flow. Water is generally of excellent quality but may have high iron content
	Crystalline Rocks	Bedrock	Not Known	Metamorphic and igneous rocks; muscovite-biotite schist, gneiss, and granite. May have weathered zone at top	Relatively impermeable. Contains some water in fractures but impracticable to develop owing to low permeability.

and delta deposits. Earlier glacial deposits associated with the Ronkonkoma glaciation underlie the Harbor Hill drift. These deposits are collectively designated as the upper Pleistocene deposits. Older inter-glacial deposits include lacustrine, estuarine and marine sediments.

The predominant surficial deposit in the Glen Cove region is a veneer of Harbor Hill ground moraine, which is a heterogeneous mixture of clay, silt, sand and boulders typically 5 to 10 feet thick although locally, the thickness is as much as 40 feet. Beneath the ground moraine lies another sequence of older (Ronkonkoma) drift containing interlayered glacial till and outwash deposits. The glacial sediments range in thickness from less than 10 to over 200 feet in the northern part of Long Island (Kilburn and Krulikas, 1987).

On most of Long Island, the glacial deposits lie uncomfortably on the Mattawan Group (Magothy Formation - undifferentiated), a Cretaceous age sedimentary sequence of discontinuous sand, gravel and clay lenses. In the Glen Cove region, however, the Magothy Formation is absent. The absence of the Magothy is attributed to channel cutting during a pre-Wisconsin stage of the Pleistocene epoch (Smolensky, et. al 1989). Post Cretaceous erosion was the major contributing factor in producing more than 400 feet of relief on the Cretaceous surface along the north shore of Long Island.

In the Glen Cove region, the upper Pleistocene deposits are underlain by an extensive unit comprised of clay, silt and a few layers of sand. This unit was believed by some researchers to be equivalent to the Gardiners Clay, which is a shallow marine sequence deposited during an interglacial period (Swarzenski, 1963; Isbister, 1966). A more recent publication (Kilburn, 1972) refers to this stratum as the Port Washington confining unit and identifies it as Pleistocene and Holocene age.

In the Glen Cove region, that sequence rests unconformably on the unnamed clay member of the Raritan Formation. The surface of the clay member is about 200 feet below sea level (Smolensky et al., 1989). The clay member and the Port Washington clay deposits are in direct contact and differentiation between the two is sometimes difficult (Smolensky, 1989). Together these strata comprise a contiguous unit at least 75 feet thick in the Glen Cove region.

The lower unit of the Raritan Formation is the Lloyd Sand Member which is approximately 125 feet thick in the Glen Cove region. The Lloyd Sand Member rests on bedrock at depths of approximately 400 to 500 feet below MSL (Smolensky et. al., 1989).

3.3.2 Site Geology

The sources for this discussion regarding Site geology is based on previous geologic investigations (Roux Associates, 1998; Hart, 1990 and RTP, 1988) and information collected during this field investigation. A total of 30 soil borings (28 soil borings and two monitoring well borings) were drilled to approximately 15 feet during this investigation primarily to collect radiological information and to assess the corresponding shallow geology in Areas A and G. Deeper borings were completed during previous investigation (CDM, 1985) to assess the overall geology of the site. Boring logs from the soil borings and monitoring wells that were drilled as part of this FFS are presented in Attachment D.

The boring logs indicate that primarily unsorted silts and sands are present in the shallow soils of the site and that the presence of fill materials such as construction and demolition (C&D) debris including wood, asphalt, metal, brick, glass, plastic, and rag fragments are detected at depth. In addition, peat or a peaty clay layer is present at approximately 12 to 14 feet below grade.

Evidence of fill materials diminishes south-west of the bermed area in Area A with depth as observed in soil borings SB-5, SB-25, SB-19 and MW-8. In these borings, fill materials was confined to the upper three foot layer and may be related to a man-made two foot silt and fill landfill cover material observed in the upper two feet of most boring throughout the site. Native materials such as light and dark sands, silts and gravels and peaty clay was encountered below approximately 6 feet.

In borings and test pits excavated and drilled in the northeast section of Area A, abundant C&D fill materials such as large concrete boulders and charred logs were observed in the upper 10 feet of drilling as observed in soil borings SB-17, SB-18 and TP-2.

A dark black compacted silt and sand layer and fragmented fill materials corresponding to elevated radiological readings was observed approximately 3 to 8 feet

below existing grade along the east side of the asphalt roadway as observed in TP-3, TP-7 and SB-27.

In Area G, clay lenses or silty clay zones were encountered and interbeded with silt and sand units as observed in soil borings and test pits. A similar dark black compacted silt and sand layer corresponding to elevated radiological readings was also observed at approximately 4-10 feet in SB-22, SB-23, SB-24 and SB-8. Fill material was also present in borings. A peaty clay unit was also observed at approximately 12 feet and may contribute to perched groundwater conditions in this area.

The two monitoring wells MW-7 and MW-8 were completed to approximately 16 and 18 feet, respectively and were installed to assess the shallow groundwater quality downgradient of Area A and G. Well completion logs are presented in Attachment E.

Boring logs and physical soil properties measured from samples collected during the drilling of soil borings and monitoring well borings as part of this FFS were consistent with the previous investigation and published sources.

3.4 SOIL CHARACTERISTICS

Soil samples from test pits, soil borings and sediment samples that were collected during the FFS investigation were analyzed for physical properties (e.g., grain size, bulk density, moisture content and Atterberg limits). Nine samples for physical parameters was submitted for analysis from four soil borings, three test pits, and two sediment locations.

Grain size data suggest that the soil consists of poorly sorted very fine to medium sands, silts and clay. The average grain size distribution estimated from seven soil samples collected at the Site consisted of approximately 18% sand, 75% silt, and 6% clay. The two wetland and sediment soil samples consisted of an average of 43% very fine sands, 54% silts and 4% clay.

Samples for hydraulic conductivity were not collected since clay beds greater than 2 feet were not encountered in soil borings. Copies of all results from the physical property testing are presented in Attachment F.

3.5 HYDROGEOLOGICAL CHARACTERISTICS

3.5.1 Regional Hydrogeology

There are two discrete aquifers in the Glen Cove region and they are designated the Upper Glacial and the Lloyd aquifers. In addition to these aquifers, local bodies of perched groundwater occur above the water table. Long Island was declared a sole source aquifer by USEPA on June 29, 1978.

Bodies of perched groundwater are found in several parts of the Glen Cove region. Perched groundwater occurs where the downward migration of water in the vadose zone is impeded by a layer of relatively low permeability which results in a local zone of saturation above and unrelated to the main water table. In the Glen Cove region, perched water occurs close to the land surface in depressions that are underlain by clayey till and clay. Perched groundwater is prevalent in the area of ground moraine north of the Harbor Hill terminal moraine (which includes the Glen Cove region).

The Upper Glacial aquifer consists of permeable upper Pleistocene deposits that occur below the water table. The water table occurs from MSL to about 60 feet above MSL in the Glen Cove region. Recharge is entirely from precipitation occurring mostly during the late fall and winter when plant growth is dormant. Under natural conditions, shallow groundwater discharges to streams, springs and Long Island Sound and its harbors by evapotranspiration and by downward leakage to the underlying aquifer. Previous investigations have indicated that groundwater movement in the Upper Glacial aquifer is generally to the south in the vicinity of the Site, with shallow discharge to Glen Cove Creek. Groundwater movement in the deeper zones of the Upper Glacial aquifer may pass under the creek. In the Glen Cove region, discontinuous beds of low permeability sediments limit the amount of water which can be pumped from the Upper Glacial aquifer; hence several supply wells in the area tap the deeper Lloyd aquifer.

The Magothy aquifer is not present in the Glen Cove region. However, groundwater likely moves into the Upper Glacial aquifer where it is in contact with the subcrop of the Magothy formation to the west and south.

The clay member of the Raritan Formation is a confining unit that overlies the Lloyd aquifer. The Port Washington confining unit occurs above, and is contiguous with, the clay member in many places. Together, these strata form an effective confining unit separating the Lloyd aquifer from the Upper Glacial aquifer in the Glen Cove region.

The lower limit of the Lloyd aquifer and the Port Washington aquifer is the Precambrian bedrock surface; the upper limit is the clay member of the Raritan formation or the Port Washington confining unit. The Lloyd aquifer is the most confined of the water bearing units, as demonstrated by minimal interference effects between pumping wells tapping the different aquifers. Hydraulic heads in the Lloyd aquifer are generally lower than those in the Upper Glacial aquifer resulting in downward leakage of water through the clay unit. The Lloyd aquifer is replenished entirely by downward percolation of water from the overlying aquifers through the more permeable zones of the confining unit and, directly but slowly, through the clay itself. The primary recharge area of the Lloyd aquifer is in eastern Nassau County. Groundwater movement in the Lloyd aquifer is generally westward, away from the recharge area. Groundwater moves laterally into the Port Washington aquifer from the Lloyd aquifer where the two units are contiguous. Water discharges by submarine leakage and through pumping wells.

3.5.2 Site Hydrogeology

The uppermost hydrostratigraphic unit on the Site is the Upper Glacial aquifer which is comprised of outwash and lacustrine deposits of Quaternary Age. Immediately beneath this aquifer lies the Port Washington confining unit, an aerially continuous clay sequence. The clay member of the Raritan Formation may also be present. These clay units impede downward groundwater movement, thereby inhibiting contaminant migration from the Upper Glacial aquifer to the underlying Lloyd aquifer. For this reason, hydrogeologic investigations of industrial sites in the area have focused almost exclusively on shallow groundwater in the Upper Glacial aquifer. Consequently, little information is available on the deeper glacial sediments and Cretaceous strata (Raritan Formation) at the Site.

The depth to groundwater in the monitoring wells ranged from approximately 4 feet to 16 feet below grade. These depths correspond to elevations approximately 2 to 11 feet

above mean sea level. This wide range of elevations over this Site (particularly Area G) indicates that groundwater at the Site may be locally perched on low-permeability peat or clay units (i.e. MW-6 in Area A or Area G where clay deposits are more readily seen in soil borings). In addition, old sheet piles encountered near MW-7 in Area G and areas near the bulkhead, may cause localized mounding effects of groundwater. In addition, water levels in some monitoring wells are affected by tidal cycle fluctuations and other wells are marginally affected (Roux, 1998).

Groundwater elevation data collected from the monitoring wells indicates a hydraulic gradient ranging from 0.003 feet/foot in Area A and 0.02 in Area G. The direction of groundwater flow beneath Area A is to the south, toward Glen Cove Creek. The groundwater flow in Area G is southeast and south-west away from the existing retention ponds toward the Glen Cove Creek. Localized perched water gradients can be seen near MW-7 in Area G and MW-6 in Area A and have not been included in the interpretation of generalized groundwater flow patterns.

A comparison of groundwater elevations collected on May 18 and June 9, 1998 indicates similar groundwater flow patterns (Refer to Table 2-4). Groundwater elevations and flow direction have been presented in Figure 3-1 for May 18, 1998.

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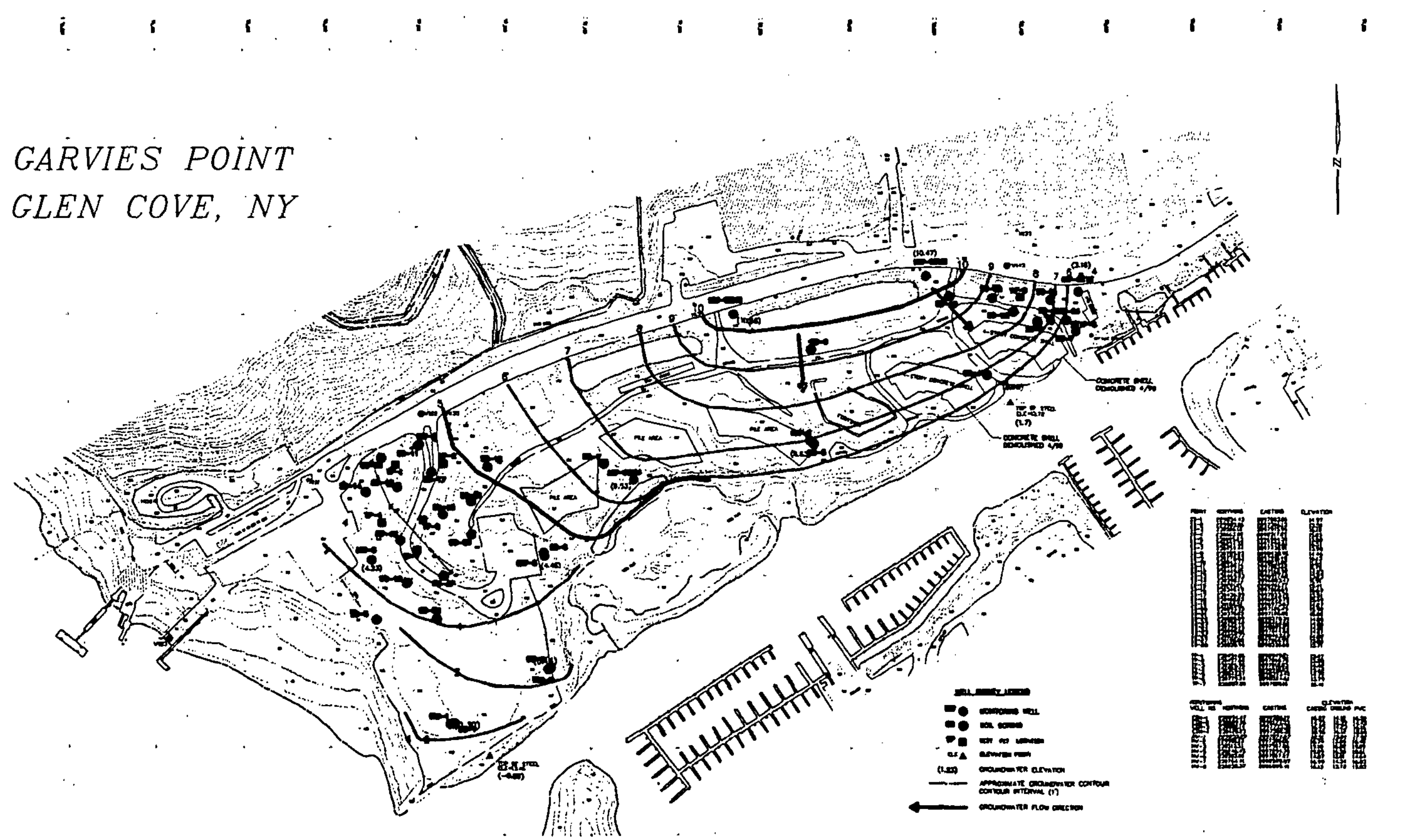
GARVIES POINT
GLEN COVE, NY



NOTES:
1. GROUNDWATER ELEVATIONS ARE BASED ON MEASUREMENTS OF WATER LEVEL IN MONITORING WELLS ON MAY 18, 1998.
2. GROUNDWATER ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL DATUM.
3. MONITORING WELL LOCATIONS AND VERTICAL ELEVATIONS ARE BASED ON AS-BUILT SURVEY BY AMERICAN GEOTECH, INC. CONDUCTED IN JUNE 1998.
4. GROUNDWATER ELEVATIONS CONTOURS AWAY FROM WELL LOCATIONS ARE INTERPOLATED BASED ON TOPOGRAPHIC CONDITIONS AND KNOWLEDGE OF REGIONAL AND LOCAL HYDROGEOLOGY.
5. GROUNDWATER ELEVATIONS AT MW-7 AND MW-6 MAY INDICATE LOCALIZED PERCHED GROUNDWATER CONDITIONS AND WERE NOT USED IN THE DEVELOPMENT OF CONTOUR MAP.

MALCOLM PIRNIE

CAPTAIN'S COVE ADJUNCT FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

FOCUSED FEASIBILITY STUDY
GROUNDWATER CONTOUR MAP
WITH FLOW DIRECTION—MAY 18, 1998

FIGURE 3-1

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 INTRODUCTION

4.1.1 General

The following discussion on the nature and extent of contamination at the Site is based on validated data obtained from the sampling events described in Section 2.0. For the purpose of understanding the general horizontal and vertical extent of contamination, laboratory analytical data from all sampling locations are presented together. These samples include subsurface soil from soil borings and test pits, surface water, sediment, and groundwater. These samples were analyzed for a full range of TCL organics, TAL inorganics (including cyanide) and radionuclides (^{234}U, ^{238}U, ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra and ^{228}Ra). Selected soil samples were also analyzed for TCLP Parameters and physical properties (grain size, moisture content, bulk density and Atterberg limits). The complete analytical results are summarized for each of the major analytical groups (e.g., volatiles, semi-volatiles, pesticide/PCBs, inorganics, radionuclides) in Attachment I.

Laboratory analytical methodologies and data validation procedures were selected to meet the data quality objectives identified in the Draft Final Work Plan and the variance to the Li Tungsten Quality Assurance Project Plan (QAPjP) (Malcolm Pirnie, 1996b). The laboratory statement of work and analytical methodologies were developed to be consistent with the latest CLP methodology (ILM04.0 and OLM03.2 for TAL/TCL analyses) or USEPA approved analytical methods for non-RAS chemical and radiological parameters and to meet data quality objectives. A list of analytical parameters and methodologies are presented in Table 4-1.

All data were validated by USEPA Region II certified data validators according to USEPA validation guidelines. Validation procedures for the radiological data were contained in the FSP which was submitted to and approved by the USEPA.

4.1.2 Comparison to ARARs and TBCs

The various media (soil, groundwater, surface water and sediment) were compared to ARARs and TBCs for volatiles, semi-volatiles, pesticide/PCBs, inorganics and radionuclides.

TABLE 4-1
ANALYTICAL PARAMETERS AND METHODOLOGIES
CAPTAIN'S COVE ADJUNCT

MATRIX	ANALYSIS	PROCEDURE
	TCL Volatiles	CLP (1)
Aqueous	TCL Semi-Volatiles	CLP (1)
	TCL Pesticide/PCBs	CLP (1)
	TAL Metals	CLP (2)
	Cyanide	CLP (2)
	Total Dissolved Solids	USEPA 160.2 (3)
	Radionuclides	HASL-300 (4)
Non-Aqueous	TCL Volatiles	CLP (1)
	TCL Semi-Volatiles	CLP (1)
	TCL Pesticide/PCBs	CLP (1)
	TAL Metals	CLP (2)
	Cyanide	CLP (2)
	Total Organic Carbon (TOC)	USEPA 11 (5)
	pH	USEPA 9045A (6)
	Ignitability	USEPA 1010 (6)
	Corrosivity	USEPA 9045A (6)
	Reactivity	USEPA 9010/9030 (6)
	Hydraulic Conductivity	ASTM D 5084-90 (7)
	Atterberg Limits	ASTM D 4318-84 (7)
	Moisture Content	ASTM D 2216-80 (7)
	Bulk Density:	
	Maximum Index	ASTM D 4253-91 (7)
	Minimum Index	ASTM D 4254-91 (7)
	Grain Size	ASTM D 422-63 (7)
	Radionuclides	HASL-300 (8)
	TCLP	USEPA 1311 (6)

(1) USEPA Contract Laboratory Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, OLM03.2.

(2) USEPA Contract Laboratory Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM04.0.

(3) All conventional extraction and analytical methods are taken from "Methods for Chemical Analysis of Water and Wastes", March 1983 rev., USEPA 600/4-79-020

(4) Radionuclides will be analyzed according to the methods described in the Environmental Measurements Laboratory (EML) Procedures Manual U. S. Department of Energy, 27th Edition, Volume 1, February 1992 or EPA 600 4-80-032, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, August 1990.

(5) "Determination of Total Organic Carbon in Sediment", July 27, 1988, by L. Kahn of the USEPA.

(6) All conventional extraction and analytical methods are taken from "Test Methods for Evaluating Solid Waste", SW-846.

(7) Method taken from the American Society for Testing and Materials, Standards Section for Construction, Volume 4.08, 1992.

(8) Radionuclides will be analyzed according to the methods described in the Environmental Measurements Laboratory (EML) Procedures Manual U. S. Department of Energy, 27th Edition, Volume 1, February 1992 or equivalent.

The ARARs and TBCs included USEPA Generic Soil Screening Levels (SSLs) and Maximum Contaminant Levels (MCLs), NYSDEC standards and site-specific background concentrations.

The New York State standards for soils were derived based upon the NYSDEC Technical Administrative Guidance Memorandum (TAGM) HWR-94-4046 Determination of Soil Cleanup Objectives and Cleanup Levels (NYSDEC, 1994) and TAGM 4003 Cleanup Guideline for Soils Contaminated with Radioactive Materials. TAGMs 4046 and 4003 are guidance documents, therefore, TAGM values are treated as TBCs.

The New York State standards for groundwater are based on the New York Codes, Rules and Regulations (NYCRR) Title 6, Chapter X, Parts 700-705. The USEPA MCLs are based on the Federal Safe Drinking Water Act (40 CFR Part 141). Surface water contaminant concentrations were compared and screened against NYSDEC Surface Water Standards provided in Title 6, Chapter X, Parts 700-705. Sediment contaminant concentrations were compared and screened against TAGM guidance values.

4.1.3 Determination of Background

Background concentrations for inorganics were derived from seven samples collected at four sample locations at the Li Tungsten Superfund Site (MP-11D/11DB on Parcel C' and MP-5/5B, SB-13/13B and TP-6 on the northern portion of Parcel B). These samples were chosen because the sample locations were in areas that are removed from known sources of contamination and believed to be relatively undisturbed.

Background concentration of radionuclides were determined from the same four Li Tungsten sample locations, six area-wide sampling locations and two site-specific samples (SB-7 and SB-9). The average background concentrations were compared to the site-specific radiological data. Groundwater background concentrations were derived from the average concentration in three wells at the Li Tungsten site (MP-5, MP-MD and Komica-1) and one upgradient monitoring well (CDM-3) located north of the two retention ponds.

4.2 SUBSURFACE SOILS

4.2.1 Volatile Organic Compounds (VOCs)

VOCs were detected in relatively few soil samples from Area A and G. VOCs were primarily detected on the northeast edge of Area A (TP-2, SB-12 and SB-21) in soil from 0 to 6 feet.

Acetone was detected in four soil samples. The TAGM guidance value for acetone (20 ug/Kg) was exceeded in two Area A samples (140 E ug/Kg in TP-2 and 390 ug/Kg in SB-12). 2-Butanone was detected in six soil samples and exceeded its TAGM guidance value of 30 ug/Kg in two soil samples (50 ug/Kg in TP-2 and 89 E ug/Kg in SB-12). Carbon disulfide was detected in two soil samples, but did not exceed its TAGM guidance value. Total xylenes were detected in one soil sample (18 ug/Kg in TP-6). Chlorobenzene was detected in two soil samples (42E ug/Kg in SB-21 and 42,000 ug/Kg in SB-21). The TAGM guidance value for chlorobenezene is 170 ug/Kg. Tetrachloroethene was detected in one sample from the monitoring well boring MW-8 at 4 J ug/Kg but did not exceed its TAGM guidance value of 140 ug/Kg.

4.2.2 Semi-Volatile Organic Compounds (SVOCs)

Soil background samples collected from the Li Tungsten site (MP-11D, MP-5B, SB-13 and TP-6) indicated no detectable levels of any semi-volatile organic compounds (SVOCs).

Seven SVOCs were detected in subsurface soils at concentrations that exceeded the TAGM or USEPA SSL guidance values. The seven SVOC compounds were benzo(b)fluoranthene, benzo(a)pyrene, benzo(a)anthracene, chrysene, 2-4 dimethylphenol, naphthalene and carbozole. SVOC contaminants which exceeded the TAGM or USEPA SSL guidance values were detected in five soil borings/test pits in Area A (TP-4, SB-12, SB-17, SB-20 and SB-27), three soil boring samples in Area G (SB-8, SB-22 and SB-23), two monitoring well borings (MW-8 and MW-7 in Areas A and G, respectively), and one site-wide boring (SB-7).

Benzo(b)fluoranthene was detected in 13 samples and exceeded the USEPA SSL guidance value (200 ug/Kg) in eight samples and the TAGM guidance value (1,100 ug/Kg) in

400709

one sample (SB-4. 1,200 ug/Kg). The two highest concentrations (1,200 and 1,100 ug/Kg) were in SB-4 (Area G) from two to six feet. The concentration of benzo(b)fluoranthene exceeding the USEPA SSL or the TAGM guidance value was detected at six locations in Area A (TP-4. SB-12. SB-17. SB-20. SB-27 and MW-8) and four locations in Area G (SB-8. SB-22. SB-23 and MW-7).

Benzo(a)pyrene was detected in 11 samples and exceeded the USEPA SSL guidance value (400 ug/Kg) in three samples and the TAGM guidance value (61 ug/Kg) in all but one sample (SB-27). Benzo(a)pyrene was detected in the same soil samples as benzo(b)fluoranthene except at SB-20 and TP-4.

Benzo(a)anthracene was detected in 12 samples and exceeded the USEPA SSL guidance value (80 ug/Kg) in 10 samples and the TAGM guidance value (224 ug/Kg) in six samples. Benzo(a)anthracene was detected in the same soil samples as benzo(a)pyrene.

Chrysene was detected in 11 samples and exceeded the TAGM guidance value (400 ug/Kg) in SB-4 (750 and 990 ug/Kg). MW-8 (590 ug/Kg). SB-18 (1,900 ug/kg) and SB-22 (3,100 ug/Kg). None of the samples exceeded the USEPA SSL guidance value of 8,000 ug/Kg.

2-4 Dimethylphenol was detected at one location (SB-04. 120 J ug/Kg). The concentration exceeded the TAGM guidance value (100 ug/Kg) but was less than the USEPA SSL of 400 ug/Kg.

Naphthalene was detected in three samples (two samples from SB-4 and one sample from SB-22) and exceeded the USEPA SSL (4,000 ug/Kg) in one sample (SB-4. 6,100 ug/Kg).

Carbazole was detected in four samples (two at SB-4. SB-22 and MW-8). Sample concentrations ranged from 88 J to 2,700 ug/Kg and exceeded the USEPA SSL (30 ug/Kg) in all samples.

Other SVOCs were detected in the subsurface soils. but at concentrations that were less than their respective regulatory screening levels including: 2-Methylnaphthalene - four samples less than the TAGM guidance value (36,400 ug/Kg); acenaphthene - four samples less than the USEPA SSL guidance value (29,000 ug/Kg); acenaphthylene - one sample less than the TAGM guidance value (41,000 ug/Kg); dibenzofuran - four samples less than the TAGM guidance value (6,200 ug/Kg); pyrene - 16 samples less than the TAGM guidance

value (50.000 ug/Kg); di-n-butylphthalate - three samples less than the TAGM guidance value (8.100 ug/Kg); fluoranthene - 14 samples less than the TAGM guidance value (50.000 ug/Kg); N-nitrosodiphenylamine - one sample less than the USEPA SSL (28.000 ug/Kg); phenanthrene - 12 samples less than the TAGM guidance (50.000 ug/Kg); anthracene - four samples less than the TAGM guidance value (50.000 ug/Kg); indeno(1,2,3-cd)pyrene - seven samples less than the USEPA SSL (700 ug/Kg); and benzo(g,h,i)perylene - eight samples less than the TAGM guidance value (50.000 ug/Kg).

4.2.3 Pesticide/PCBs

Soil background samples collected from Li Tungsten (MP-11D, MP-5B, SB-13 and TP-6) indicated no detectable concentration of any pesticide or PCB compound. The pesticide/PCBs detected in the subsurface which exceeded the TAGM guidance or the USEPA SSL values included total PCBs (the summation of Aroclor-1016, 1221, 1232, 1242, 1248, 1254, and 1260), heptachlor epoxide and dieldrin.

Pesticides

Heptachlor epoxide was detected in five samples (three samples near the eastern end of Area A and two samples in Area G (SB-22 and MW-7). Two of the five samples from Area A slightly exceeded the TAGM guidance value (20 ug/Kg); TP-2, 34E ug/Kg and SB-2, 28 EN ug/Kg, but SB-21 was less than the USEPA SSL (30 ug/Kg).

Dieldrin was detected in two samples from the eastern end of Area A (SB-20, 4.9 EN ug/Kg and SB-21, 13 EN ug/Kg and one sample from Area G (SB-23, 12EN ug/Kg). All three samples were less than the TAGM guidance value (44 ug/Kg), but above the USEPA SSL (.2 ug/Kg).

Other pesticides detected at concentrations which were less than their respective TAGM guidance and USEPA SSL value included: 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, gamma-chlordan, endrin aldehyde, endrin ketone, endosulfan I, delta-GHC, beta-BHC, and heptachlor.

PCBs

Total PCBs exceeded the TAGM guidance value (1,000 ug/Kg) in two samples (TP-6, 12,000 ug/Kg and SB-21, 5,500 ug/Kg). TP-6 is located near the bulkhead in Area G and SB-21 is located on the east edge of Area A near the unpaved road. The entire concentration from both samples consisted of one congener: Aroclor-1248.

4.2.4 Inorganics

The concentration of inorganics in the subsurface soils were compared to average site-specific background from the Li Tungsten Site and/or regulatory levels (e.g., USEPA SSLs or TAGM guidance values). Site-specific background concentrations for inorganics were obtained by averaging the concentration in the following samples at the Li Tungsten Site (MP-11D, MP-11DB, MP-5, MP-5B, SB-13, SB-13B and TP-6). The average site-specific background concentration for each TAL metal is presented in Table 4-2.

Some inorganics in the soils may represent accessory metals in tungsten ore. The accessory metals include: antimony, arsenic, barium, copper, cobalt, chromium, lead, manganese, mercury, nickel, thorium, uranium, vanadium and zinc. In addition, laboratory analysis of three ore residue samples from the Dickson Warehouse confirm that high concentration of accessory metals are present in the ore residues.

Aluminum slightly exceeded the average site-specific background concentration of 9,676 mg/Kg in three samples (TP-2, 13,300 mg/Kg; TP-3, 10,300 mg/Kg, and TP-4, 13,700 mg/Kg.

Antimony is one accessory metal commonly found in tungsten ore. Antimony was detected in only one of the seven site-specific background samples at a concentration of 1.6 mg/Kg (TP-6); the USEPA SSL for antimony is 0.3 mg/Kg. The measured concentration of antimony exceeded the site-specific background concentration (0.3 mg/Kg) and the USEPA SSL (0.3 mg/Kg) in 21 samples. High concentrations of antimony were detected in Area A borings and test pits (TP-1, 1,030 mg/Kg; TP-3, 234 mg/Kg; SB-16, 208 mg/Kg, SB-17, 731 mg/Kg) and Area G (TP-6, 55.5E mg/Kg; and SB-24, 201 mg/Kg) corresponding to areas and depths which exhibited elevated radiological contamination. Comparably, antimony was detected in low concentrations in site-specific site-wide borings (SB-7, 2.3 J mg/Kg).

Table 4-2.
DETERMINATION OF SITE-SPECIFIC BACKGROUNG CONCENTRATION OF INORGANICS
LI TUNGSTEN SITE
GLEN COVE, NY

CONSTITUENT	SB-13 (mg/Kg)	SB-13B (mg/Kg)	MP-5 (mg/Kg)	MP-5B (mg/Kg)	MP-11D (mg/Kg)	MP-11DB (mg/Kg)	TP-6 (mg/Kg)	Site-Specific Average (mg/Kg)
Aluminium	11,500	6,890	15,400	3,760	3,930	5,550	20,700	9,676
Antimony	ND	ND	ND	ND	ND	ND	1.6 J	0.3
Arsenic	R	2.4 E	14.9	6.5	4.4	4.5	5.1 E	6.3
Barium	58	87.4	62.8	32.8 J	11.5 J	18.2 J	72.6	49
Beryllium	0.71 J	1.1	ND	ND	ND	0.75 J	0.84 J	0.5
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	555 J	2,120	1,180	681 J	91.1 J	66.1 J	884 J	796
Chromium	20.8	23	21.9	7.7	6 5 E	14	34.4	18.3
Cobalt	8.4 J	7.6 J	15.9	2.6 J	2.2 J	1.6 J	11.6	7.1
Copper	10.1 E	9.6 E	26.9 E	7.5 E	4.1 J	38.6	15.1 E	15.9
Iron	15,500	12,100	36,700	25,400	7,040	12,700	32,000	20,206
Lead	16.1	5.1 E	103	3.9	15.3 E	11.1 E	9.8	23
Magnesium	2,200	2,370	2,250	1,230 J	790 J	1,510	4,510	2,122
Manganese	626	2220 E	541 E	407 E	125 E	55 E	673 E	664
Mercury	0.06 J	ND	0.11	ND	ND	ND	ND	0.03
Nickel	11.1 E	21 E	18.2	8.4 J	4.1 J	6.5 J	19.8	12.7
Potassium	1,260	2,100	1,270	1,140 J	422 J	919 J	2,790	1,414
Selenium	ND	1.9 E	2.7	ND	R	R	1.4 E	0.9
Silver	ND	ND	0.6 J	ND	ND	0.34 J	ND	0.1
Sodium	49.9 J	62.2 J	84.5 J	73.5 J	ND	ND	91.3 J	51.6
Thallium	ND	1.1 J	ND	ND	ND	ND	ND	0.2
Vanadium	27.7	15.9	46.3	15.3	4.7 J	20.6	0.45	18.7
Zinc	42.7 E	62.5 E	81.2	15.9	13.9 E	34 E	57 E	44

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Arsenic is another accessory metal commonly found in tungsten ore. The concentration of arsenic in the Li Tungsten site-specific background samples averaged 6.3 mg/Kg; the TAGM guidance value is 7.5 mg/Kg. In general, soil samples outside Areas A and G were significantly lower in concentration than soil samples collected within Areas A and G. For example, concentrations detected in borings SB-7 and SB-8 were 10.8 mg/Kg and 6.6 mg/Kg, respectively. Overall, arsenic was detected in 28 soil samples. The concentration of arsenic exceeded the site-specific background concentration in 24 samples and exceeded the TAGM guidance value in 23 samples. The highest concentration of arsenic was detected in Area A (TP-1, 2,760 mg/Kg).

Barium, another accessory metal in tungsten ore, was detected in 25 soil samples at concentrations ranging from 6.5 mg/Kg to 855 mg/Kg. The concentration of barium exceeded the average site-specific background concentration of 49 mg/Kg in 25 samples, exceeded the USEPA SSL (82 mg/Kg) in 21 samples and exceeded the TAGM guidance value (300 mg/Kg) in eight samples.

Beryllium was detected in 24 samples at concentrations ranging from 0.08 mg/Kg to 5.4 mg/Kg. The concentration of beryllium exceeded the average site-specific background concentration of 0.5 mg/Kg in 11 samples and exceeded the TAGM guidance value (3 mg/Kg) in two test pit samples from Areas A and G (TP-4, 4.3 mg/Kg and TP-6, 5.4 mg/Kg). The highest concentration of beryllium was detected in a soil sample from 5 to 6 feet in TP-6 in Area G, near the existing bulkhead.

Cadmium was detected in 19 samples above the TAGM guidance value of 1 mg/Kg. Cadmium was not detected in any of the Li Tungsten site-specific background samples and was at low concentrations in site-wide borings (SB-7, 1.1J mg/Kg and SB-9, 0.13 J mg/Kg). The highest concentrations were detected in Area A soil samples (i.e, TP-1, 174 mg/Kg; TP-3, 139 mg/Kg,

Calcium was detected in all soil samples and exceeded the site-specific background concentration of 796 mg/Kg in all samples (the TAGM guidance value for calcium is equivalent to the site background).

Chromium is a common accessory metal in tungsten ore and was detected in all samples. The concentration of chromium ranged from 5.7E mg/Kg (SB-16) to 244 mg/Kg (SB-24). The concentration of chromium exceeded the average site-specific background

concentration of 18.3 mg/Kg in 14 samples: the TAGM guidance value (10 mg/Kg) was exceeded in 22 samples. The distribution of chromium shows a similar pattern to other accessory metals. The highest concentrations were found in Area A and Area G soils corresponding to elevated levels of radiological activity.

Cobalt, another common accessory metal in tungsten ore, was detected in all samples at concentrations ranging from 2.1J (SB-16 and SB-9) to 379 E mg/Kg (TP-4). The measured concentration of cobalt exceeded the average site-specific background concentration of 7 mg/Kg in 19 samples and exceeded the TAGM value (30 mg/Kg) in 10 samples. The highest concentrations of cobalt were detected in the test pits in Area A (TP-1, 331 mg/Kg; TP-2, 100 mg/Kg, TP-3, 228 mg/Kg, and TP-4, 379E mg/Kg). Other high concentrations were detected in soil borings from Area G (SB-23-4-6, 103 mg/Kg; SB-24, 172 mg/kg; and SB-26, 93.5 mg/kg).

Copper, a common accessory metal in tungsten ore, was detected in all samples and ranged in concentration from 11.5 E mg/Kg (SB-9) to 11,300 mg/Kg (TP-1) in Area A. The concentration of copper exceeded the average site-specific background concentration of 15.9 mg/Kg in 26 samples and exceeded the TAGM value (25 mg/Kg) in 22 samples.

Iron, which is not an accessory metal in tungsten ore, was detected in all samples. Iron concentration ranged from 4,230 mg/Kg (SB-9) to 200,000 mg/Kg (TP-1). The concentration of iron exceeded the average site-specific background concentration of 20,206 mg/Kg in 13 samples; all samples exceeded the TAGM value (2,000 mg/Kg).

Lead, another common accessory metal in tungsten ore, was detected at levels which exceeded the site-specific background concentration of 23 mg/Kg in 25 samples. The highest concentration of lead detected in TP-1 (29,500 mg/Kg). The TAGM guidance value for lead is equivalent to site background. Urban background levels for lead typically range from 200-500 mg/Kg.

Magnesium was detected in all samples and exceeded the average site-specific background concentration of 2,172 mg/Kg in 10 samples. The highest magnesium concentration was detected in TP-4 (39,100 mg/Kg), located in Area A.

Manganese, another common accessory metal in tungsten ore, was detected in all samples at concentrations ranging from 70.2 mg/Kg in the site-wide soil boring (SB-9) to 215,000 mg/Kg. The concentration of manganese exceeded the site-specific background

concentration (664 mg/Kg) in 12 samples. The TAGM guidance value for manganese is equivalent to site background. Significantly higher concentrations of manganese was detected in Area G soil borings (SB-23, 63,700 mg/Kg; SB-24, 215,000 mg/kg; and SB-26, 51,700 mg/Kg as compared to Area A soil borings.

Mercury was detected in 26 samples and ranged in concentration from non-detect to 4.1 mg/Kg (TP-6). Mercury exceeded the average site-specific background concentration of 0.03 mg/Kg in 25 samples. In addition, the concentration of mercury exceeded the TAGM value (0.1 mg/Kg) in 18 samples.

Nickel was detected in all samples and ranged in concentration from 2.2 J (SB-16) to 145 mg/Kg (TP-1). Nickel exceeded the average site-specific background concentration of 12.7 mg/Kg in 22 samples. The TAGM value (13 mg/Kg) is virtually the same as the site-specific background level.

Potassium was detected in all samples and exceeded the average site-specific background concentration of 1,414 mg/Kg in only two samples: SB-17 (1,430 mg/kg) and TP-2 (2,500 mg/Kg).

Selenium was detected in 22 samples and exceeded the average site-specific background concentration and the TAGM value (2 mg/Kg) in 14 samples. The highest concentrations of selenium corresponded to Area A test pits and soil borings SB-23, SB-24 and SB-26 in Area G.

Silver was detected in 26 samples and exceeded the site-specific background concentration of 0.1 mg/Kg in all samples. The TAGM value is equivalent to site background. The highest concentration of silver was detected in TP-1 at 245 mg/Kg.

Sodium exceeded the average site-specific background concentration of 51.6 mg/Kg in 25 samples. The highest detected sodium concentration was in TP-1 (9,990 mg/Kg). Thallium was detected in only 2 samples (SB-21, 2.6 J mg/kg and SB-4, 3.9 mg/Kg) and exceeded or equaled the average site-specific background concentration of 0.2 mg/Kg in each sample. Vanadium was detected in 27 samples. Vanadium exceeded the average site-specific background concentration of 18.7 mg/Kg in 17 samples. Zinc, detected in all soil samples, exceeded the average site-specific background concentration of 44 mg/Kg in 24 samples. Cyanide was detected in one sample from Area A (TP-1, 0.79 mg/Kg).

4.2.5 Radionuclides

The concentration of radionuclides in test pit, soil boring and sediment samples were compared to combined average site-specific background radionuclide concentrations which included samples from Li Tungsten and Captain's Cove (SB-7 and SB-9). The average site-specific background concentration for all radionuclides was approximately 1 pCi/g. As established in OSWER Directive No. 9200.4-25, a clean-up goal of 5 pCi/g plus background for the sum of Ra and Ra as well as the sum of Th and Th is relevant and appropriate for soil at the Site. The analytical results revealed that Areas A and G contained residues which originated at the Li Tungsten site. Areas A and G are located on the northwest and northeast portions of the Site, respectively. Their approximate surface areas are shown on Figure 4-1. A summary of the analytical results are presented in Attachment G.

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

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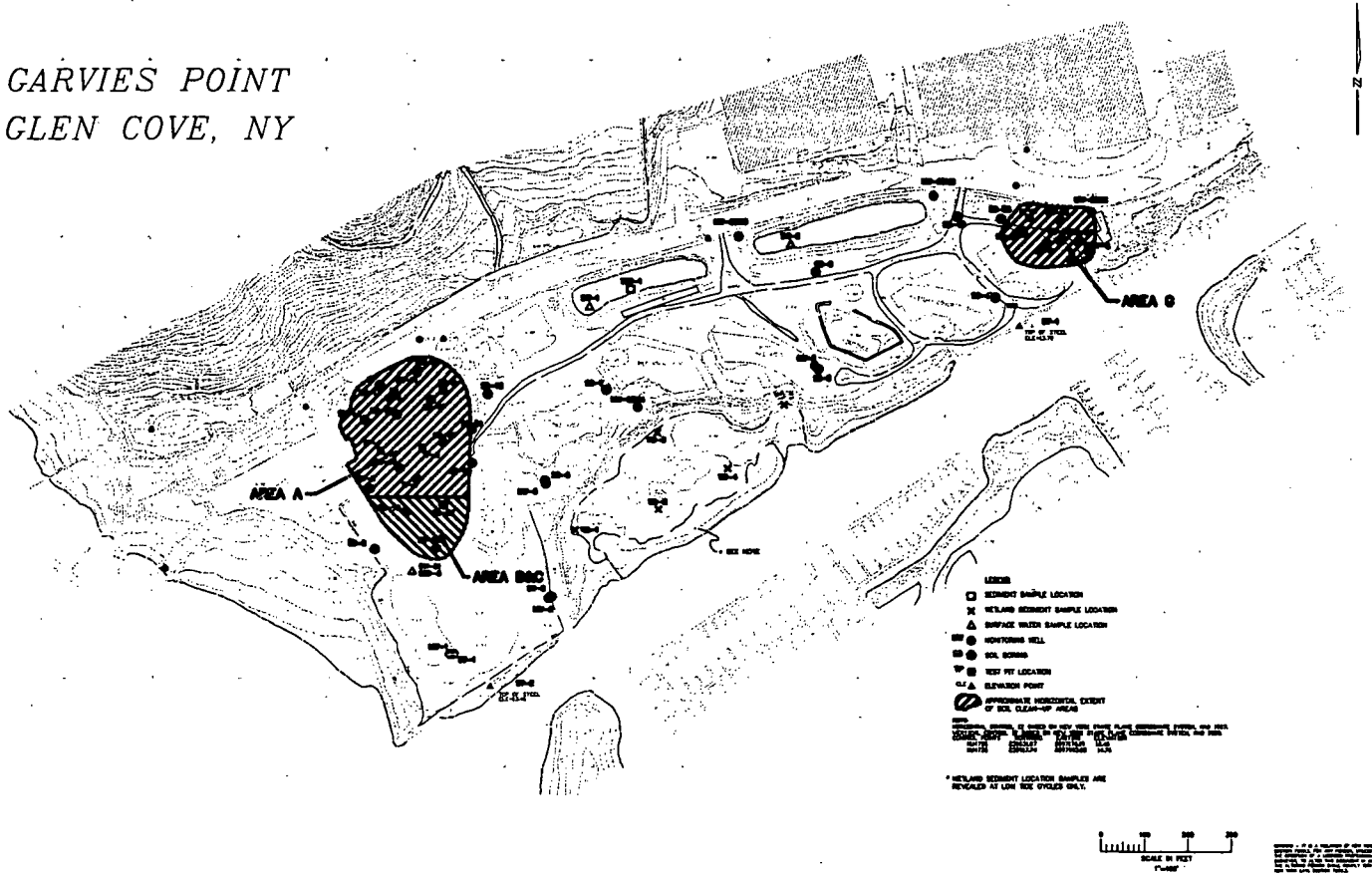

MALCOLM PIRNIE

CAPTAIN'S COVE ADJUNCT – FOCUSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT 68-W9-0051; W.A. NO. 025-2L4L

FOCUSED FEASIBILITY STUDY
SOILS GREATER THAN PRELIMINARY REMEDIATION GOALS

FIGURE

(SB-8, SB-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.

4.3 GROUNDWATER

One round (May-June 1998) of groundwater samples were collected from each of the 11 monitoring wells (9 existing and 2 new). The results of the groundwater sampling are presented in Attachment G. In the discussion below, the analytical results are compared to the USEPA Maximum Contaminant Levels (MCLs) and the NYSDEC groundwater standards (NYSDEC standard), whichever is the more stringent. In cases where there is no NYSDEC standard for a specific volatile organic compound, a Principal Organic Contaminant (POC) standard of 5 µg/L is applied (New York State Codes, Rules and Regulations Title 6, Chapter X Parts 700-705).

4.3.1 Volatile Organic Compounds

VOCs (petroleum compounds and chlorinated volatile hydrocarbons) were primarily detected in samples from CDM-2 and MW-3 located geographically outside Areas A and G. CDM-2 is hydraulically upgradient of Area G; MW-3 is hydraulically downgradient of the existing retention ponds in the middle section of the site. Chlorobenzene and 1-2-dichloroethane were the only other VOCs to be detected in other samples outside of Areas A and G.

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Petroleum Compounds

Benzene was detected in two samples and exceeded the NYSDEC standard (0.7 µg/L) in two samples (MW-3, 8.4 J µg/L and CDM-2, 13J µg/L). Toluene was detected in MW-3 only (88 µg/L), but did not exceed the MCL for toluene (1,000 µg/L). Xylenes (total) were also detected in MW-3 (2.5J µg/L) but was less than the MCL for xylenes (10,000 µg/L) and the NYSDEC POC of 5 µg/L.

Chlorinated Volatile Hydrocarbons

Chlorinated volatile hydrocarbons and their associated degradation products (chlorobenzene, vinyl chloride, 1,2-dichloroethene, and 1,2-dichloroethane) were detected in samples from 7 of the 11 monitoring wells (MW-1, MW-2, MW-3, MW5, CDM-2, CDM-3 and CDM-4). Chlorobenzene was detected in five of the 11 monitoring wells at concentrations ranging from 2.6 µg/L (MW-1) to 500 µg/L (CDM-3) and exceeded the NYSDEC POC of 5 µg/L in two samples (MW-5, 6.2J µg/L and CDM-3, 500 µg/L). Vinyl chloride was detected in two samples at concentrations of 2.6 µg/L (MW-3) and 190 µg/L (CDM-2). The MCL and NYSDEC standard for vinyl chloride of 2 µg/L was exceeded in both samples. 1,2-dichloroethene was detected in the same wells (MW-3, 2.2 J µg/L and CDM-2, 218 µg/L) and exceeded the MCL for 1,2-DCE (70 µg/L) in one sample. 1,2-dichloroethane was also detected in CDM-4 (4.2 µg/L) below the MCL for 1,2-dichloroethane (5 µg/L).

Methylene chloride and chloroform was detected in one sample at concentration of 26J µg/L and 610 µg/L, respectively. Although the concentrations exceeded the NYSDEC POC standards of 5 µg/L and 7 µg/L, methylene chloride and chloroform may be a common laboratory contaminant and may not represent a site-specific contaminant at these low concentrations.

4.3.2 Semi-Volatile Organic Compounds

Several semi-volatile organic compounds (SVOCs) were detected in from three monitoring wells (MW-3, CDM-1 and CDM-2). CDM-1 and CDM-2 are hydraulically upgradient of Area G and MW-3 is located in the middle of the Site. The primary SVOCs detected included phenols, polynuclear aromatic hydrocarbons (PAHs) and phthalates. Many

of the SVOCs do not have MCLs or NYSDEC standards. Of the SVOCs detected, only 1,4-dichlorobenzene (75 µg/L) and 1,2-dichlorobenzene (60 µg/L) have MCLs; phenol (1 µg/L), and bis (2-ethylhexylphthalate (50 µg/L) have NYSDEC standards. Phenol was detected in one sample at concentration of 2.1 J µg/L (CDM-1), slightly above the MCL. 2-Choroopenol was detected in CDM-1 and CDM-2 (2.1 J and 1.5 J µg/L). 1,2,-dichlorobenzene, 1,3-dichlorbenzene, and 1,4-dichlorobenzene were detected once (19 µg/L, 10 µg/L, and 37 µg/L, respectively) in CDM-2 near the east upgradient edge of the existing eastern retention pond. These compounds were present at concentrations less than their MCLs for 1,2-dichlorobenzene and 1,4-dichlorobenzene. In addition, 1,2,4-trichlorobenzene was detected in two samples from CDM-1 and CDM-2 (2.5 J µg/L and 31 µg/L). Concentrations of 4-methylphenol, naphthalene, 2-methylnaphthalene, acenaphthene, and diethylphthalate were detected only once in MW-3 at concentrations of 2.2 J µg/L, 5.5 J µg/L, 1.7 J µg/L, 1.3 J µg/L, and 1.2 J µg/L, respectively. Only naphthalene slightly exceeded 5 µg/L. Bis (2-chloroethyl)ether was detected in CDM-1 (3.7 J µg/L). Bis(2-ethylhexyl)phthalate was also detected once in CDM-2 at a concentration of 2.8 J µg/L, which is less than the NYSDEC standard (50 µg/L).

4.3.3 Pesticides/PCBs

One pesticide, endosulfan sulfate, was detected in one sample (CDM-4) at a concentration of 0.17 µg/L. There is no available MCL or NYSDEC standard for endosulfan sulfate. Polychlorinated biphenyls (PCBs) were not detected in any of the samples.

4.3.4 Inorganics

All groundwater samples were filtered in the field. Both the filtered and unfiltered samples were analyzed for inorganics. However, many of the samples retained high turbidity levels. Both the filtered and unfiltered results are presented in the summary tables in Attachment G. Filtered samples were taken from the following 11 wells: MW-1, MW-2, MW-3, MW-5, MW-6, MW-7, MW-8, CDM-1, CDM-2, CDM-3, and CDM-4.

In general, differences between the dissolved and undissolved fractions for many inorganics were observed. Some samples showed a significant differences between the dissolved and undissolved fractions while other samples exhibited a minor differences. In

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addition, high iron and manganese concentrations were also observed in select samples. Higher percentage differences between the undissolved and dissolved phases may indicate the potential for transport of some inorganics as colloid particles onto iron and manganese particles. Conversely, smaller pecentage differences between the undissolved and dissolved phases may be indicative of true aquifer conditions.

Since filtered groundwater may be more representative of the dissolved phase, results of filtered samples are compared to maximum contaminant levels listed by two government agencies, NYSDEC 10 NYC RR: Public Water Systems and the USEPA Drinking Water Regulations and Health Advisories (October 1996). Differences between the undissolved and dissolved phases are also stated for some inorganic constitutents.

Overall, many of the inorganics were detected frequently, although only a few exceeded agency listed contamination levels. A Site-wide distribution pattern repeated itself for certain inorganics (i.e., iron and manganese). These inorganics were detected in all filtered samples. Five additional inorganics were detected in concentrations above agency standards in some wells: arsenic, antimony, aluminum, selenium, thallium.

Arsenic was detected in seven of the ten wells at concentrations ranging from 2.3 J µg/L (MW-2) to 10200 µg/L (MW-8). Five of these wells exceeded the NYSDEC and EPA MCL standard of 50 µg/L. Arsenic was detected downgradient of Area G at well MW-7 (195 µg/L). In addition, all five wells surrounding Area A contained arsenic, but only four of the wells had concentrations exceeding the NYSDEC/EPA standard (MW-1, 648 µg/L; MW-5, 106 µg/L; MW-6, 115 µg/L; and MW-8, 10,200 µg/L). The highest concentration of arsenic (10,200 µg/L) was at well MW-8, directly downgradient of Area A. The undissolved concentration was also high in MW-8 (11,400 µg/L).

Antimony was detected in three of the ten wells at concentrations ranging from 14.0 J µg/L (MW-7) to 41.4 J µg/L (MW-8). The NYSDEC and the USEPA MCL standards (6 µg/L) were exceeded all three samples. Similar to arsenic, the highest concentration of antimony was from well MW-8, directly downgradient of Area A, while wells further downgradient of Area A contained no antimony. The concentrations of antimony in the undissolved phase were similar to the dissolved phase in MW-8 (40.5 Jµg/L vs. 41.4Jµg/L).

Aluminum was detected in four of the ten wells at concentrations ranging from 25.6 J µg/L (MW-5) to 254 E µg/L (MW-8). Only one well (MW-8 at 254 E µg/L) exceeded the

EPA MCL secondary standard for aluminum (50 to 200 μg/L). The secondary EPA standards are simply recommendations to the states to establish limits, and they are not enforceable. NYSDEC has no limits listed for aluminum in their MCL table.

Selenium was detected in four of the ten wells at concentrations ranging from 13.6 E μg/L (MW-1) to 120 E μg/L (MW-6). Three of these wells exceeded the NYSDEC and EPA MCL limit of 50 μg/L. MW-6 had the highest concentration in the dissolved and undissolved phases (120E μg/L vs. 142 μg/L, respectively) and is located within Area A. MW-8 had the next highest concentration in the dissolved and undissolved phases (105 E μg/L vs. 93.3Eμg/L, respectively) and is downgradient of Area A. MW-1, farther downgradient from MW-8, showed a concentration of selenium below the NYSDEC and EPA standard. MW-7 had a concentration of 69.4 E μg/L and is located directly downgradient of Area G.

Thallium was detected in two of the ten wells, both of which had concentrations greater than the NYSDEC and the USEPA MCL of 3 μg/L: MW-1 (7.9 J μg/L) and MW-2 (9.2 J μg/L). The concentrations in the undissolved phases were also similar. These wells are located in the southwestern portion of the Site, directly south of Area A. Thallium was not detected in any wells within or adjacent to Areas A or G.

As stated above, both iron and manganese were detected throughout the Site, however, the range of concentrations exceeded NYSDEC standards in some samples and were less than NYSDEC standards in other samples. Iron was detected at all ten wells at concentrations ranging from 37.6 J μg/L (MW-CDM-2) to 25,000 μg/L (MW-1). Eight of the ten wells had concentrations greater than the NYSDEC and the USEPA MCL standard of 300 μg/L: 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). No particular pattern of contamination was evident.

Manganese was detected at all ten wells at concentrations ranging from 37.4 μg/L (MW-8) to 5,420 μg/L (MW-6). The USEPA MCL lists manganese as a secondary MCL. The USEPA suggests a concentration of 50 μg/L; however, NYSDEC has set tan actual standard at 300 μg/L. Under the NYSDEC standard, eight of the ten wells sampled exceeded the accepted limit for manganese concentrations in groundwater: 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).

4.3.5 Radionuclides

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.

Uranium-234 concentrations exceeded the maximum site-specific background (CBM-2 - 0.85 pCi/L) in nine of the eleven samples. The concentration of U which exceeded the background value ranged from 1.6 pCi/L (MW-3) to 7.2 pCi/L (MW-7). The highest concentration of U (MW-7) is hydraulically downgradient of Area G.

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

4.4 SURFACE WATER

Three surface water samples (SW-1, SW-2 and SW-3) were collected from the Site. SW-1 and SW-2 were collected from the east and west retention ponds, respectively. SW-3 was collected from the topographic depression in the southwestern portion of the Site near Area C and downgradient of Area A.

The analytical results for the five samples are compared to NYSDEC standards for Class D Fresh Water, where listed. If a Class D standard is not provided, an alternative standard (Class C, Class B or Class A) is used. While the Class D standard represents the lowest quality fresh water, this classification includes surface water suitable for fish survival, and primary and secondary contact recreations.

4.4.1 Volatile Organic Compounds

VOCs were not detected in any of the three surface water samples collected from the Site.

4.4.2 Semi-Volatile Organic Compounds

SVOCs were not detected in any of the three surface water samples collected from the Site.

4.4.3 Pesticides/Polychlorinated Biphenyls

PCBs were not detected in any of the three surface water samples collected from the Site.

4.4.4 Inorganics

In general, SW-3, (collected in the topographic depression downgradient of Area A in the northwest portion of the Site) had significantly higher concentrations of inorganics than either SW-1 or SW-2 (collected from the retention ponds), except for sodium (which was higher in SW-2 at a concentration of 25,300 μg/L). SW-3 exceeded surface water standards for aluminum (15,000 μg/L), cobalt (43.6 μg/L), copper (333 μg/L), iron (62,000 μg/L), lead (418 μg/L), manganese (1,840 μg/L), nickel (63.6 μg/L), and zinc (772E μg/L). In addition, SW-2 exceeded surface water standards for iron (19,400 μg/L), manganese (587 μg/L), and sodium (25,300 μg/L). SW-1 did not exceed surface water standards for any of the compounds.

4.4.5 Radionuclides

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 .

4.5 SEDIMENT

Two sediment samples (SED-1 and SED-3) were collected from the west retention pond and the topographic depression, respectively. Five wetland sediment samples (WS-1-WS-5) were collected from the tidal flat area. The sediment samples (SED-1 and SED-3) were analyzed for full TAL/TCL and radionuclides. The five wetland sediment samples (WS-1-WS-5) were analyzed for radionuclide analysis only since these locations were previously sampled and analyzed for full TAL/TCL under the NYSDEC RI/FS.

The results of the all sediment samples for full TAL/TCL were compared to NYSDEC TAGM values. The results of all sediment samples for radionuclides analysis were compared to the combined average site-specific background radionuclide concentrations from Li Tungsten and Captain's Cove (i.e., SB-7 and SB-9) and the clean-up goal of 5 pCi/g for the sum of radium and thorium concentrations. The average site-specific background concentration for all radionuclides was approximately 1 pCi/g. Sediment sample results are presented in Attachment J.

4.5.1 Volatile Organic Compounds

Two VOC compounds (acetone and 2-butanone) were detected in SED-3 at concentrations of 520 E ug/kg and 110E ug/kg, respectively.

4.5.2 Semi-Volatile Organic Compounds

SVOCs were not detected in SED-1 and SED-3.

4.5.3 Pesticides/Polychlorinated Biphenyls

Five pesticide compounds were detected in SED-3 (Heptachlor epoxide, 2.8 J ug/kg; 4,4'-DDD, 7.2J ug/kg; 4,4'-DDT, 5.5J ug/kg; alpha-chlordane, 18E ug/kg; and gamma

chlordane, 14 E ug/kg. Pesticide concentrations detected in SED-3 were below TAGM guidance values.

PCB compounds were not detected in the two sediment samples.

4.5.4 Inorganics

Inorganic analytical results were compared to available TAGM guidance values for sediment (e.g., arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc). In general, concentrations of inorganics detected in SED-3 (topographic depression, downgradient of Area A) were significantly higher than SED-1 (the retention pond). Inorganic analytical results in sediment are located in Appendix G. For example, although lead was detected in both samples, SED-3 had a concentration approximately 69 times higher than SED-1 (3.9 mg/kg vs. 271 E mg/Kg). In addition, barium was detected at higher concentrations in SED-3 (126 E mg/kg) vs. SED-1(5.8 J mg/kg). Likewise, antimony, arsenic, cadmium, chromium, and nickel were also detected at higher concentrations in SED-3 than in SED-1.

4.5.5 Radionuclides

Sediment collected from SED-1 (west retention pond) was below the average site-specific background of 1 pCi/g and the clean-up goal of 5 pCi/g. The maximum concentration detected was for radium-226 of 0.251 pCi/g. Sediment collected from SED-3 (topographic depression) was slightly above the average site background 1 pCi/g , but below the 5 pCi/g clean-up goal. The highest concentrations detected were for radium-226 (1.66 pCi/g) and radium-228 (1.29 pCi/g).

4.6 WETLAND SEDIMENT

Five samples were collected from the wetlands (WS-1 through WS-5) and analyzed for radionuclides. WS-1, WS-3, and WS-5 were located along the toe of the existing slope of the tidal flat area. WS-2 and WS-4 were located in the center of the tidal flat area. WS-1, WS-3, and WS-5 were located upgradient (north) of WS-2 and WS-4. The concentration of radionuclides in the five wetland sediment samples were all below the average site-specific background of 1 pCi/g and the clean-up goal of 5 pCi/g. Radionuclide concentrations ranged

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from < 0.023 pCi/g of Thorium 230 (WS-1) to a maximum concentration of 0.625 radium-226 (WS-4). The highest concentrations of radionuclides was from radium-226 at WS-3 and WS-4 of 0.602 pCi/g and 0.625 pCi/g, respectively. WS-3 is located along the toe of the slope and approximately in the middle of the tidal flat area. WS-4 is located downgradient of WS-3 (south) and is the southern most wetland sediment sample collected.

4.7 TOXICITY CHARACTERISTIC LEACHING PROCEDURE SAMPLES

Toxicity characteristic leaching procedure (TCLP) analyses were performed on five soil samples: TP-3 (2-3 feet); SB-16 (6-8 feet); SB-24 (4-6 feet); TCLP-4 and TCLP. The last two samples (TCLP-4 and TCLP-5) were ore residues stored in the Dickson Warehouse. The purpose of the TCLP testing was to tentatively classify hazardous or non-hazardous areas and identify wastes that may be likely to leach hazardous constituents into groundwater under improper management conditions. In addition, ore residues in the Dickson Warehouse were tested to determine if soil would be considered a hazardous waste.

None of the contaminants detected in the extract procedure exceeded the maximum toxicity characteristic levels. Trace levels (well below TCLP standards) of arsenic, barium, cadmium, chromium, lead, silver and selenium were detected. Based upon the TCLP results, none of the five soil samples would be characterized as a RCRA hazardous waste. Analytical results of TCLP analyses are presented in Attachment G.

SECTION 5

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5.0 BASELINE RISK ASSESSMENT

5.1 INTRODUCTION

This section presents evaluations of baseline human health risks associated with radiological and chemical contamination detected at the Site.

The objectives of the baseline risk assessment are:

- to provide an analysis of potential health risks, currently and in the future, in the absence of any major action to control or mitigate radiological and chemical contamination, and
- to assist in determining the need for and extent of remediation.

It provides a basis for comparing a variety of remedial alternatives and determining which will be most protective of human health.

The baseline risk assessment follows guidance outlined in the U.S. Environmental Protection Agency's (USEPA) Risk Assessment Guidance for Superfund (RAGS) Volume I Human Health Evaluation Manual (Parts A, B, and D) and other USEPA guidance cited throughout this section. In addition, radiological risks are also calculated with the RESRAD (Yu et al., 1993) and RESRAD-Baseline (Yu et al., 1994) computer models. For the readers of this section who are unfamiliar with risk assessment terminology, a glossary of risk assessment terms is provided in Section 8.3 of this report. A separate section describing radiological terms is also provided in Section 8.2.

As the Site is considered an adjunct to the Li Tungsten site, this risk assessment was conducted to be consistent with the Li Tungsten risk assessment found in the Draft Final Remedial Investigation (RI) Report (Malcolm Pirnie, 1998). However, some changes in the radiological risk assessment reflect guidance documents recently released by USEPA which were not available during preparation of the Li Tungsten risk assessment. These include OSWER Directives 9200-4.18 and 9200-4.25 which establish the conditions under which the uranium mill tailings standards (40 CFR Part 192) are relevant and appropriate at CERCLA

sites. The emphasis on risk assessment is on the lifetime risk, rather than the lifetime or annual dose equivalent received by the current or future site occupant. Therefore, results of the risk estimate calculations are expressed only as risk fractions; annual dose equivalent rates which were provided by RESRAD and shown in the Li Tungsten risk assessment are not included in the current risk assessment.

5.1.1 Overview of the Human Health Evaluation Process

There are four components to the human health evaluation process: 1) data evaluation, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization. In the data evaluation, relevant site data are compiled and analyzed to select contaminants of potential concern which are representative of those detected at the Site. These are referred to as radionuclides of potential concern (ROPCs) in the radiological risk assessment and chemicals of potential concern (COPCs) in the chemical risk assessment. In the exposure assessment, actual or potential contaminant release pathways are analyzed, potentially exposed human populations and exposure pathways are identified, contaminant concentrations at potential points of human exposure are determined, and contaminant intakes are estimated. In the toxicity assessment, qualitative and quantitative toxicity data for each ROPC and COPC are summarized and appropriate guidance levels with which to characterize risks are identified. The likelihood and magnitude of adverse health risks are estimated in the risk characterization in the form of excess lifetime cancer risks (for the ROPCs and carcinogenic COPCs) and non-cancer hazard quotients (for the COPCs). Sources of uncertainty in the evaluation are then noted and discussed. This stepwise process is used in the following sections to evaluate potential health risks that may be associated with exposure to ROPCs and COPCs detected at the Site.

5.2 HUMAN HEALTH EVALUATION: RADIOLOGICAL RISK

In its series of RAGS documents, the USEPA has published a methodology for calculating the carcinogenic risk due to exposure to radioactive materials[1]. The methodology is similar to that developed for chemical carcinogenic risk assessment in that exposure pathway-specific radionuclide intakes are determined and multiplied by cancer slope factors, which result in pathway-specific risks. The risks from each pathway are summed, yielding the total excess lifetime cancer risk.

Over the past several years, researchers at Argonne National Laboratory have developed the RESRAD computer model, which can be used to calculate pathway-specific radiation dose levels and carcinogenic risk resulting from exposure to radioactive materials in soil. A related computer model, RESRAD-Baseline uses radionuclide concentrations measured in environmental media other than soil and estimates carcinogenic risk following RAGS methodology. In assessing the risks to current and future populations occupying the Site posed by radioactive materials, cancer risks were calculated by both the RESRAD and RAGS methodologies. RESRAD-Baseline was used to estimate the risk from ingestion of ground water underlying the Site. Whenever possible, parameter values used by RESRAD were set equal to the values incorporated in the RAGS methodology. The differences between the two sets of results are discussed in Section 5.4.

5.2.1 Data Evaluation

This section of the human health evaluation focuses on radiological contamination in surface and subsurface soils throughout the Site, groundwater underlying the Site, and sediment from the retention ponds and the wetland area. While the entire environmental data set has been presented earlier, data summary tables, organized to facilitate the data evaluation, are presented in Attachment G and discussed in the following sections. The

[1]There are no non-carcinogenic hazards posed by exposure to the radioactive contaminants present at the Site.

intent is to identify those environmental media and radionuclides that pose potential risks to human health. Background concentrations of the radionuclides are also presented in the tables and are used to screen ROPCs in soil. Background concentrations also provide a frame of reference when evaluating the magnitude of radiological contamination.

Soil, groundwater, and sediment are environmental media of concern because they are or may become readily available for human contact. Air is also of concern due to the potential for inhalation of radiologically-contaminated respirable particulate matter that may be released from soil.

For the purposes of this human health evaluation, there is a potential concern if a radionuclide in soil or sediment is detected at concentrations above those typically found due to natural background. For groundwater, there is a potential concern if a radionuclide is detected at concentrations above the USEPA Maximum Contaminant Levels (MCLs) promulgated under the Federal Safe Drinking Water Act. All of the radionuclides that were quantified in the environmental samples (^{232}Th, ^{230}Th, ^{228}Th, ^{228}Ra, ^{226}Ra, ^{238}U, and ^{234}U) are naturally occurring and therefore exist in environmental media at some background concentration. Site-specific background concentrations have been established so that the risks attributed to Site contaminants do not include the unavoidable risk due to exposure to natural background radiation.

The radiological analytical data for soil, sediment, and groundwater from the field investigation are summarized in Rad Tables 2.1 to 2.13 of Attachment G and discussed below. Figures depicting sample locations can be referenced in previous sections of the report.

All of the radionuclides that will be carried through the risk assessment are members of the thorium and uranium series. ROPCs for soil, sediment, and groundwater are presented in Rad Tables 2.1 to 2.13 in Attachment G. Both of the methodologies used to estimate risk (i.e., RESRAD and RAGS) include the risk from lead-210 (^{210}Pb), a member of the uranium series which is present in waste residues which contain other uranium series radionuclides. Lead-210 was not quantified in samples collected during the investigation and it has been

assumed that the ^{210}Pb (in soil and sediment) concentrations were equal to measured concentrations of ^{226}Ra.

5.2.1.1 Soil

Data for soil are grouped into surface soil (defined as 0 to 2 feet) and surface and subsurface soils combined (defined as all depths and termed "all soil") for the following areas: Areas A, B, C, D, E combined; and Area G. These areas are depicted on Figure 1-4. Soil data from Areas A, B, C, D, E are combined due to their close proximity and are termed Area A for the remainder of this risk assessment.

Soil quality data are summarized in Rad Tables 2.1 to 2.10 in Attachment G; the range of detected concentrations, locations of the maximum detected concentrations, concentrations used for screening, maximum background values, ROPC flags, and the rationale for radionuclide selection or deletion are provided.

Site-specific background concentrations in soil have been established so that the risk attributed to greater than background concentrations of ROPCs may be distinguished from the unavoidable risk due to exposure to natural background radiation. Site-specific background radionuclide concentrations in soil are derived from data on selected samples collected during the Li Tungsten and Captain's Cove investigations. During the Li Tungsten investigation, samples were collected from soil borings in areas that were not impacted by site-related activities, and from surface soil locations within a few miles of the Site. The background data set consisted of the following 13 soil samples, which were collected at six boring locations, one test pit location, and six off-site surface soil locations:

<u>Boring locations</u>

LT-MP-5	LT-MP-11DB
LT-MP-5B	LT-SB-13
LT-MP-11D	LT-SB-13B

<u>Test Pit location</u>

LT-TP-06

Off-site Surface Soil locations

LT-SS-13	LT-SS-14
LT-SS-15	LT-SS-16
LT-SS-17	LT-SS-18

In addition, soil samples from two borings at the Captain's Cove site (CC-SB-7 and CC-SB-9) are included in the background data set. These borings were located in the center of the site, in areas that were not impacted by disposal of radiological wastes.

The radionuclides quantified during the Li Tungsten investigation did not include ^{234}U and ^{210}Pb of the uranium series and ^{228}Th of the thorium series. Thus, the concentrations of these decay products were estimated. For the background samples, secular equilibrium was assumed, therefore, ^{234}U, ^{210}Pb, and ^{228}Th concentrations were set equal to measured concentrations of ^{238}U, ^{226}Ra, and ^{228}Ra, respectively. The only decay product not quantified during the Captain's Cove investigation was ^{210}Pb; concentrations of ^{210}Pb were set equal to measured concentrations of ^{226}Ra.

Radionuclides are of potential concern if they were detected at concentrations above those typically found due to natural background. If the maximum detected concentration of a radionuclide was greater than the maximum background concentration, the radionuclide was selected as a ROPC.

Area A

Thorium-232, ^{230}Th, ^{228}Th, ^{228}Ra, ^{226}Ra, ^{238}U, ^{210}Pb, and ^{234}U are selected as ROPCs in both surface soil and all soil.

Area G

Thorium-230, ^{226}Ra, ^{238}U, ^{210}Pb, and ^{234}U are selected as ROPCs in surface soil. Thorium-232, ^{230}Th, ^{228}Th, ^{228}Ra, ^{226}Ra, ^{238}U, ^{210}Pb, and ^{234}U are selected as ROPCs in all soil.

5.2.1.2 Sediment

Sediment quality data from the retention ponds and the wetland area are summarized in Rad Tables 2.11 and 2.12 in Attachment G, respectively; the range of detected concentrations, locations of the maximum detected concentrations, concentrations used for screening, maximum background values, ROPC flags, and the rationale for radionuclide selection or deletion are provided. Since no background data were collected for sediment, sediment quality data were compared to soil background.

No ROPCs were selected in sediment at either the retention ponds or the wetland area.

5.2.1.3 Groundwater

Groundwater quality data from ten on-site monitoring wells (CDM-3 is designated a background well as described below) were combined because while they were screened at different depths, all were screened in the Upper Glacial Aquifer, above the Port Washington Clay which acts as a confining unit. Groundwater quality data are summarized in Rad Table 2.13 in Attachment G; the range of detected concentrations, locations of the maximum detected concentrations, concentrations used for screening, ROPC flags, and the rationale for radionuclide selection or deletion are provided.

Site-specific background concentrations in groundwater have been established so that the risk attributed to greater than background concentrations of the ROPCs does not include the unavoidable risk due to exposure to natural background radiation. Site-specific background radionuclide concentrations in groundwater were derived based on data from selected monitoring wells collected during the Li Tungsten and Captain's Cove investigations. During the Li Tungsten investigation, two rounds of samples were collected from monitoring wells MP-5 and MP-11D, and one sample (GW-Konica-01) was collected from a well installed for an investigation of the neighboring Konica Imaging property that had been identified as representing background conditions. In addition, the sample collected from monitoring well CDM-3 at the Captain's Cove site, identified as representative of

background is also included in the background data set.

The radionuclides quantified during the Li Tungsten investigation did not include ^{234}U and ^{210}Pb of the uranium series and ^{228}Th of the thorium series. Thus, the concentrations of these decay products were estimated. For the background samples, secular equilibrium was assumed, therefore, ^{234}U, ^{210}Pb, and ^{228}Th concentrations were set equal to measured concentrations of ^{238}U, ^{226}Ra, and ^{228}Ra, respectively. Lead-210 was not analyzed in groundwater samples from the Captain's Cove investigation; concentrations of ^{210}Pb were set equal to measured concentrations of ^{226}Ra.

Radionuclides are of potential concern if they were detected at concentrations above those typically found due to natural background. If the maximum detected concentration of a radionuclide was greater than the maximum background concentration, the radionuclide was selected as a ROPC.

Uranium-234, ^{228}Ra, and ^{230}Th are selected as ROPCs in groundwater.

5.2.2 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of human exposure to the ROPCs that are present in or migrating from the environmental media being evaluated.

As indicated previously, this risk assessment was conducted to be as consistent as possible with the Li Tungsten risk assessment (Malcolm Pirnie, 1998). Therefore, with one exception, potentially exposed populations at the Site are the same as those evaluated in the Li Tungsten risk assessment (Malcolm Pirnie, 1998). Off-site exposure to wind-blown dust is not evaluated in this risk assessment since there are no adjacent residential receptors in the vicinity of the Site.

5.2.2.1 Potentially Exposed Populations

Since no use is currently being made of the Site, trespassers are regarded as the only potentially exposed on-site population in the current scenario. Potable water in Glen Cove

is provided by the City of Glen Cove; the water is obtained from deep groundwater aquifers and transported to a local water treatment plant. The groundwater quality in the shallow Upper Glacial Aquifer above the Port Washington Clay, which acts as a confining unit, is the focus of this investigation. Thus, there are no populations potentially exposed to groundwater in the Upper Glacial Aquifer in the current scenario.

Tentative redevelopment plans for the Site include commercial, retail and light industrial uses. Thus, potentially exposed populations in the future scenario include site workers and construction workers. Since redevelopment plans have not been finalized, resident adults and resident children are also populations potentially exposed to soil in the future scenario.

The southern portion of the Site is expected to be developed for use as a passenger ferry terminal. The passengers will access the Site from Garvey's Point Road and potentially pass through Area A to reach the proposed dock on Glen Cove Creek.

Sensitive receptors are typically any subpopulation that may be at increased risk from exposure due to increased sensitivity, behavior patterns, and/or current or past exposures from other sources. Since children represent a sensitive subpopulation that could be at increased risk of exposure, they were evaluated in the residential scenarios.

5.2.2.2 Exposure Pathways

Surface soil at Area A and Area G represent the medium of concern for the current scenario, while surface soil and all soil at Area A and Area G and groundwater in the Upper Glacial Aquifer underlying the Site represent the media of concern for the future scenario. The exposure pathways selected for evaluation and the basis for inclusion or exclusion of certain exposure scenarios are provided in Rad Table 1 in Attachment G and are discussed below.

Trespassers are assumed to be 12-18 year-old adolescents. Casual exposure to ROPCs in surface soil at Area A and Area G via external radiation and inadvertent ingestion may be possible for trespassers making unauthorized entry. Since no ROPCs were selected in sediment at either the retention ponds or the wetland area, trespasser contact with sediment does not represent an exposure pathway of concern. Trespasser exposure is assumed to

continue into the future.

Should the Site be redeveloped for commercial, retail, and/or industrial uses, exposure to ROPCs in surface soil at Area A and Area G via external radiation and inadvertent ingestion may be possible for adult site workers in the future scenario. Additionally, exposure to ROPCs in all soil at Area A and Area G via external radiation, inadvertent ingestion, and inhalation of ROPCs sorbed onto respirable particulates may be possible for adult construction workers in the future scenario. Since redevelopment plans have not been finalized, exposure to ROPCs in all soil at Area A and Area G via external radiation, inadvertent ingestion, and inhalation of radon decay products are also considered for resident adults and resident children in the future scenario. In addition, it is assumed that home-grown produce could result in ingestion of ROPCs incorporated into plants.

The City of Glen Cove should continue to provide potable water in the future. However, should groundwater in the Upper Glacial Aquifer be used as a potable source in the future, potential on-site populations (i.e., site worker, resident adult, and resident child) may also be potentially exposed to groundwater via ingestion.

The ferry passengers, termed "visitors" in Rad Table 1 in Attachment G, are assumed to access the Site infrequently and not have the same direct contact with the soil as would a trespasser. Thus, while visitors are a potentially exposed population in the future scenario, exposure to surface soil was not quantified in the risk assessment.

It is not possible to quantify inhalation exposure to radon and radon decay products for the future residential adult and child for use in the RAGS baseline risk assessment because there are no residences or buildings currently on-site in which to measure concentrations of the radioactive gas. However, RESRAD calculates the risk from inhalation of radon/radon decay products based on ^{226}Ra and ^{228}Ra concentrations in soil. Therefore, the risks due to this pathway quantified with RESRAD are added to the risks quantified using the RAGS methodology in Section 5.2.4 Risk Characterization so that the total risks calculated for the future resident adult and child include all appropriate pathways.

5.2.2.3 Data Utilization

In utilizing the analytical data to derive representative exposure point concentrations,

the result for samples and their duplicates were not considered separately. Rather, a radionuclide-specific value representing the maximum value of the sample and its duplicate was used. If a ROPC was not detected in a sample at a concentration exceeding the analytical minimum detectable concentration (MDC), it was assumed to be present at its MDC as a conservative "proxy" concentration. Adjusting "less than MDC" data by assigning values equal to the MDC assumes that a radionuclide may be present at a concentration just below the reported MDC, which, for the ROPCs at the Site, is often within the range of natural background. Radiological data that were noted (i.e., qualified) by the laboratory or the data validator with an indicator that the concentration was estimated were treated the same way as data without such qualifiers.

5.2.2.4 Estimates of Radionuclide Intake

Estimates of radionuclide intake were developed to portray reasonable maximum exposures (RME) that might be expected to occur under current and future exposure scenarios. That is to say, the maximum exposure at the Site that was considered is one that was above the average exposure but still within the range of possibility.

To develop exposure point concentrations that reflect RME, it was necessary to evaluate the entire analytical data set. The USEPA recommends that the arithmetic average concentration of the data be used for evaluating long-term exposure and that, because of the uncertainty associated with estimating the true average concentration at a site, the 95% upper confidence limit (UCL) on the arithmetic average be used as the exposure point concentration (USEPA, 1992, 1989b). The 95% UCL provides reasonable confidence that the true average will not be underestimated. Since data sets with fewer than 10 samples per exposure area provide poor estimates of the average concentration (USEPA, 1992), 95% UCL concentrations were only calculated for data sets with 10 or more samples. The maximum detected concentration was used for data sets with fewer than 10 samples. The medium-specific exposure point concentrations as well as arithmetic means and the rationale for selecting the exposure point concentrations are presented in Rad Tables 3.1 through 3.11 in Attachment G.

The USEPA indicates that it is reasonable, in most cases, to assume that soil

sampling data are lognormally distributed, but, in cases where there is a question about the distribution of the data set, a statistical test may be used to identify the best distributional assumption (USEPA, 1992). Therefore, before calculating the 95% UCL concentrations, the Shapiro and Wilk W statistical test (for sample sizes ≥ 10 and ≤ 50) was run on the data for each ROPC to determine if the data follow a normal distribution (Gilbert, 1987). If the results of the W test indicated that the data were not normally distributed, a lognormal distribution was assumed. The appropriate equation (USEPA, 1992) was then used to calculate the 95% UCL concentrations. If there is great variability in measured concentrations, the 95% UCL concentration may be high and occasionally exceed the maximum detected value. In such cases, the maximum detected concentration was used.

The derivation of the exposure point concentrations for the ROPCs is presented in Attachment F. Exposure point concentrations of ROPCs on respirable particles released from soil into the air and in home-grown produce were calculated as described in Attachment F.

Exposure point concentrations for the ROPCs in each environmental medium, presented in Rad Tables 3.1 through 3.11, include the contribution from natural background. Therefore, the risk assessment calculations were also conducted on the average background concentrations for each scenario. Subtracting the risk due to exposure to natural background concentrations results in "above background" risk estimates, i.e., risks attributed to contamination at the Site.

In addition to the derivation of representative exposure point concentrations, evaluation of potential human exposure involves the estimation of several parameters such as ingestion and inhalation rates, and exposure time, frequency, and duration. Rad Tables 4.1 to 4.10 present the equations for estimating intakes and define the intake variables and their default values. Application of this type of equation is consistent with RAGS. The radiological risks estimated with this methodology were compared to the risks generated with the RESRAD computer code as part of the radiological risk assessment uncertainty analysis (Section 5.2.5).

The RESRAD Version 5.70 and RESRAD-Baseline Version 2.2 computer models were developed at Argonne National Laboratory as tools to implement the U.S. Department

of Energy (DOE) requirements for evaluating residual radioactive material. Originally released in 1989, RESRAD has been modified several times and has been included in Title 10, Part 834 of the *Code of Federal Regulations* (March 1993). In addition to its use at DOE facilities, RESRAD is currently being used to show compliance with U.S. Nuclear Regulatory Commission (NRC) decommissioning criteria and has been used at CERCLA federal facilities and by USEPA headquarters personnel to draft proposed residual radioactivity standards.

RESRAD calculates the radiation dose equivalent and subsequent carcinogenic risk for several environmental pathways based on radionuclide concentrations in soil. The RESRAD-Baseline code calculates the dose equivalent and risk from radionuclide concentrations in environmental media other than soil[2]. RESRAD provides a more detailed risk analysis than does the RAGS methodology; it models the environmental fate of the ROPCs through several environmental media and calculates the risk at user-selected future times. It accounts for the decay of radionuclides and the buildup and decay of radionuclide decay products in addition to the original ROPCs. RESRAD-Baseline closely replicates the RAGS methodology. Intake quantities are calculated based on the environmental media concentrations and the exposure parameters chosen. Radiogenic cancer risks are determined by two means:

- dose conversion factors published by the USEPA in Federal Guidance Reports No. 11 and 12 (USEPA, 1988; 1993) are used to calculate the total committed effective dose equivalent, which is then multiplied by the default value of 7.6×10^{-7} risk/mrem (USEPA, 1988; 1993),
- and carcinogenic slope factors published in the USEPA Health Effects Assessment Summary Tables (HEAST) (USEPA, 1995) are multiplied by the intake quantities and summed to derive the total risk.

Rad Tables 4.1 to 4.10 in Attachment G list the parameters selected for the various exposure scenarios. RESRAD includes default values for many parameters related to the contaminated and uncontaminated zones, saturated and unsaturated zones, and ingestion of

[2]RESRAD-Baseline has not yet officially been released by the DOE, but is has been distributed to interested persons within various Federal and State agencies and to other interested professionals.

produce which is potentially contaminated with radionuclides. The RAGS methodology contains values for some, but not all, of the RESRAD parameters; the parameters used in both methodologies are shown in the tables. Where RESRAD default values differ from values cited in the literature as being appropriate for use in the RAGS methodology, the RESRAD values were changed to conform to the values used in RAGS.

RESRAD also requires values for some parameters which do not appear in the RAGS methodology calculations. The RESRAD default values for the geological and hydrological parameters (such as effective porosity, hydraulic conductivity, evapotranspiration coefficient, runoff coefficient, erosion rate, etc.) were reviewed and where appropriate, replaced with site-specific values. Site-specific values utilized in RESRAD are shown in Table 5-1.

The parameters necessary to estimate radionuclide intakes are described below.

Soil - For trespassers, an average ingestion rate (IR-S) of 100 mg of soil/day was used to evaluate inadvertent ingestion of soil (as might result from hand-to-mouth behavior) (USEPA, 1991). The "fraction ingested" (FI) was based on an estimate of the fraction of soil that is presumed to be contaminated. For this evaluation, it was assumed that 100% of the soil ingested is contaminated with concentrations equivalent to the estimated exposure point concentrations. The exposure frequency (EF) was assumed to be 120 days/year (equivalent to about three times a week during two-thirds of a 350-day year, with one-third of the year representing poor weather days). The exposure duration (ED) was assumed to be 6 years since trespassers are assumed to be 12-18 year old adolescents. RESRAD distinguishes between indoor and outdoor annual time fractions[3] because while indoors, there is a reduction in the external gamma radiation dose due to attenuation of gamma ray-energy within the floor and walls of the structure. The exposure time (ET) was assumed to be 2 hours/day; this resulted in an outdoor time fraction of 0.0274.

For site workers, an average IR-S of 50 mg of soil/day was used to evaluate inadvertent ingestion of soil. The ET was assumed to be 8 hours/day, the EF was assumed to be 250 days/year (USEPA, 1991), and the ED was assumed to be 25 years. Equal amounts

[3]The total time fraction is the fraction of a year which a person spends being exposed to the ROPCs. It is equal to: (# hours/day on-site/24 hours) x (# days on-site/365 days). RESRAD allows the user to apportion the total time fraction between indoor and outdoor occupancy.

TABLE 5-1

PARAMETER VALUES USED ONLY IN RESRAD
CAPTAIN'S COVE

PARAMETER	UNIT	DEFAULT VALUE	SITE-SPECIFIC VALUE	REFERENCE
SOIL BULK DENSITY				
Contaminated Zone	g/cm^3	1.5	1.3	Sample Analysis
Unsaturated Zone	g/cm^3	1.5	1.3	Sample Analysis
Saturated Zone	g/cm^3	1.5	1.3	Sample Analysis
TOTAL POROSITY				
Contaminated Zone	--	0.4	0.43	RESRAD Manual
Unsaturated Zone	--	0.4	0.43	RESRAD Manual
Saturated Zone	--	0.4	0.43	RESRAD Manual
EFFECTIVE POROSITY				
Contaminated Zone	--	0.2	0.33	RESRAD Manual
Saturated Zone	--	0.2	0.33	RESRAD Manual
Unsaturated Zone	--	0.2	0.33	RESRAD Manual
HYDRAULIC CONDUCTIVITY				
Contaminated Zone	m/yr	10	9.5	Slug Test Data/RESRAD Manual
Unsaturated Zone	m/yr	10	95	Slug Test Data/RESRAD Manual
Saturated Zone	m/yr	100	950	Slug Test Data/RESRAD Manual
PRECIPITATION RATE	m/yr	1	1.2	1980 Nassau County Data
RUNOFF COEFFICIENT				
Areas A and G	--	0.2	0.27	RESRAD MANUAL

TABLE 5-1 (Continued)

PARAMETER VALUES USED ONLY IN RESRAD
CAPTAIN'S COVE

DISTRIBUTION COEFFICIENTS				
Radium	cm^3/g	36000		RESRAD MANUAL
Thorium	cm^3/g	3,300		RESRAD MANUAL
Uranium	cm^3/g	15		RESRAD MANUAL
EVAPOTRANSPIRATION COEFFICIENT	--	0.5	0.46	Salum, 1979
SOIL-SPECIFIC B PARAMETER				
Contaminated Zone	--	5.3	4.9	RESRAD MANUAL
Unsaturated Zone	--	5.3	4.9	RESRAD MANUAL
Saturated Zone	--	5.3	4.9	RESRAD MANUAL
EROSION RATE				
Contaminated Zone	m/yr	0.001	0.00042	RESRAD MANUAL
LENGTH OF CONTAMINATED ZONE PARALLEL TO THE AQUIFER FLOW	m	100	300	Site Measurement
HYDRAULIC GRADIENT	--	0.02	0.04	Site Data
WATERSHED AREA FOR NEARBY STREAM OR POND	m^2	1E+06	2.3E+06	USGS Topographic Map
WATER TABLE DROP RATE	m/yr	0.001		RESRAD MANUAL
WELL-PUMP INTAKE DEPTH	m	10	0	No Pumping Wells on Site

TABLE 5-1 (Continued)

PARAMETER VALUES USED ONLY IN RESRAD
CAPTAIN'S COVE

MASS LOADING FOR INHALATION	g/m^3	$2x10^{-4}$		
DEPTH OF ROOTS	m	0.9		RESRAD MANUAL
THICKNESS OF CONTAMINATED ZONE				
surface soil pathways	m	2	0.67	Site Data
all soil pathways	m	2	2	Site Data
DILUTION LENGTH FOR AIRBORNE DUST	m	3	1.8	Site Model
SHAPE FACTOR, EXTERNAL GAMMA	--	1		RESRAD MANUAL
DEPTH OF SOIL MIXING LAYER	m	0.15		RESRAD MANUAL
AREA OF CONTAMINATED ZONE				
Area A	m^2	10,000	14,375	Site Data
Area G	m^2	10,000	3,611	Site Data
EFFECTIVE RADON DIFFUSION COEFFICIENT				
Cover Material	m^2/s	2.00E-06		RESRAD MANUAL
Contaminated Zone	m^2/s	2.00E-06		RESRAD MANUAL
Building Foundation Material	m^2/s	3.00E-07		RESRAD MANUAL
RADON EMANATION COEFFICIENT				
Rn-222/Rn-220	--	0.25/0.15		RESRAD MANUAL
RADON VERTICAL DIMENSION OF MIXING	m	2		RESRAD MANUAL
AVERAGE ANNUAL WIND SPEED	m/s	2		RESRAD MANUAL
AVERAGE BUILDING AIR EXCHANGE RATE	1/hr	0.5		RESRAD MANUAL
BUILDING ROOM HEIGHT	m	2.5		RESRAD MANUAL
BUILDING INDOOR AREA FACTOR	--	0		RESRAD MANUAL
BUILDING FOUNDATION THICKNESS	m	0.15		RESRAD MANUAL
FOUNDATION DEPTH BELOW GROUND SURFACE	m	1		RESRAD MANUAL

of time were assumed for indoor and outdoor occupancy; the total time fraction was 0.23, with indoor and outdoor time fractions equal to 0.114. All other parameters were as described previously.

For construction workers, an IR-S of 480 mg of soil/day was used to evaluate inadvertent ingestion of soil (USEPA, 1991). An inhalation rate (IN) of 2.3 m^3/hr was used to evaluate inhalation exposure to ROPCs adsorbed to respirable particulates potentially released to the ambient air during the digging of an excavation (USEPA, 1991). The ET was assumed to be 8 hours. The EF was assumed to be 60 days/year because construction work is limited in duration and the ED was assumed to be 1 year. The construction worker was assumed to spend 8 hours a day on-site with 75% of the time spent outdoors and 25% of the time spent indoors; this resulted in an indoor time fraction of 0.0137 and an outdoor time fraction of 0.041. All other parameters were as described previously.

IR-Ss of 100 mg/day and 200 mg/day were used to evaluate inadvertent ingestion of soil for on-site resident adults and resident children, respectively. As part of the residential scenario, it is assumed locally grown produce could result in ingestion of radionuclides incorporated into plants. The "typical" adult consumes approximately 200 g/day of vegetables and 140 g/day of fruit (USEPA, 1991). Research suggests that the "reasonable worst-case" proportion of vegetables and fruits that are home-grown are 40 and 30 %, respectively. This corresponds to 80 g/day of vegetables and 42 g/day of fruit (USEPA, 1991). To incorporate estimated radionuclide concentrations in the edible portions of above-ground and root produce, the ingestion rates are further categorized into vegetable and fruit types.

Three garden crops (carrots, lettuce, and tomatoes) were selected as representative of all homegrown produce, including root vegetables, leafy vegetables, and garden fruit and legumes, respectively. Ingestion rates for the individual crops were based on U.S. Department of Agriculture data presented by the USEPA (1986). The carrot ingestion rate was based on the consumption of all root vegetables including potatoes; the lettuce ingestion rate was based on the consumption of all leafy vegetables; and the tomato ingestion rate was based on the consumption of garden fruits and legumes. Legumes are included with garden fruit because of their similar chemical transfer coefficients (Baes et al., 1984). These

groupings simplify the exposure methodology while giving consideration to all potential garden crops. Based on the data, the following ingestion rates are derived for the three selected crops. Resident adults are assumed to ingest 17 g/day of lettuce, 48 g/day of carrots, and 57 g/day of tomatoes (42 g/day of garden fruit or tomatoes plus 15 g/day of legumes). These values proportionally correspond to the 122 g/day of vegetables and fruit suggested by USEPA for use in risk assessments. Ingestion rates of garden produce by resident children could be determined only for a 2-year-old (USEPA, 1986). Resident children were assumed to ingest 4 g/day of lettuce, 27 g/day of carrots, and 24 g/day of tomatoes. The EF for the residents was 350 days/year, assuming only a 2-week vacation away from the area over the course of a year (USEPA, 1991). The EDs were equal to 30 years for the adult and 6 years for the child. All other parameters were as described previously.

Exposure to penetrating gamma radiation emitted by the decay of radionuclides in soil was evaluated for all current and future on-site receptors. The USEPA gamma shielding factor default value of 0.8 was used to evaluate the risk from exposure to external gamma radiation (USEPA, 1989b). The ET for both the resident adult and child was 17 hours/day, with 75% and 87.5% of the time spent indoors for the adult and child, respectively, and 25% and 12.5% of the time spent outdoors for the adult and child, respectively. This resulted in indoor time fractions of 0.51 and 0.59 for the adult and child, respectively, and outdoor time fractions of 0.17 and 0.095 for the adult and child, respectively. An ET of 17 hours/day represents the average time spent at home whether indoors or outdoors (USEPA, 1989a). The ETs, EFs, EDs, and time fractions for the other potentially exposed population were as described previously.

Groundwater - The groundwater pathway was included for the future scenario site worker and the future residential scenario (adult and child). As discussed earlier, all groundwater data were grouped together to determine site-wide exposure point concentrations for each ROPC. The risks from this pathway would apply to all future site workers and residents, regardless of Site area. An IR of 1 liter/day (about four 8-ounce glasses/day) was used for site workers (USEPA, 1991). All other parameters used in the Site worker ingestion of groundwater calculation are as described previously for site worker exposure to soil.

An IR of 2 liters/day (about eight 8-ounce glasses/day) was assumed for resident adults; this represents the 90th percentile value for adult daily water consumption (USEPA, 1989a). An IR of 1 liter/day (about eight 4-ounce glasses/day), which represents the 90th percentile of daily water consumption for infants (USEPA, 1989a), was used for resident children. An inhalation rate (IN) of 0.83 m^3/hour, which represents the average adult inhalation rate (USEPA, 1989a) was used to assess inhalation exposure for resident adults and resident children. All other parameters are as described previously for residential exposure to soil.

5.2.3 Toxicity Assessment

The toxicity assessment, also termed the dose-response assessment, characterizes the relationship between the magnitude of exposure and the potential that an adverse effect will occur. It involves determining whether exposure to a contaminant can cause an increase in the incidence of a particular adverse health effect, and characterizing the nature and strength of the evidence of causation. The toxicity information is then quantitatively evaluated and the relationship between the dose of the contaminant received and the incidence of adverse effects in the exposed population is evaluated.

The carcinogenic potential of radiation exposure is the only health effect of concern due to chronic exposure to the radionuclides present at the Site. Long-term radiation exposure has been found to increase the risk of developing cancer in humans. By applying carcinogenic slope factors to any dose, no matter how small, the risk assessment methodology is consistent with the "no-threshold" hypothesis, i.e., any radiation dose conveys some measurable carcinogenic risk. Due to the magnitude of the exposures which can occur at the Site, acute effects from high level, short-term radiation exposures are not possible and are therefore not evaluated as part of this radiological risk assessment.

The USEPA and other regulatory agencies have performed cancer potency assessments for numerous radionuclides and the guidance they provide is used in this human health evaluation. Carcinogenic slope factors for the evaluation of cancer risk from lifetime exposure to radionuclides are obtained from the USEPA HEAST, which are tabular presentations of provisional toxicity data (USEPA, 1995). The carcinogenic slope factors for external radiation, ingestion, and inhalation used in the risk assessment are presented in Rad Table

5.1 in Attachment G.

As mentioned above, RESRAD and RESRAD-Baseline also incorporate the HEAST carcinogenic slope factors to calculate radiogenic risk from radionuclide intake/exposure data[4]. In addition, the codes calculate the total committed dose equivalent by multiplying the radionuclide intakes by dose conversion factors published by the USEPA in Federal Guidance Reports No. 11 and 12 (USEPA, 1988; 1993).

5.2.4 Risk Characterization

Typically, remediation of carcinogenic hazardous materials at CERCLA sites are designed to reduce total excess lifetime cancer risks to the 1E-06 (i.e., 1 in 1,000,000) to 1E-04 (i.e., 1 in 10,000) range[5] (USEPA, 1991). However, when assessing radiological risk from radionuclides which occur naturally in the environment, the risks associated with the populations and pathways selected for evaluation must be compared to the unavoidable risk from natural background radiation. For some long-term scenarios, this background risk approaches or even exceeds the typical upper bound acceptable risk of 1E-04.

To estimate net risk, therefore, the risk due to background levels of ROPCs in soil and groundwater have been subtracted from the gross risk estimates which represent RME conditions. The average concentration of each ROPC in background soil and background groundwater were used to calculate the risk estimates due to background, for soil and groundwater, respectively.

It should be noted that because RESRAD calculates the risk from inhalation of radon/radon decay products based on ^{226}Ra and ^{228}Ra concentrations in soil, the risks due to this pathway quantified with RESRAD have been added to the risks quantified using the RAGS methodology so that the total risks calculated for the future resident adult and child

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[4]During an evaluation of the RESRAD and RESRAD-Baseline results, it was discovered that the ingestion carcinogenic slope factors for ^{210}Pb differed. RESRAD-Baseline was using the carcinogenic slope factor from the HEAST, 1994 table while RESRAD had been updated to include the carcinogenic slope factors published in the 1995 version of HEAST. RESRAD-Baseline does not allow the user to change the carcinogenic slope factors used in the calculations; therefore the risk for groundwater ingestion was recalculated by hand using the updated ^{210}Pb carcinogenic slope factor.

[5]The upper boundary of the risk range should not be considered to be a discrete value, but rather an approximation, taking into consideration appropriate site conditions, occupancy patterns, etc.

include all appropriate pathways.

In the sections that follow, the risk estimates calculated with RAGS are discussed for each population evaluated. A comparison to the RESRAD or RESRAD-BASELINE (as applicable) risk estimates is presented in Section 5.2.5. Radionuclide-specific risks have not been emphasized. Rather, the combined risk to the population from all ROPCs is quantified and evaluated as it represents the relevant hazard posed by site contaminants.

5.2.4.1 Current and Future Adolescent Trespasser

The current and future trespasser is assumed to spend the entire time in either Area A or Area G during each 2-hour visit. A trespasser in Area A and Area G may be exposed to radiation via the external pathway and inadvertent ingestion of surface soil. The exposure to external radiation and ingestion intake were calculated based on RME conditions consistent with RAGS methodology.

The risk estimates for the trespasser are shown in Attachment G, Rad Tables 6.1 and 6.2 for Area A, and Rad Tables 6.28 and 6.29 for Area G. The net risk estimates for Area A and Area G are shown in Rad Tables 6.3 and 6.30, respectively. The 5.9E-06 and 1.2E-06 risks to the trespasser in Area A and Area G, respectively, are within the acceptable risk range of 1E-04 to 1E-06 established by the USEPA for CERCLA sites. The major exposure pathway is external gamma radiation, which accounts for greater than 90 % of the total risk.

5.2.4.2 Future Site Worker

External radiation, inadvertent ingestion of surface soil, and ingestion of groundwater from the upper glacial aquifer are the relevant exposure pathways for the future site worker. The site worker is assumed to divide occupancy time evenly between indoor and outdoor areas during each 8-hour visit to Area A or Area G.

The risk estimates for the site worker in Area A due to exposure point and background concentrations are shown in Attachment G, Rad Tables 6.4 through 6.7. The 1.8 E-04 net risk estimate for the Area A site worker (Attachment G, Rad Table 6.8) slightly exceeds the acceptable risk range of 1E-04 to 1E-06 established by the USEPA for CERCLA sites. The major exposure pathway is external gamma radiation, which accounts for

approximately 99 % of the total risk.

The risk estimates for the site worker in Area G due to exposure point and background concentrations are shown in Attachment G, Rad Tables 6.31 through 6.34. The 3.6E-05 net risk estimate for the Area G site worker (Attachment G, Rad Table 6.35) is within the acceptable risk range of 1E-04 to 1E-06 established by the USEPA for CERCLA sites.

The major exposure pathway is external gamma radiation, which accounts for approximately 95 % of the total risk.

5.2.4.3 Future Construction Worker

Like the trespasser and site worker, the construction worker may be exposed to ROPCs via external radiation and inadvertent soil ingestion. However, all soil, rather than surface soil, is the contaminated medium considered. Inhalation of particulate radioactivity is an additional potential route of exposure to ROPCs. The risk estimates due to exposure point and background concentrations of ROPCs for these three routes are shown in Attachment G, Rad Tables 6.9 through 6.12 for Area A and Rad Tables 6.36 through 6.39 for Area G. The net risk estimates are shown in Attachment G, Rad Tables 6.13 and 6.40 for Area A and Area G, respectively.

The risk estimates of 1.4E-04 and 1.5E-04 for the Area A and Area G future construction worker, respectively, are essentially equal. These risks slightly exceed the acceptable risk range of 1E-04 to 1E-06 established by the USEPA for CERCLA sites. However, it must be considered that this risk level for a construction worker exposure during 60 days in one year, while the USEPA acceptable risk range is intended to apply to a potential receptor based on a typical lifetime exposure duration. External gamma radiation is the primary contributor to the total risk, accounting for approximately 99 % in either Area A or Area G.

5.2.4.4 Future Resident Adult

A hypothetical future resident could be exposed to ROPCs via external radiation, inadvertent ingestion of soil, ingestion of home grown produce and groundwater from the

upper glacial aquifer, and inhalation of radon decay products. Risk estimates have been calculated based on exposure point and background concentrations of ROPCs for residents of both Area A and Area G. The risk estimates due to exposure point and background concentrations of ROPCs for all pathways, excluding radon data, are shown in Attachment G Rad Tables 6.14 through 6.19 for Area A, and Rad Tables 6.41 through 6.46 for Area G. The net risk estimates are shown in Attachment G, Rad Tables 6.20 and 6.47 for Area A and Area G, respectively.

The net risk estimates for the resident adult are 1.3E-01 and 1.1 E-01 for Area A and Area G, respectively. These risk estimates are approximately three orders of magnitude greater than what is typically considered acceptable by the USEPA. The primary contributors to the total risk estimate are inhalation of radon decay products and external gamma radiation (approximately 75 and 25 % for both Area A and Area G, respectively). As mentioned above, the risk estimate resulting from inhalation of radon decay products was calculated with RESRAD, which models the indoor radon and radon decay product concentration from the radium concentration in surrounding and underlying soil.

5.2.4.5 Future Resident Child

The resident child scenario is similar to the resident adult scenario. However, several parameter values included in the risk calculations vary from those used for the adult to reflect the differences in ingestion, inhalation, and occupancy rates. Risk estimates have been calculated based on exposure point and background concentrations of ROPCs for residents of both Area A and Area G. The risk estimates due to exposure point and background concentrations of ROPCs for all pathways, excluding radon data, are shown in Attachment G Rad Tables 6.21 through 6.26 for Area A, and Rad Tables 6.48 through 6.53 for Area G. The net risk estimates are shown in Attachment G, Rad Tables 6.27 and 6.54 for Area A and Area G, respectively.

The net risk estimates for the resident child are 3.1E-02 and 2.4E-02 for Area A and Area G, respectively. As was the case for the resident adult, the risk estimates exceed the upper boundary of the USEPA acceptable risk range. The primary contributors to the total risk estimate are inhalation of radon decay products and external gamma radiation

(approximately 78 and 22 % for both Area A and Area G, respectively).

The differences in some parameter values used to estimate risk to the resident child and adult slightly impact the risk estimate calculations. However, the main reason for the lower lifetime risk to the child is simply a result of the shorter exposure duration (6 years) compared to the 30-year exposure duration utilized in the resident adult scenario.

5.2.5 Uncertainty Analysis

Comparison of Results - RAGS and RESRAD

Pathway-specific, above-background excess lifetime cancer risk estimates were calculated using both the RAGS methodology and the RESRAD and RESRAD-BASELINE models. Both methodologies utilize carcinogenic slope factors published in HEAST (USEPA, 1995). The RAGS methodology incorporates a straightforward calculation of intake over the exposure period, which is multiplied by the pathway-specific carcinogenic slope factor for each radionuclide. The total intake quantities computed by RESRAD are influenced by its ability to 1) model the movement of radionuclides through environmental media over time; and 2) account for the ingrowth, mobility, and decay of radioactive decay products. Differences in the calculated risk estimates may result from RESRAD's ability to perform environmental modeling of radionuclides.

The pathway-specific results generated via RAGS and RESRAD/RESRAD-BASELINE are shown in Table 5-2. The risk estimates due to external radiation are fairly consistent, with several sets of paired results essentially identical, and others falling within a factor of two of each other with one exception, the risk due to inadvertent ingestion of soil by all populations was significantly greater with RAGS in all scenarios. However, the relative risk from soil ingestion was one to two orders of magnitude less than that due to external radiation. The risk estimates derived with RESRAD due to inhalation of particulates by the construction worker were approximately 1.5 orders of magnitude greater than those calculated with RAGS.

As expected, the risk estimates derived with RAGS due to groundwater ingestion from the upper glacial aquifer to the site worker, the resident adult, and resident child were identical to those derived with RESRAD-Baseline. The risk estimates due to inhalation of

TABLE 5-2
RAGS / RESRAD COMPARISON OF RESULTS
CAPTAIN'S COVE

POPULATION	PATHWAY	NET RISK			
		AREA A		AREA G	
		RAGS	RESRAD	RAGS	RESRAD
TRESPASSER	External Radiation	5.5E-06	5.2E-06	9.7E-07	2.3E-06
	Ingestion of Surface Soil	4.1E-07	1.1E-08	1.9E-07	6.3E-09
SITE WORKER	External Radiation	1.7E-04	1.8E-04	3.0E-05	7.8E-05
	Ingestion of Surface Soil	1.8E-06	4.0E-07	8.4E-07	2.3E-07
	Ingestion of Groundwater	4.5E-06	4.5E-06	4.5E-06	4.5E-06
CONSTRUCTION WORKER	External Radiation	1.0E-04	1.0E-04	8.2E-05	7.9E-05
	Ingestion of All Soil	9.4E-06	5.1E-07	1.0E-05	5.6E-07
	Inhalation of Particulates	2.4E-05	3.7E-04	5.3E-05	8.3E-04
RESIDENT ADULT	External Radiation	3.4E-02	3.8E-02	2.7E-02	3.0E-02
	Ingestion of All Soil	3.4E-04	2.3E-04	3.7E-04	2.5E-04
	Ingestion of Home-grown Produce	2.0E-04	3.3E-03	2.2E-04	2.6E-03
	Ingestion of Groundwater	1.5E-05	1.5E-05	1.5E-05	1.5E-05
	Inhalation of Radon Decay Products*	--	9.7E-02	--	7.7E-02
RESIDENT CHILD	External Radiation	6.6E-03	7.5E-03	5.3E-03	5.9E-03
	Ingestion of All Soil	1.4E-04	9.3E-05	1.5E-04	4.2E-05
	Ingestion of Home-grown Produce	1.9E-05	3.0E-04	2.0E-05	2.3E-04
	Ingestion of Groundwater	1.5E-06	1.5E-06	1.5E-06	1.5E-06
	Inhalation of Radon Decay Products*	--	2.4E-02	--	1.9E-02

*: It is not possible to use RAGS methodology to quantify the risk from radon decay products in the absence of radon and radon decay product data. Therefore, the radon inhalation pathway risk calculated with RESRAD is included here.

radon decay products by both the resident adult and resident child were only performed via RESRAD because it is not possible to use RAGS methodology to quantify the radon pathway in the absence of radon and radon decay product data.

The risk estimates calculated with RESRAD due to ingestion of ROPCs in home-grown produce were significantly higher than those calculated with RAGS. This apparent discrepancy is not surprising because the methodology incorporated in RESRAD model differs from that utilized in RAGS. Whereas RAGS performs a straightforward calculation based on the fractional uptake from soil to plant, RESRAD incorporates several factors, such as redistribution of ROPCs in soil and foliar deposition in addition to root uptake and rate of soil erosion.

5.2.6 Summary

Radionuclide analyses of soil samples showed that ROPCs 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 result in total excess lifetime cancer risks within the USEPA acceptable risk range. It is unclear if ROPCs 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. However, two are background wells (the background Konica well and the background well GW-MP-11D). Therefore, the fluctuations in concentrations of radium may reflect regional variability.

5.3 HUMAN HEALTH EVALUATION: CHEMICAL RISK

5.3.1 Data Evaluation

This section of the human health evaluation focuses on chemical contamination in surface and subsurface soils throughout the Site, groundwater underlying the Site, and surface water and sediment from the retention ponds and the wetland area. While the entire environmental data set has been presented earlier, data summary tables, organized to facilitate the data evaluation, are presented and discussed in the following sections. The intent is to identify those environmental media and COPCs that, if contacted, pose potential risks to human health. Where available, federal criteria are presented in the data summary tables as a frame of reference in evaluating the levels of chemical contamination.

Laboratory analytical methodologies and data validation procedures were selected to meet the data quality objectives identified in the Work Plan. All samples were analyzed by non-RAS laboratories; CLP laboratories could not accept any samples from the Site due to the potential for radioactive contamination. The laboratory statement of work and analytical methodologies were developed to be consistent with the latest CLP methodology (ILM0.40 and OLM03.2 for TAL/TCL analyses) or USEPA-approved analytical methods for other parameters. Analytical data were validated following USEPA guidelines by USEPA Region II certified data validators.

Regarding environmental media, the soils, groundwater, surface water and sediment are of concern because they are or may become readily available for human contact. Air is also of concern due to the potential for airborne chemically-contaminated respirable particulate matter to be released from soil.

Regarding chemical contamination, the following process was used to select COPCs. A concentration-toxicity screen was conducted first, to identify those chemicals in a particular medium most likely to contribute significantly to the risk estimates. Chemicals representing greater than 1% of the total relative risk were selected as COPCs. The chemicals were then screened against USEPA, Region III risk-based concentrations (RBCs)

for residential use and tap water use (USEPA. 1998d) for soil and groundwater. respectively. so as not to eliminate chemicals at concentrations greater than the RBCs. Chemicals detected in concentrations greater than the RBCs were selected as COPCs. For the metals. since they naturally occur in soil. if the average detected concentration in soil or sediment is less than twice the site-specific average background concentration the chemical was eliminated as a COPC. For the essential nutrients (i.e., calcium, iron, magnesium, potassium and sodium), if the concentrations are less than nutrient screening concentrations calculated using recommended Daily Allowances (RDA), the chemical was eliminated as a COPC. A number of detected chemicals are without USEPA toxicity criteria and could not be included in the concentration-toxicity screen. Chemicals without toxicity criteria are selected as COPCs and evaluated qualitatively. Finally, chemicals with a USEPA weight-of-evidence classification of A (i.e., known human carcinogens) were also selected as COPCs. The concentration-toxicity screen methodology and results, as well as the reason for selection or elimination of COPCs where not based solely on the screen, are presented in Attachment F. The derivation of the nutrient screening concentrations is also presented in Attachment F.

Chemical analytical data for soil, groundwater, surface water, and sediment from the field investigation are summarized in Standard Tables 2.1 to 2.10 in Attachment H and discussed below. The PCBs, a class of chlorinated hydrocarbons with a biphenyl nucleus, were manufactured commercially in the U.S. as chemical mixtures under the trade name Aroclor. They are routinely analyzed, quantified, and reported in environmental samples as individual Aroclor mixtures (e.g., Aroclor 1254). Aroclors 1248, 1254, and 1260 were detected in one or more samples. Concentrations of the Aroclor mixtures, where detected in a sample, are summed and reported throughout this evaluation as simply "PCBs". Figures depicting sample locations can be referenced in previous sections of the report. COPCs for surface soil and all soil by area, for groundwater underlying the Site, and for surface water and sediment are summarized below and presented in Standard Tables 2.1 to 2.10 in Attachment H. With the exception of nine COPCs without USEPA toxicological criteria, all of the COPCs are evaluated quantitatively. The nine COPCs without USEPA toxicological criteria, which include three organic chemicals classified as polycyclic aromatic hydrocarbons (PAHs) (acenaphthylene, benzo[g,h,i]perylene, and phenanthrene), one semi-

volatile organic compound (4-methyphenol), three pesticides (endosulfan sulfate, endrin aldehyde, and endrin ketone) and two metals (lead and magnesium), are evaluated qualitatively.

5.3.1.1 Soil

Soil quality data are summarized in Standard Tables 2.1 to 2.6 in Attachment H; frequency of detection, range of detected concentrations, range of qualifiers, locations of the maximum detected concentrations, range of detection limits, concentrations used for screening, background values, screening toxicity values, ARAR/TBC values (TBC values are associated with specific exposure assumptions and risk values), ARAR/TBC sources, COPC flags, and the rationales for chemical deletion or selection are provided. Data for soil are grouped as previously discussed in Section 5.2.1 Data Evaluation for the human health evaluation, radiological risk.

Site-specific background metals concentrations in soil are derived based on data from selected samples collected during the Li Tungsten investigation. These samples were collected from soil borings in areas that do not appear to have been impacted by site-related activities. Data from the following seven soil samples at three boring locations and one test pit location are used to characterize site-specific background:

Boring locations

LT-MP-5	LT-MP-11DB
LT-MP-5B	LT-SB-13
LT-MP-11D	LT-SB-13B

Test Pit location

LT-TP-06

Area A:

Based on the above analysis, eight [benzo(a)pyrene, benzo(g,h,i)perylene, phenanthrene, PCBs, antimony, arsenic, copper, and lead] COPCs were selected in surface soil and 19 [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenanthrene, endrin aldehyde, PCBs, antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, and

manganese] COPCs were selected in all soil.

Area G:

Based on the above analysis, nine [benzo(b)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, phenanthrene, arsenic, barium, copper, and lead] COPCs were selected in surface soil and 15 [acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, phenanthrene, endosulfan sulfate, endrin ketone, PCBs, antimony, arsenic, cadmium, iron, lead, and manganese] COPCs were selected in all soil.

5.3.1.2 Groundwater

Groundwater quality data from ten on-site monitoring wells (CDM-3 is designated a background well as described below) are summarized in Standard Tables 2.7 to 2.8; frequency of detection, range of detected concentrations, range of qualifiers, locations of the maximum detected concentrations, range of detection limits, concentrations used for screening, background values, screening toxicity values, ARAR values, ARAR sources, COPC flags, and the rationales for chemical deletion or selection are provided. Here the ARARs are the USEPA MCLs promulgated under the Federal Safe Drinking Water Act. A MCL is the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

Site-specific background concentrations in groundwater are derived based on data from selected monitoring wells collected during the Li Tungsten investigation. These include two rounds of data from monitoring wells MP-5 and MP-11D, as well as one sample (GW-Konica-01) collected from a well installed for an investigation of the neighboring Konica Imaging property that had been identified as representing background conditions. In addition to the samples from the Li Tungsten investigation, one on-site monitoring well (CDM-3) at the Captain's Cove site was identified as representative of background; the sample collected from this well (CC-MW-CDM-3) was also included in the background data set.

Based on the above analysis, 17 [benzene, chlorobenzene, chloroform, 1,2-dichloroethane, 1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene,

trichloroethene, vinyl chloride, bis(2-chloroethyl)ether, 1,4-dichlorobenzene, endosulfan sulfate, antimony, arsenic, lead, and magnesium] COPCs were selected in groundwater.

5.3.1.3 Surface Water and Sediment

Surface water and sediment quality data are summarized in Standard Tables 2.9 and 2.10, respectively; frequency of detection, range of detected concentrations, range of qualifiers, locations of the maximum detected concentrations, range of detection limits, concentrations used for screening, background values (for sediment only), COPC flags, and the rationales for chemical deletion or selection are provided. Surface water data collected from one location in each of the retention ponds and surface water quality data from one sample collected in the topographic depression in the southwestern portion of the Site were combined to represent on-site surface water. Sediment quality data collected from one location in each of the retention ponds were combined to represent sediment in the retention ponds. The sampling locations in the wetland area were analyzed for radionuclides only.

No site-specific background data were collected for surface water and sediment as part of either this or the Li Tungsten investigations. Site-specific background concentrations in soil are used for screening metals in sediment. No toxicity screening values are available for surface water and sediment. Therefore, only the concentration/toxicity screen, nutrient screen, and, for sediment, comparison to background were used to select COPCs.

Based on the above analysis, 11 [aluminum, antimony, arsenic, barium, cadmium, copper, iron, lead, manganese, nickel, and vanadium] COPCs were selected in surface water and ten [benzo(g,h,i)perylene, phenanthrene, 4-methylphenol, antimony, arsenic, cadmium, copper, lead, silver, and zinc] COPCs were selected in all soil.

5.3.2 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of human exposure to the COPCs that are present at or migrating from the media being evaluated.

5.3.2.1 Potentially Exposed Populations

Potentially exposed populations are as discussed previously in Section 5.2.2.1 Potentially Exposed Populations for the radiological risk assessment.

5.3.2.2 Exposure Pathways

Exposure pathways are generally as discussed in Section 5.2.2.2 Exposure Pathways for the radiological risk assessment with the following exceptions:

- instead of external radiation, dermal contact with COPCs in soil, surface water, sediment, and groundwater is considered,
- trespasser exposure pathways include exposure to surface water in the retention ponds and low area via dermal contact and do not include exposure to sediment at the wetland area because no chemical analyses were performed for those samples,
- because volatile organic chemicals (VOCs) were selected as COPCs in groundwater, resident exposure to VOCs in groundwater via inhalation during showering is evaluated,
- and resident exposure to chemicals in home-grown produce is not evaluated.

The exposure pathways selected for evaluation and the basis for inclusion or exclusion of certain exposure scenarios are provided in Standard Table 1 in Attachment H.

5.3.2.3 Data Utilization

Data utilization is as discussed previously in Section 5.2.2.3 Data Utilization for the human health evaluation, radiological risk with one exception. If a COPC was not detected in a sample, a value of ½ its limit of detection is used as a "proxy" concentration. Adjusting non-detects by assigning values of ½ the limit of detection assumes that a chemical may be present at a concentration just below the reported limit of detection. Data that were noted (i.e., qualified) by the laboratory or the data validator with an indicator that the concentration was estimated, or that the identity of the chemical and the concentration were based on presumptive evidence, were treated the same way as data without such qualifiers.

5.3.2.4 Estimates of Chemical Intake

Estimates of chemical intake are as discussed previously in Section 5.2.2.4. Estimates of Contaminant Intake for the human health evaluation, radiological risk with the

following exceptions. Exposure point concentrations of volatile COPCs in air from release from groundwater during showering were calculated as described in Attachment F following guidance in Schaum et al. (1992). An adjustment factor of 0.6 times the exposure point concentration was used to evaluate exposure of the skin (termed dermal exposure) to the volatile COPCs in groundwater during showering (Schaum et al., 1992). This approach was also used for site worker exposure to groundwater via dermal contact. The exposure point concentrations are presented in Standard Table 3 in Attachment H.

The generic equation for estimating chemical intakes which defines the intake variables in terms of chemical-related, population-related and evaluation-determined parameters is as follows:

Equation:

$$CDI = \frac{C \times CR \times EFD}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake; the amount of chemical at the exchange boundary (mg/kg body weight-day)
C	=	Chemical concentration; the "average" concentration contacted over the exposure period (e.g., mg/kg soil) (In practice, C is either the 95% UCL on the average concentration or the maximum concentration.)
CR	=	Contact Rate; the amount of contaminated medium contacted/unit time or event (e.g. liters/day)
EFD	=	Exposure frequency and duration; describes how long and how often exposure occurs; often calculated using two terms (EF and ED)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	Body Weight; the average body weight over the exposure period (kg)
AT	=	Averaging Time; time period over which exposure is averaged (days)

The averaging time (AT) referenced depends on the type of toxic effect being assessed. When evaluating exposures for potential long-term, non-cancer health effects, intakes are calculated by averaging over the period of exposure. This is equal to the

exposure duration (ED) multiplied by 365 days/year. When evaluating potential carcinogenic risks, intakes are calculated by prorating the total cumulative intake over a lifetime (i.e., lifetime average daily intake). This is equal to 70 years multiplied by 365 days/year. This distinction is consistent with the hypothesis that the mechanism of action for each of these effects is different. The approach for carcinogens is based on the assumption that a high dose received over a short period of time is equivalent to a corresponding low dose spread over a lifetime.

Application of the exposure equations results in estimates of chemical intake or absorbed dose expressed in mg of chemical per kg body weight per day (mg/kg-day).

Other variables used in estimating chemical intakes are as discussed previously in Section 5.2.2.4 Estimates of Radionuclide Intake for the human health evaluation, radiological risk and are presented in Standard Tables 4.1 to 4.18 in Attachment H for soil, groundwater, surface water, and sediment. Estimation of skin surface areas available for contact and skin permeability factors are necessary for evaluation of the dermal contact exposure route. The variables for estimating absorbed dose from dermal exposure are also presented in Standard Tables 4.1 to 4.18 in Attachment H and are described below.

Soil - Dermal contact with soil is evaluated for arsenic, cadmium, and PCBs only; this is due to the general lack of chemical-specific data on dermal absorption from the soil matrix (USEPA, 1992). For dermal contact with soil, the surface area available for contact (SA), the soil-to-skin adherence factor (SSAF), and the rate of absorption (DABS) are considered.

A SA of 1970 cm^2 is used to evaluate dermal contact with soil by trespassers; this value represents 12.5% of the total body surface area. The 50th percentile total body surface area of 12-18 years is 15,757 cm^2 (USEPA, 1989a). An SSAF of 1.00 mg/cm^2 is used (USEPA, 1992). The average body weight (BW) of 12-18 year olds is 57.7 kg (USEPA, 1989a). An DABS of 3% is used for arsenic; this is the value recommended by Cal EPA (USEPA, 1993a). An DABS of 14% is used for the PCBs as recommended by the USEPA (1996a). One % is used as the DABS for cadmium; this is the upper value of the 0.1 to 1% range provided by the USEPA (1992).

For site workers and construction workers, a SA of 2570 cm^2 corresponding to the

surface area of the hands, forearms, and face (calculated as half the surface area of the head) is used (USEPA, 1989a). An adult BW of 70 Kg is used (USEPA, 1991). All other dermal exposure parameters and assumptions are as discussed previously for trespassers.

SAs of 2425 cm^2 and 872.5 cm^2 are assumed in assessing dermal exposure of resident adults and resident children, respectively. The SAs for resident adults and resident children were also derived using 12.5% of the total body surface area. The 50th percentile total body surface area for an adult (USEPA, 1989a) is 19,400 cm^2. The 50th percentile total body surface area (SA) for 2-6 year old children is 6980 cm^2 (USEPA, 1992). BWs of 70 and 15 Kg are used for resident adults and children, respectively (USEPA, 1991). All other dermal contact parameters and assumptions are as discussed previously for trespassers.

Groundwater - As dermal exposure of site workers may be possible during washing, a SA of 2570 cm^2, representing the skin surface of the hands, forearms, and face (calculated as half the surface area of the head) is used (USEPA, 1989a). The permeability coefficients (PCS) used to estimate dermal exposure are presented in Attachment F.

In the home, the greatest opportunity for dermal exposure to the COPCs in groundwater is during showering or bathing. Thus, the entire surface areas of the body, presented above, are used to evaluate exposure resident adult and resident children via dermal contact. An exposure time (ET) of 12 minutes/day (or 0.2 hours/day) is used to evaluate dermal exposure to the COPCs in groundwater; this value represents the 90th percentile value for showering for all age groups (USEPA, 1989a). An inhalation rate of 0.83 m^3/hr is used to evaluate inhalation of volatile COPCs released from groundwater during showering (USEPA, 1989a) by both resident adults and children.

Surface Water: For trespasser exposure to via dermal contact, the PCS used to estimate dermal exposure are as presented above for groundwater. An ET of 2 hours is assumed. All of the other parameters and assumptions were discussed previously for trespasser exposure to soil.

Sediment: The values used to estimate trespasser exposure via ingestion and dermal contact are the same as those for the trespasser exposure to soil.

5.3.3 Toxicity Assessment

The toxicity assessment, also termed the dose-response assessment, serves to characterize the relationship between the magnitude of exposure and the potential that an adverse effect will occur. It involves determining whether exposure to a chemical can cause an increase in the incidence of a particular adverse health effect, and characterizing the nature and strength of the evidence of causation. The toxicity information is then quantitatively evaluated and the relationship between the dose of the contaminant received and the incidence of adverse effects in the exposed population is evaluated.

The USEPA and other regulatory agencies have performed toxicity assessments for numerous chemicals and the guidance they provide is used in this human health evaluation. These include verified reference doses, or RfDs, for the evaluation of noncarcinogenic effects from chronic exposure and cancer potency slope factors for the evaluation of cancer risk from lifetime exposure. Each of these is discussed below. Sources of toxicological information and criteria, in order of preference, include IRIS (Integrated Risk Information System), which is a USEPA database containing current health risk information for many chemicals (USEPA, 1998b), the USEPA Health Effects Assessment Summary Tables (HEAST) which are tabular presentations of provisional toxicity data (USEPA, 1997), and the USEPA National Center for Environmental Assessment's (NCEA) Superfund Technical Support Center (USEPA, 1998c).

5.3.3.1 Noncarcinogenic Effects

The potential for noncancer health effects associated with chemical exposure is evaluated by comparing an estimated intake [such as a chronic daily intake (CDI)] over a specified time period with a reference dose (RfD) derived for a similar exposure period. The RfD is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. According to the USEPA, RfDs often have an uncertainty spanning perhaps an order of magnitude or greater. Chronic RfDs, used in this report, are specifically developed

to be protective of long-term exposure to a chemical. For the construction worker assumed to have exposure over a 1-year period, subchronic RfDs are the more appropriate criteria. However, as subchronic RfDs are often lacking or in some cases set equal to chronic RfDs, chronic RfDs are used as conservative approximations.

The RfDs for the characterization of chronic noncancer risk via both oral and inhalation exposure routes are presented in Standard Table 5 in Attachment H, along with the target organ, any uncertainty or modifying factors used in the derivation of the RfD, the source of the RfD, and the date of the RfD. Generally order of magnitude (i.e., in increments of 10) uncertainty factors reflect the various types of data (e.g., a no observable adverse affect level from a valid chronic study in humans) used to estimate the RfDs. Modifying factors, that can range from greater than zero to 10, reflect qualitative professional judgement regarding scientific uncertainties (e.g., the completeness of the overall database) not covered under the uncertainty factor. All of the reference doses and concentrations have been developed by the USEPA.

RfDs for oral exposure are available for most of the chemicals of concern. RfDs are not available, however, for dermal exposure. In their absence, oral RfDs are used and adjusted as per USEPA guidance (USEPA, 1989b) to reflect absorbed dose. This allows for comparison between exposures estimated as absorbed doses and toxicity values expressed as absorbed doses. In the absence of chemical-specific information on oral absorption, a default efficiency was assumed. Oral to dermal adjustment factors and the resulting adjusted RfDs are also presented in Standard Table 5.

A limited number of reference concentrations (RfCs) for inhalation exposure are available. Following consultation with the USEPA NCEA, the available RfCs were converted into RfDs based on a standard inhalation rate of 20 m^3/day, a standard body weight of 70 kg, and appropriate chemical-specific information.

The RfD for Aroclor 1254, the lower of the two available Aroclor-specific RfDs (the RfD for Aroclor 1016 is the other), is used as representative of all PCB mixtures. As presented earlier, Aroclors 1248, 1254, and 1260 were detected in one or more samples. Use of the RfD for Aroclor 1254 may overestimate the hazard for the other Aroclor mixtures.

The ratio of the estimate of chronic daily intake to the health-protective criterion (CDI/RfD) is called a hazard quotient (USEPA, 1989b). The hazard quotient assumes that there is a level of exposure (i.e., the RfD) below which it is unlikely for even sensitive subpopulations to experience adverse health effects. If the hazard quotient exceeds 1.0, there may be concern for potential non-cancer effects. The greater the hazard quotient above 1.0, the greater the level of concern.

5.3.3.2 Carcinogenic Effects

Regardless of the mechanism of effect, risk evaluation methods employed by the USEPA generally derive from the hypothesis that thresholds for cancer induction by carcinogens do not exist and that the dose-response relationship is linear at low doses. Such risk evaluation methods often require extrapolation from high dose exposures to laboratory animals, workers, or other highly exposed individuals to evaluate low doses more typical of environmental exposures. In the absence of adequate information to the contrary, a linearized, multistage, non-threshold low-dose extrapolation model is recommended by the USEPA as the most appropriate method for assessing chemical carcinogens. The USEPA emphasizes that this procedure leads to a plausible upper limit to the risk that is consistent with some proposed mechanisms of carcinogenesis (USEPA, 1996c, 1986).

Through application of this approach, the USEPA has derived estimates of incremental excess cancer risk from lifetime exposure to potential carcinogens. This is accomplished by establishing the carcinogenic potency of the chemical substance through critical evaluation of the various test data and fitting dose-response data to a low-dose extrapolation model. The slope factor (which describes the dose-response relationship at low doses) is expressed as a function of intake [i.e., $(mg/Kg\text{-}day)^{-1}$]. The slope factors for the carcinogenic COPCs presented in Standard Table 6 are used to estimate finite, upper limits of risk at low dose levels administered over a lifetime. For children, the estimated cancer risk reflects the potential risk over a lifetime due to childhood exposure. The weight-of-evidence classification for carcinogenicity, the source of the slope factor, and the date of the slope factor are also presented in Standard Table 6.

The USEPA recommends a tiered approach for selecting the appropriate slope factor

for evaluating exposure to PCBs (USEPA 1996 and USEPA. 1998b). Based on this approach. since exposure via soil ingestion. dermal contact (with application of an absorption factor). and inhalation of respirable particulates are evaluated. the "high risk and persistence" upper-bound slope factor is used as representative of all PCB mixtures.

A relative potency approach recommended by the USEPA (1993b) is used to estimate cancer risks from exposure to the carcinogenic PAHs. The relative potency approach. which takes into account the differing potencies of the carcinogenic PAHs. is used rather than the former practice of assuming that all carcinogenic PAHs are equivalent in potency to benzo[a]pyrene. Estimates of cancer risks under the equivalent potency assumption overestimates the carcinogenic potency of most PAH mixtures since benzo[a]pyrene has been demonstrated to be one of the most potent carcinogenic PAHs. The slope factor for benzo[a]pyrene is adjusted based on the following potencies of the other carcinogenic PAHs relative to benzo[a]pyrene:

benzo[a]pyrene	1.0
benzo[a]anthracene	0.1
benzo[b]fluoranthene	0.1
dibenz[a.h]anthracene	1.0
ideno[1.2.3-c.d]pyrene	0.1

The following equation is used to arrive at an estimate of incremental cancer risk (USEPA, 1989b):

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where:

Risk = a unitless probability (e.g., 2×10^{-5} or 2 in 100 thousand) of an individual developing cancer;

CDI = chronic daily intake averaged over 70 years (mg/Kg-day); and

SF = slope factor. expressed in $(\text{mg/Kg-day})^{-1}$

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This linear equation is valid only at low risk levels (i.e., below estimated risks of 0.01). According to the USEPA, this approach does not necessarily give a realistic prediction of risk. The true value of the risk at trace ambient concentrations is unknown, and may be as low as zero.

As with RfDs, the USEPA has not derived slope factors for dermal exposure. In their absence, slope factors for oral exposure are used and adjusted to reflect absorbed dose. This allows for risk estimation based on exposures estimated as absorbed doses and slope factors expressed as absorbed doses. The same absorption factors used to adjust RfDs are applied in adjusting slope factors.

5.3.3.3 Mixtures

The USEPA has also developed guidelines to evaluate the overall potential for noncancer and cancer effects posed by multiple chemicals. For the evaluation of noncarcinogenic health effects, this approach assumes that exposures to several chemicals at the same time could result in an adverse health effect. The sum of the hazard quotients (for individual chemicals, exposure routes, exposure pathways, or potentially exposed populations) is the hazard index. When the hazard index exceeds 1.0, there may be concern for potential health effects. Generally, hazard indices are only calculated for mixtures of chemicals that induce the same effect (termed toxic endpoint) by the same mechanism of action. COPCs 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 RfDs (as presented in Standard Table 5), are as follows:

Toxicological Basis	COPC
Central Nervous System	Aluminum Manganese
Circulatory System (Hematopoietic)	Antimony Barium Cobalt Zinc
Development	PCBs Barium

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	Nickel
Immune System	PCBs
Kidney	Toluene Trichloroethene 1,4-Dichlorobenzene Cadmium
Liver	Chlorobenzene Chloroform 1,2-Dichloroethene (total) Methylene chloride Tetrachloroethene Toluene Trichloroethene 1,4-Dichlorobenzene Iron
Skin	Arsenic Silver
Gastrointestinal Tract	Copper
Lung	1,2-Dichloroethane

In this evaluation, the hazard quotients of a mixture of chemicals that can have different effects are first summed into a hazard index as a screening-level analysis, as recommended by the USEPA (1989b). This approach may overestimate the likelihood of adverse, noncarcinogenic health effects. Then, toxic endpoint-specific hazard indices are calculated.

For the evaluation of carcinogenic risks, the individual risks associated with exposure to each chemical are summed. This additive approach, which assumes that the chemicals act independently of each other (i.e., that there are no synergistic or antagonistic chemical interactions and all chemicals produce the same effect) is used to approximate the probabilities of the same individual developing cancer as a consequence of exposure to two or more carcinogens.

5.3.3.4 COPCs without Toxicological Criteria

USEPA-derived toxicological criteria (i.e., RfDs, RfCs, and cancer slope factors for oral and inhalation exposure) are not available to quantitatively assess the potential for human health risks for nine COPCs including three PAHs (acenapthylene, benzo[g,h,i]perylene and phenanthrene), one semi-volatile organic compound (4-methylphenol), three pesticides (endosulfan sulfate, endrin aldehyde, endrin ketone) and two metals (lead and magnesium). Concentrations of the essential nutrient magnesium were elevated in seven of ten groundwater samples relative to background concentrations and were elevated in five of ten groundwater samples relative to the nutrient screening concentrations. These COPCs are evaluated qualitatively in the Risk Characterization section.

5.3.3.5 Toxicity Profiles

Toxicological summaries (termed ToxFAQs) prepared by the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service are provided in Attachment H for those COPCs found to be the predominant contributors to risk estimates greater than the USEPA acceptable levels.

5.3.4 Risk Characterization

The human health risks associated with potential exposure to the individual COPCs for each potentially exposed population, currently and in the future in the absence of remedial action, are presented in the Standard Tables 7.1 through 7.19 and 8.1 through 8.19 for non-cancer hazards and cancer risks, respectively, in Attachment H. The potential for noncarcinogenic and carcinogenic health effects associated with possible exposure to COPCs in the media of concern are summarized in Standard Tables 9.1 through 9.14 in the form of total hazard indices and total estimated cancer risks, respectively, and discussed below. Where the total hazard index or total estimated cancer risk is greater than the USEPA acceptable levels, the COPCs that are the predominant contributors to the risk estimates are also presented in Standard Tables 10.1 through 10.10 in Attachment H; the risks for those COPCs identified as predominant contributors are either greater than the USEPA acceptable

levels or contribute significantly to total risks greater than the USEPA acceptable levels. Total pathway hazard indices and total estimated pathway cancer risks are also presented. Toxic endpoint-specific hazard indices are also calculated and presented in Standard Tables 9.1 through 9.14 in Attachment H.

The estimated risks are compared to the USEPA acceptable levels specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1990). For noncarcinogenic health effects, the NCP states that acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety. In practice, the USEPA defines this as both hazard quotients and hazard indices less than or equal to 1.0. For known or suspected carcinogens, the NCP states that acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} (1 in 10,000) and 10^{-6} (1 in 1,000,000).

5.3.4.1 Current and Future Adolescent Trespassers

Current and Future Scenarios: Surface Soil at Area A

The total hazard index (Standard Table 9.1) for adolescent trespasser exposure to the COPCs in surface soil from ingestion and dermal contact is 1E+00 (i.e., 1); this hazard index is equal to the USEPA acceptable level of 1.0. The total estimated cancer risk (Standard Table 9.1) is about 1E-05 (i.e., 1 in 100,000), within the USEPA acceptable risk range.

Current and Future Scenarios: Surface Soil at Area G

The total hazard index (Standard Table 9.2) for adolescent trespasser exposure to the COPCs in surface soil from ingestion and dermal contact is 2E-02 (i.e., 0.02); this hazard index is less than the USEPA acceptable level of 1.0. The total estimated cancer risk (Standard Table 9.2) is about 9E-07 (i.e., 9 in 10,000,000), less than the USEPA acceptable risk range.

Current and Future Scenarios: Surface Water in the Retention Ponds and Low Area

and Sediment in the Retention Ponds

The total hazard index (Standard Table 9.3) for trespasser exposure to the COPCs in surface water from dermal contact and in sediment from ingestion and dermal contact is 3E-01 (i.e., 0.3); this hazard index is less than the USEPA acceptable level of 1.0. The total estimated cancer risk (Standard Table 9.3) is about 2E-06 (i.e., 2 in 1,000,000), within the USEPA acceptable risk range.

5.3.4.2 Future Site Workers

Future Scenario: Surface Soil at Area A

The total hazard index (Standard Table 9.4) for site worker exposure to the COPCs in surface soil from ingestion and dermal contact is 2E+00 (i.e., 2); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Dermal contact with PCBs is the predominant contributor to the risk estimate. The toxic endpoint-specific hazard indices for hematopoeitic, developmental, immune system, skin, and gastrointestinal tract effects are less than or equal to USEPA acceptable level. The total estimated cancer risk (Standard Table 9.4) is about 8E-05 (i.e., 8 in 100,000), within the USEPA acceptable risk range.

Future Scenario: Surface Soil at Area G

The total hazard index (Standard Table 9.5) for site worker exposure to the COPCs in surface soil from ingestion and dermal contact is 3E-02 (i.e., 0.03); this hazard index is less than the USEPA acceptable level of 1.0. The total estimated cancer risk (Standard Table 9.5) is about 5E-06 (i.e., 5 in 1,000,000), within the USEPA acceptable risk range.

Future Scenario: Groundwater

The total hazard index (Standard Table 9.6) for site worker exposure to the COPCs in groundwater from ingestion and dermal contact is 4E+02 (i.e., 400); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic effects. Ingestion of arsenic is the predominant contributor to the risk estimate. The toxic endpoint-specific hazard indices for liver, lung, hematopoeitic, and

kidney effects are less than or equal to the USEPA acceptable level. The toxic endpoint-specific hazard index for skin effects is greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.6) is about 6E-02 (i.e., 6 in 100), greater than the USEPA acceptable risk range. Ingestion of arsenic is the predominant contributor to the risk estimate.

5.3.4.3 Future Construction Workers

Future Scenario: All Soil at Area A

The total hazard index (Standard Table 9.7) for construction worker exposure to the COPCs in all soil from ingestion, dermal contact, and inhalation is 1E+02 (i.e., 100); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Inhalation of manganese and cobalt, ingestion of and dermal contact with arsenic, and ingestion of antimony are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for liver, developmental, immune system, kidney, and gastrointestinal tract effects are less than the USEPA acceptable level. The toxic endpoint-specific hazard indices for skin, hematopoeitic and central nervous system effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.7) is about 1E-04 (i.e., 1 in 1,000), at the upper range of the USEPA acceptable risk range.

Future Scenario: All Soil at Area G

The total hazard index (Standard Table 9.8) for construction worker exposure to the COPCs in all soil from ingestion, dermal contact, and inhalation is 9E+02 (i.e., 900); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Inhalation and ingestion of manganese are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for liver, hematopoeitic, developmental, immune system, and kidney effects are less than or equal to the USEPA acceptable level. The toxic endpoint-specific hazard indices for skin and central nervous system effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.8) is about 2E-05 (i.e., 2 in 100,000), within the

USEPA acceptable risk range.

5.3.4.4 Future Residents

Future Scenario: All Soil at Area A

The total hazard index (Standard Table 9.9) for adult resident exposure to the COPCs in all soil from ingestion and dermal contact is 3E+01 (i.e., 30); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Ingestion of and dermal contact with arsenic and ingestion of antimony are the predominant contributor to the risk estimate. The toxic endpoint-specific hazard indices for liver, developmental, immune system, kidney, gastrointestinal tract, and central nervous system effects are less than or equal to the USEPA acceptable level. The toxic endpoint-specific hazard indices for hematopoeitic and skin effects is greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.9) is about 9E-03 (i.e., 9 in 1,000), greater than the USEPA acceptable risk range. Ingestion of and dermal contact with arsenic are the predominant contributors to the risk estimate.

The total hazard index (Standard Table 9.12) for child resident exposure to the COPCs in all soil from ingestion and dermal contact is 2E+02 (i.e., 200); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Ingestion of arsenic, manganese, antimony, iron, copper, cadmium, and dermal contact with arsenic and cadmium are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for developmental and immune system effects are equal to the USEPA acceptable level. The toxic endpoint-specific hazard indices for liver, kidney, hematopoietic, gastrointestinal tract, skin, and central nervous system effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.12) is about 5E-03 (i.e., 5 in 1,000), greater than the USEPA acceptable risk range. Ingestion of and dermal contact with arsenic are the predominant contributors to the risk estimate.

Future Scenario: All Soil at Area G

The total hazard index (Standard Table 9.10) for adult resident exposure to the COPCs in all soil from ingestion and dermal contact is 2E+01 (i.e., 20); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Ingestion of manganese and arsenic and dermal contact with PCBs are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for liver, hematopoeitic, and kidney effects are less than the USEPA acceptable level. The toxic endpoint-specific hazard indices for developmental, immune system, skin, and central nervous system effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.10) is about 1E-03 (i.e., 1 in 1,000), greater than the USEPA acceptable risk range. Ingestion of and dermal contact with arsenic are the predominant contributors to the risk estimate.

The total hazard index (Standard Table 9.13) for child resident exposure to the COPCs in all soil from ingestion and dermal contact is 2E+02 (i.e., 200); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic health effects. Ingestion of manganese, arsenic, PCBs, antimony, and iron, and dermal contact with PCBs and arsenic are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard index for kidney effects is less than the USEPA acceptable level. The toxic endpoint-specific hazard indices for liver, developmental, hematopoeitic, immune system, skin, and central nervous system effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.13) is about 7E-04 (i.e., 7 in 10,000), greater than the USEPA acceptable risk range. Ingestion of arsenic is the predominant contributor to the risk estimate.

Future Scenario: Groundwater

The total hazard index (Standard Table 9.11) for adult resident exposure to the COPCs in groundwater from ingestion, dermal contact, and inhalation is 1E+03 (i.e., 1000); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic effects. Ingestion of arsenic and antimony, inhalation of chloroform, and dermal contact with arsenic are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for lung and kidney effects are less than

the USEPA acceptable level. The toxic endpoint-specific hazard indices for liver, skin, and hematopoeitic effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.11) is about 2E-01 (i.e., 2 in 10), greater than the USEPA acceptable risk range. Ingestion of and dermal contact with arsenic are the predominant contributors to the risk estimate.

The total hazard index (Standard Table 9.14) for child resident exposure to the COPCs in groundwater from ingestion, dermal contact, and inhalation is 3E+03 (i.e., 3000); this hazard index is greater than the USEPA acceptable level of 1.0, indicating a potential for adverse, noncarcinogenic effects. Ingestion of arsenic and antimony, inhalation of chloroform and chlorobenzene, and dermal contact with arsenic are the predominant contributors to the risk estimate. The toxic endpoint-specific hazard indices for lung and kidney effects are less than the USEPA acceptable level. The toxic endpoint-specific hazard indices for liver, skin, and hematopoeitic effects are greater than the USEPA acceptable level. The total estimated cancer risk (Standard Table 9.14) is about 9E-02 (i.e., 9 in 100), greater than the USEPA acceptable risk range. Ingestion of and dermal contact with arsenic are the predominant contributors to the risk estimate.

5.3.4.5 COPCs Without Toxicological Criteria

As presented earlier, USEPA-derived toxicological criteria are not available to quantitatively assess the potential for human health risks for three PAHs, one semi-volatile organic compound, three pesticides, and two metals. Possible health implications that may be associated with exposure to these chemicals are as follows:

Acenaphthylene, benzo[g,h,i]perylene, and phenanthrene: These three chemicals are among the 17 PAHs typically analyzed for and evaluated at hazardous waste sites; the 17 PAHs often occur together in the environment and many have similar environmental fate and toxicological characteristics (ATSDR, 1996). However, reliable environmental fate and toxicological information exists for only a few of the 17 PAHs and the potential health effects of the other less well-studied PAHs must be inferred from this information (ATSDR, 1996). The USEPA (1998b) regards all three chemicals as not classifiable as to carcinoge-

nicity.

As presented in Standard Table 2, benzo[g,h,i]perylene and phenanthrene were detected in one or more soil samples in Area A and Area G in concentrations within the range of other detected noncarcinogenic PAHs (e.g., fluoranthene). As presented in Standard Table 2 in Attachment H, benzo[g,h,i]perylene and phenanthrene were also detected in one sediment sample from the retention ponds. Since the other detected noncarcinogenic PAHs were not selected as COPCs based on the concentration-toxicity screen, it is unlikely that acenaphthylene, benzo[g,h,i]perylene nor phenanthrene in either soil or sediment would significantly increase the risk estimates.

4-Methylphenol (p-cresol): 4-Methylphenol is an isomer of cresol which is derived from coal tar. 4-Methylphenol is used largely as a disinfectant, in the formulation of antioxidants, and also has many applications in the fragrance and dye industries.

It is readily absorbed through the skin and the membranes of the pulmonary system. As such, intoxication may result from ingestion, inhalation, or absorption through the skin. Chronic exposure can lead to liver, kidney, spleen, pancreas, and central nervous system damage (Lewis, 1998).

Studies in animals have not found any additional effects that would occur after long-term exposure to lower levels of cresols. It is possible that some of the effects in humans listed above, such as kidney problems and anemia, might occur at lower levels if exposure occurs over a longer time period. Effects on the nervous system, such as loss of coordination and twitching of muscles, are produced by low levels of cresols in animals, but it is not known whether low levels also cause such effects in humans. Cresols may enhance the ability of carcinogenic chemicals to produce tumors in animals, and have some ability to interact with mammalian genetic material in the test tube, but have not been shown to produce cancer in humans or animals. The EPA has determined that cresols are possible human carcinogens. Animal studies suggest that cresols probably would not produce birth defects or affect reproduction in humans (ATSDR, 1997). 4-Methylphenol was detected in one of the two sediment samples from the retention ponds at 0.52 mg/Kg.

Endosulfan sulfate: Endosulfan sulfate is a reaction product found in technical endosulfan, a man-made insecticide, as a result of oxidation in nature, biotransformation, or photolysis. Information regarding the health effects associated with oral, dermal, and inhalation exposure to endosulfan sulfate is unavailable (ATSDR, 1993a). Endosulfan sulfate was detected in only one of ten soil samples at Area G at 0.0052 mg/Kg and in one of ten groundwater samples at 0.00017 mg/L.

Endrin aldehyde and Endrin ketone: Endrin aldehyde and endrin ketone are not commercially used but are degradation products of the pesticide endrin. Endrin is no longer produced or sold for general use in the United States. Information regarding the health effects associated with oral, dermal, and inhalation exposure to endrin ketone is generally unavailable although one dietary study in rodents suggests that exposure to endrin ketone can cause liver dysfunction (ATSDR, 1994). Endrin aldehyde was detected in only one of 19 soil samples at Area A (0.0084 mg/Kg) and endrin ketone was detected in six of ten soil samples at Area G ranging in concentration from 0.0068 to 0.024 mg/Kg.

Lead: Chronic exposure to low levels of lead may result in hematologic (blood and blood-forming), neurobehavioral, kidney, and other effects in humans (ATSDR, 1993b). Effects such as slowed nerve conduction velocities, altered testicular function, reduced hemoglobin production and other signs of impaired heme synthesis, and blood pressure effects have been observed in adults. Children, who represent a sensitive portion of the population, may experience an array of pathophysiological effects. Electrophysiological effects, impaired cognitive performance (as measured by IQ tests, performance in school, and other means), heme synthesis impairment, inhibition of pyrimidine and alanine synthesis, interference with vitamin D hormone synthesis, and early childhood growth reductions have been observed in children. In addition, factors influencing neurological development such as low birth weights and decreased gestational age and deficits in mental indices have been reported in infants.

Lead was detected in concentrations greater than the USEPA interim soil lead guidance criterion of 400 mg/Kg for residential land use (USEPA, 1998a) or the soil lead guidance range of 750 to 1700 mg/Kg for industrial land use (USEPA, 1996b) in the

following soil and sediment samples:

Area A:

Surface Soil:	CC-SB-21-0-2 (512 mg/Kg)
All Soil:	CC-TP-1-7-8 (29,500 mg/Kg) CC-TP-2-4-5 (4,950 mg/Kg) CC-TP-3-5-6 (10,000 mg/Kg) CC-TP-4-5-6 (3,480 mg/Kg) CC-SB-12-4-6 (801 mg/Kg) CC-SB-13-4-6 (735 mg/Kg) CC-SB-14-2-4 (6,810 mg/Kg) CC-SB-15-2-4 (1,150 mg/Kg) CC-SB-17-2-4 (3,330 mg/Kg) CC-SB-18-4-6 (3,990 mg/Kg) CC-SB-21-0-2 (512 mg/Kg)

Area G:

All Soil:	CC-TP-6-5-6 (1,130 mg/Kg) CC-SB-23-4-6 (870 mg/Kg) CC-SB-24-6-8 (3,000 mg/Kg) CC-SB-26-6-8 (1,200 mg/Kg)
Retention Ponds:	CC-SED-1 (3.9 mg/Kg) CC-SED-3 (271 mg/Kg)

Lead was detected in eight of the 10 groundwater samples (to 0.544 mg/L), as well as in all of the four background groundwater samples (to 0.133 mg/L), at concentrations greater than the USEPA MCL action level of 0.015 mg/L for lead in drinking water at the tap.

Magnesium: Magnesium is an essential nutrient in humans involved as a cofactor in many vital enzymatic reactions and important in the maintenance of membrane electric potential. The kidney is the key organ in the homeostasis of magnesium, and disturbances of magnesium metabolism have been described in several renal diseases. Most magnesium compounds taken orally have minimal toxicity (Clayton and Clayton, 1994). By the respiratory route, the few available data indicate moderate toxicity. There is no evidence that

the inhalation of magnesium dust has led to lung injury. No reports of serious cases of magnesium poisoning among industrial workers have been reported. Magnesium concentrations less than those that impart an astringent taste typically pose no health problems and are likely to be beneficial to human health; consequently, there are no health-based limits for drinking water.

Magnesium concentrations greater than the nutrient screening concentration of 40 mg/L) were detected in groundwater samples from the following five monitoring wells:

CC-MW-1 (at 68.4 mg/L)
CC-MW-2 (at 48.0 mg/L)
CC-MW-5 (at 76.5 mg/L)
CC-MW-6 (at 64.2 mg/L)
CC-MW-8 (at 47.5 mg/L)

5.3.4.6 Uncertainty Analysis

Some uncertainty is inherent in the process of conducting predictive, quantitative human health evaluations. Environmental sampling and analysis, fate and transport modeling, and human exposure modeling are all prone to uncertainty, as are the available toxicity data used to characterize risks.

Uncertainty associated with environmental sampling is generally related to the limitations of the sampling in terms of the number and distribution of samples, while uncertainty associated with the analysis of samples is generally associated with systematic or random errors (e.g., false positive or negative results). Thus exposure may be overestimated or underestimated depending on how well each environmental medium is characterized.

While aspects of the exposure assessment methodology can result in overestimation or underestimation of long-term exposure, exposure is probably overestimated, overall, for the potentially exposed populations evaluated. The exposure point concentrations used in the exposure assessment (i.e., the 95% UCL on the average concentration or the maximum detected concentration, without consideration of environmental migration, transformation, degradation, or loss) should result in overestimates of long-term exposure. As discussed in Attachment F, potential exposure to non-volatile COPCs adsorbed to respirable particulates made airborne from mechanical erosion is based on conservative air dispersion modeling that

over predicts air concentrations.

Assumptions and model input parameters that result in reasonable maximum exposure estimates are used in the exposure assessment; the actual frequencies and durations of exposure would probably be less than evaluated so that long-term exposure should be overestimated. Model input parameters (e.g., permeability constants) which are influenced by a number of factors may result in overestimates or underestimates of long-term exposure.

Potential exposure to chemicals in groundwater from dermal contact during showering (or bathing/washing) is based on data from unfiltered water samples and, as chemicals adsorbed to particulates in the water may be unavailable for dermal absorption, exposure may be overestimated.

The derivation of health effects criteria that form the basis of the risk characterization can result in overestimates or underestimates of potential health risks. In most cases, the criteria are derived from extrapolation from laboratory animal data to humans. RfDs and cancer slope factors for oral exposure are used as criteria to assess exposure from dermal absorption. While the criteria for oral exposure are adjusted for such use following USEPA guidance, oral absorption for the organic chemicals is assumed to be 100%; this may underestimate dermal contact risks for some chemicals. For those chemicals with specific oral absorption factors, consideration was not given to the absorption efficiency of the exposure vehicle used in the studies on which the toxicity factors are based; this may overestimate or underestimate dermal contact risks for some chemicals. Furthermore, for some chemicals, health criteria are insufficient to determine reference doses or slope factors for oral and/or inhalation exposure. As a result, the overall risks may be underestimated.

Central Tendency Analysis

As presented above, analysis of the soil and groundwater pathways resulted in risks in excess of the USEPA acceptable levels for the future scenario site worker, construction worker, resident adult, and resident child. Per USEPA, Region II guidance, the pathways are reevaluated using central tendency exposure parameter values, where available, in place of the upper-bound values used in the RME analysis. This was accomplished by calculating the % difference between the RME and the central tendency exposure parameter values used in the individual exposure route calculations for each population, where appropriate, and

adjusting the RME risks accordingly. The exposure parameter values used in the central tendency analysis are presented in Table 5-3 and the reevaluated risk estimates are presented in Table 5-4. The revised exposure parameter values and reevaluated risks are described below. Except as noted, all the other risk estimates remain greater than the USEPA acceptable levels.

For future site worker exposure to surface soil, 50% of the ingestion and dermal contact exposures (i.e., FI = 0.5), an exposed body surface area of 2,000 cm^2, representing a "typical case" limited to the head and hands (USEPA, 1992), and an exposure duration of 4 years, representing the 50th percentile time spent at a specific job (Bureau of Labor Statistics, 1987) are used in the central tendency analysis. The hazard indices for ingestion of and dermal contact with surface soil are approximately two and three times less, respectively. The estimated cancer risks for ingestion of and dermal contact with surface soil are approximately 13 and 16 times less, respectively. This reduces the total pathway hazard index for site worker exposure to surface soil at Area A to below the USEPA acceptable level of 1.0.

For future construction worker exposure to all soil, 50% of the ingestion and dermal contact exposures (i.e., FI = 0.5), an exposed body surface area of 2,000 cm^2, representing a "typical case" limited to the head and hands (USEPA, 1992), and an exposure frequency of 20 days/year are used in the central tendency analysis. The hazard indices and estimated cancer risks for ingestion, dermal contact, and inhalation exposures to all soil are approximately six, eight, and three times less, respectively, for both the hazard index and the cancer risk. This reduces the total pathway hazard index for construction worker exposure to all soil at both Area A and Area G to below the USEPA acceptable level of 1.0.

For future adult resident exposure to all soil, 50% of the ingestion and dermal contact exposures (i.e., FI = 0.5) and an exposure duration of 9 years, representing the national median time spent at one residence (USEPA, 1989b), are used in the central tendency analysis. The total hazard indices and total and estimated cancer risks are each approximately two times less; the total pathway hazard indices remain greater than the USEPA acceptable levels for adult resident exposure to all soil at Area A and Area G and the total estimated cancer risks remain greater than the USEPA acceptable level for adult

TABLE 5-3

SUMMARY OF EXPOSURE PARAMETERS
CENTRAL TENDENCY

CAPTAIN'S COVE

MEDIUM	EXPOSURE PARAMETER	UNITS	SYMBOL	SITE WORKER	CONSTRUCTION WORKER	ON-SITE RESIDENT ADULT	ON-SITE RESIDENT CHILD
SOIL: INGESTION, DERMAL CONTACT, AND INHALATION							
	Ingestion Rate	mg/day	IR	50 [1]	480 [1]	100 [1]	200 [1]
	Fraction Ingested	unitless	FI	0.5	0.5	0.5	0.5
	Inhalation Rate	cu.m/hour	IR_i		2.3 [1]		
	Exposure Time - Inhalation	hour/day	ET		8 [3]		
	Skin Surface Area	cm^2	SA	2000 [4]	2000 [4]	2425 [4]	872.5 [4]
	Soil-Skin Adherence Factor	mg/cm^2	AR	0.5 [4]	0.5 [4]	0.5 [4]	0.5 [4]
	Fraction Contacted	unitless	FC	0.5	0.5	0.5	0.5
	Skin Absorption Factor	unitless	ABS	Chemical Specific	Chemical Specific	Chemical Specific	Chemical Specific
GROUNDWATER: INGESTION, DERMAL CONTACT, AND INHALATION							
	Ingestion Rate	l/day	IR	0.7 [2]		1.4 [2]	0.5 [2]
	Skin Surface Area	cm^2	SA	2000 [4]		18150 [4]	6980 [4]
	Exposure Time - Dermal Contact	hours/day	ET	0.2 [3]		0.2 [3]	0.2 [3]
	Exposure Time - Inhalation	hours/day	ET			0.2 [2]	0.2 [2]
	Inhalation Rate	cu.m/hour	IR			0.6 [2]	0.6 [2]
	Permeability Coefficient	cm/hour	PC	Chemical Specific		Chemical Specific	Chemical Specific

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TABLE 5-4

COMPARISON OF CANCER RISKS AND HAZARD INDICES
CAPTAIN'S COVE

EXPOSURE POPULATION AND PATHWAY	RME CANCER RISK		CENTRAL TENDENCY CANCER RISK		RME HAZARD INDEX	CENTRAL TENDENCY HAZARD INDEX
FUTURE SCENARIO						
SITE WORKERS						
Ingestion of Surface Soil from Area A	2E-05		2E-06		5E-01	3E-01
Dermal Contact with Surface Soil from Area A	6E-05		4E-06		1E+00	4E-01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**8E-05**		**5E-06**		**2E+00**	**7E-01**
Ingestion of Surface Soil from Area G	2E-06		1E-07		1E-02	6E-03
Dermal Contact with Surface Soil from Area G	3E-06		2E-07		2E-02	8E-03
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**5E-06**		**4E-07**		**3E-02**	**1E-02**
CONSTRUCTION WORKER						
Ingestion of All Soils from Area A	7E-05		1E-05		2E+01	3E+00
Dermal Contact with All Soils from Area A	1E-05		2E-06		2E+00	3E-01
Inhalation of Respirable Particulates at Area A	4E-05		1E-05		9E+01	3E+01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-04**		**2E-05**		**1E+02**	**3E+01**
Ingestion of All Soils from Area G	9E-06		1E-06		1E+01	2E+00
Dermal Contact with All Soils from Area G	2E-06		2E-07		7E-01	9E-02
Inhalation of Respirable Particulates at Area G	4E-06		1E-06		9E+02	3E+02
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E-05**		**3E-06**		**9E+02**	**3E+02**
ADULT RESIDENT						
Ingestion of All Soils from Area A	7E-03	*	3E-03	**	2E+01	0E+00
Dermal Contact with All Soils from Area A	3E-03	*	6E-04	**	1E+01	0E+00
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**9E-03**		**3E-03**		**3E+01**	**0E+00**
Ingestion of All Soils from Area G	9E-04	*	3E-04	**	2E+01	0E+00
Dermal Contact with All Soils from Area G	4E-04	*	3E-04	**	4E+00	0E+00
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-03**		**6E-04**		**2E+01**	**0E+00**
CHILD RESIDENT						
Ingestion of All Soils from Area A	5E-03		2E-03		2E+02	9E+01
Dermal Contact with All Soils from Area A	7E-04		4E-04		2E+01	1E+01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**5E-03**		**3E-03**		**2E+02**	**1E+02**
Ingestion of All Soils from Area G	6E-04		3E-04		2E+02	8E+01
Dermal Contact with All Soils from Area G	1E-04		5E-05		7E+00	3E+00
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**7E-04**		**4E-04**		**2E+02**	**8E+01**

TABLE 5-3 (Continued)

SUMMARY OF EXPOSURE PARAMETERS
CENTRAL TENDENCY

CAPTAIN'S COVE

MEDIUM	EXPOSURE PARAMETER	UNITS	SYMBOL	SITE WORKER	CONSTRUCTION WORKER	ON-SITE RESIDENT ADULT	ON-SITE RESIDENT CHILD
OTHER PARAMETERS							
	Exposure Frequency	days/year	EF	250 [1]	*20 [3]*	350 [1]	350 [1]
	Exposure Duration	years	ED	*4 [5]*	1 [2]	*9 [1]*	6 [1]
	Body Weight	kg	BW	70 [1]	70 [1]	70 [1]	15 [1]
	Averaging Time for Non-Carcinogenic Effects	days x years	AT_{NC}	*1460*	365	*3285*	2190
	Averaging Time for Carcinogenic Effects	days x years	AT_C	25550	25550	25550	25550

REFERENCES

[1] USEPA, 1991
[2] USEPA, 1989a
[3] Professional judgement
[4] USEPA, 1992a
[5] Bureau of Labor Statistics, 1987

Central Tendency Value

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TABLE 5-4 (Continued)

COMPARISON OF CANCER RISKS AND HAZARD INDICES
CAPTAIN'S COVE

EXPOSURE POPULATION AND PATHWAY	RME CANCER RISK	CENTRAL TENDENCY CANCER RISK	RME HAZARD INDEX	CENTRAL TENDENCY HAZARD INDEX
SITE WORKERS				
Ingestion of Groundwater	6E-02	7E-03	4E+02	4E+02
Dermal Contact with Groundwater	4E-05	5E-06	2E-01	2E-01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**6E-02**	**7E-03**	**4E+02**	**4E+02**
ADULT RESIDENT				
Ingestion of Groundwater	2E-01	4E-02	1E+03	1E+03
Dermal Contact with Groundwater	5E-04	1E-04	3E+00	3E+00
Inhalation of Chemicals Volatilized from Groundwater	4E-08	4E-09	4E+01	1E+01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E-01**	**4E-02**	**1E+03**	**1E+03**
CHILD RESIDENT				
Ingestion of Groundwater	9E-02	5E-02	2E+03	1E+03
Dermal Contact with Groundwater	2E-04		4E+00	
Inhalation of Chemicals Volatilized from Groundwater	4E-08	1E-08	2E+02	6E+01
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**9E-02**	**5E-02**	**3E+03**	**1E+03**

* Based on 30 year exposure, 6 year child exposure plus 24 year adult exposure.
** Based on 15 year exposure, 6 year child exposure plus 9 year adult exposure.

resident exposure to all soil at Area A but are reduced to within the upper end of the USEPA acceptable risk range for adult resident exposure to all soil at Area G.

For future child resident exposure to all soil, 50% of the ingestion and dermal contact exposures (i.e., FI = 0.5) were assumed in the central tendency analysis. The total hazard indices and total estimated cancer risks are each approximately two times less; the total pathway hazard indices and total estimated cancer risks remain greater than the USEPA acceptable levels for child resident exposure to all soil at both Area A and Area G.

For future site worker exposure to groundwater, an ingestion rate of 0.7 l/day, an exposed body surface area of 2,000 cm^2, and an exposure duration of 4 years are used in the central tendency analysis; these values represent one-half the overall average adult tap water consumption rate of 1.4 l/day (USEPA, 1989a, 1989b), a "typical case" limited to the head and hands (USEPA, 1992), and the 50th percentile time spent at a specific job (Bureau of Labor Statistics, 1987), respectively. The hazard indices for ingestion and dermal contact exposure remain the same. The estimated cancer risks for ingestion and dermal contact exposures are approximately three and eight times less, respectively. The total estimated cancer risk, while reduced, remains greater than the USEPA acceptable risk range for site worker exposure to groundwater.

For future adult resident exposure to groundwater, an ingestion rate of 1.4 l/day (about six 8-ounce glasses/day), an inhalation rate of 0.6 m^3/hour, an exposure time of 0.2 hours/day for inhalation while showering, and an exposure duration of 9 years are used in the central tendency analysis. These values represent the average adult tap water consumption rate (USEPA, 1989a, 1989b), an inhalation rate for all age groups while showering (USEPA, 1989b), the 50th percentile time spent showering, 0.1 hours/day, (USEPA, 1989b) plus 0.1 hours/day spent in the bathroom after the shower, and the national median time spent at one residence (USEPA, 1989b), respectively. The hazard indices for ingestion and dermal contact remain the same while the hazard index for inhalation is approximately three times less. The estimated cancer risks are approximately five, four, and nine times less, for ingestion, dermal contact, and inhalation, respectively. The total pathway hazard index, while reduced, remains greater than the USEPA acceptable level. The total estimated cancer risk, while reduced, remains greater than the USEPA acceptable risk range.

For the resident child, an ingestion rate of 0.5 l/day (about four 4-ounce glasses/day), an inhalation rate of 0.6 m^3/hour, and an exposure time of 0.2 hours/day for inhalation while showering are used in the central tendency analysis. These values represent the total average daily consumption rate of water and water-based foods by a 2-year old child (USEPA, 1989a), an inhalation rate for all age groups while showering (USEPA, 1989a), and the 50th percentile time spent showering, 0.1 hours/day, (USEPA, 1989b) plus 0.1 hours/day spent in the bathroom after the shower, respectively. The total pathway hazard index and total estimated cancer risk, while reduced, remain greater than the USEPA acceptable levels.

5.3.5 Summary

The human health evaluation addresses the consequences of reasonable maximum exposure to COPCs from hypothetical current and future exposure scenarios in the absence of remedial action at the Site. A summary of the risk estimates is presented in Standard Tables 9.1 through 9.14 in Attachment H. Estimated risks that exceed the USEPA acceptable levels and the chemicals associated with those risks are presented in Standard Tables 10.1 through 10.10 and discussed below by environmental medium.

5.3.5.1 Soil

Area A

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 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 - 1700 mg/Kg for industrial land use.

Area G

Potential exposure to soil at 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, and 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 - 1700 mg/Kg for industrial land use.

5.3.5.2 Surface Water and Sediment

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.

5.3.5.3 Groundwater

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, 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 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.

5.4 HUMAN HEALTH EVALUATION: RADIOLOGICAL AND CHEMICAL RISKS

Carcinogenic risks associated with potential exposures to ROPCs and COPCs are estimated in Sections 7.2 and 7.3, respectively. The environmental models, risk assessment methodologies, and cancer slope factors used in the two analyses are unique to the ROPCs and COPCs to which they have been applied. However, despite the differences in the quantitative approach to assessing radiological and chemical carcinogenic risks, it is not inappropriate to sum the risk estimates for populations that may be exposed to both types of contaminants (USEPA, 1997). The resultant combined risks provide the best estimate of the total estimated carcinogenic impact of Site contaminants on potentially exposed populations.

The total estimated cancer risks are presented in Table 5-5. For the chemical risk evaluation, groundwater-related risks are combined with soil-related risks for the future scenario site worker, resident adult, and resident child on an area-by-area basis. This was done to conform with the radiological risk evaluation. Potential exposures to the current and future scenario adolescent trespasser at Area A and Area G, the future scenario site worker, resident adult, and resident child at Area A and Area G result in estimated total cancer risks greater than the USEPA acceptable risk range. The predominant contributor (i.e., radiological or chemical) and the predominant environmental medium (i.e., air, soil, or groundwater) to the total estimated cancer risks varies.

Non-carcinogenic risks do not result from exposure to the radiological contaminants present at the Site. Therefore, a combined radiological and chemical non-carcinogenic hazard can not be evaluated.

TABLE 5-5

SUMMARY OF CANCER RISKS: RADIOLOGICAL AND CHEMICAL
CAPTAIN'S COVE

EXPOSURE POPULATION AND PATHWAY	CANCER RISK
CURRENT AND FUTURE SCENARIOS	
ADOLESCENT TRESPASSERS	
Ingestion of surface soil from Area A (chemical)	7E-06
Dermal contact with surface soil from Area A (chemical)	6E-06
Ingestion of and external gamma from surface soil from Area A (radiological)	5.9E-06
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E-05**
Ingestion of surface soil from Area G (chemical)	5E-07
Dermal contact with surface soil from Area G (chemical)	4E-07
Ingestion of and external gamma from surface soil from Area G (radiological)	1.2E-06
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E-06**
Dermal contact with surface water from the Retention Ponds and low area (chemical)	7E-08
Ingestion of sediment from the Retention Ponds (chemical)	1E-06
Dermal contact with sediment from the Retention Ponds (chemical)	N/A
Ingestion of and external gamma from sediment from Area B (radiological)	N/A
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-06**
FUTURE SCENARIOS	
SITE WORKERS	
Ingestion of surface soil from Area A (chemical)	2E-05
Dermal contact with surface soil from Area A (chemical)	6E-05
Ingestion of groundwater (chemical)	6E-02
Dermal contact with groundwater (chemical)	4E-05
Ingestion of and external gamma from surface soil from Area A and groundwater ingestion (radiological)	1.8E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**6E-02**
Ingestion of surface soil from Area G (chemical)	2E-06
Dermal contact with surface soil from Area G (chemical)	3E-06
Ingestion of groundwater (chemical)	6E-02
Dermal contact with groundwater (chemical)	4E-05
Ingestion of and external gamma from surface soil from Area G (radiological)	3.6E-05
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**6E-02**
CONSTRUCTION WORKER	
Ingestion of all soils from Area A (chemical)	7E-05
Dermal contact with all soils from Area A (chemical)	1E-05
Inhalation of respirable particulates at Area A (chemical)	4E-05
Ingestion of, external gamma from, and inhalation of respirable particulates from all soils from Area A (radiological)	1.4E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**3E-04**
Ingestion of all soils from Area G (chemical)	9E-06
Dermal contact with all soils from Area G (chemical)	2E-06
Inhalation of respirable particulates at Area G (chemical)	4E-06
Ingestion of, external gamma from, and inhalation of respirable particulates from all soils from Area G (radiological)	1.5E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E-04**

TABLE 5-5 (Continued)

SUMMARY OF CANCER RISKS: CHEMICAL AND RADIOLOGICAL
CAPTAIN'S COVE

EXPOSURE POPULATION AND PATHWAY	CANCER RISK	
ADULT RESIDENT		
Ingestion of all soils from Area A (chemical)	7E-03	*
Dermal contact with all soils from Area A (chemical)	3E-03	*
Ingestion of groundwater (chemical)	2E-01	
Dermal contact with groundwater (chemical)	5E-04	
Inhalation of chemicals volatilized from groundwater (chemical)	4E-08	
Ingestion, external gamma, produce ingestion, radon from soil at Area A and groundwater ingestion (radiological)	1.3E-01	
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**3E-01**	
Ingestion of all soils from Area G (chemical)	9E-04	*
Dermal contact with all soils from Area G (chemical)	4E-04	*
Ingestion of groundwater (chemical)	2E-01	
Dermal contact with groundwater (chemical)	5E-04	
Inhalation of chemicals volatilized from groundwater (chemical)	4E-08	
Ingestion, external gamma, produce ingestion, radon from soil at Area G and groundwater ingestion (radiological)	1.1E-01	
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**3E-01**	
CHILD RESIDENT		
Ingestion of all soils from Area A (chemical)	5E-03	
Dermal contact with all soils from Area A (chemical)	7E-04	
Ingestion of groundwater (chemical)	9E-02	
Dermal contact with groundwater (chemical)	2E-04	
Inhalation of chemicals volatilized from groundwater (chemical)	4E-08	
Ingestion, external gamma, produce ingestion, radon from soil at Area A and groundwater ingestion (radiological)	3.1E-02	
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-01**	
Ingestion of all soils from Area G (chemical)	6E-04	
Dermal contact with all soils from Area G (chemical)	1E-04	
Ingestion of groundwater (chemical)	9E-02	
Dermal contact with groundwater (chemical)	2E-04	
Inhalation of chemicals volatilized from groundwater (chemical)	4E-08	
Ingestion, external gamma, produce ingestion, radon from soil at Area G and groundwater ingestion (radiological)	2.4E-02	
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-01**	

* Based on 30 year exposure, 6 year child exposure plus 24 year adult exposure.

SECTION 6

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6.0 SUMMARY

The FFS was implemented to investigate the overall extent of the radiological contamination identified at the Captain's Cove site. During the 1970's and 80's, the Site was used by the City of Glen Cove as a municipal landfill and accepted wastes from the Li Tungsten site. In 1997, the NYSDEC conducted a surficial radiation survey and delineated surficial contamination in two primary areas: the northwest corner (Area A) and the extreme eastern corner (Area G). Additional smaller areas of contamination were also identified (Areas B, C, D and E). The FFS included field observations, analytical sampling and gamma logging profiles which further characterized the areas delineated by the NYSDEC investigation.

Soil

In Area A, elevated concentrations (greater than 5 pCi/g) of thorium and uranium series radionuclides were found in all five test pits and eight of the 15 soil boreholes. Contaminated material was primarily found from the surface to approximately seven feet below grade.

In Area G, elevated concentrations of thorium and uranium series radionuclides were found in both test pits and in five of the eight soil borings. While the depth of contamination varied, the maximum radionculide concentrations were found in the soil at depths between 6 to 8 feet below grade.

In subsurface soils, VOCs were detected in relatively few samples from Areas A and G. VOCs were detected on the northeast edge of Area A (TP-2, SB-12 and SB-21) in soils from 0 to 6 feet. TAGM guidance values were exceeded for acetone, 2-butanone, and chlorobenzene. Likewise, seven SVOCs (benzo(b)fluoranthene, benzo(a) pyrene, benzo(a)anthracene, chrysene, 2-3 dimethylphenol, napththalene, and carbozole) were detected in subsurface soils at concentrations that exceeded the TAGM or USEPA SSL guidance values. In addition, total PCBs exceeded the TAGM guidance value (1,000 ug/Kg) in two samples (at concentrations up to 12,000 ug/Kg) located near the bulkhead in Area G and the east edge of Area A near the unpaved road. Pesticides such as heptachlor epoxide

were detected in five samples (three samples near the eastern end of Area A and two samples in Area G) with two of the five samples from Area A slightly exceeding the TAGM guidance value (20 ug/Kg).

Many inorganics in the subsurface soils located within Areas A and G were detected at higher concentrations than in areas outside the areas of radiological concern. Some inorganics in the soil are similar to accessory metals found in tungsten ore. For example, arsenic was detected in 28 soil samples and exceeded the site-specific background concentration in 24 samples and the TAGM guidance value in 23 samples. The highest concentration of arsenic (2,760 mg/Kg) was detected in TP-1 in Area A. In contrast, concentrations of arsenic detected in borings (SB-7 and SB-8) were 10.8 mg/Kg and 6.6 mg/Kg, respectively. Chromium, cobalt, manganese, nickel, antimony and beryllium also showed similar distribution patterns (higher in areas associated with Areas A and G than outside these areas).

Groundwater

Several VOCs (petroleum and chlorinated volatile hydrocarbons) were detected in samples from CDM-2 and MW-3 located geographically outside of Area A and G. Several SVOCs were detected in three monitoring wells (MW-3, CDM-1 and CDM-2). CDM-1 and CDM-2 are hydraulically upgradient of Area G and MW-3 is located in the middle of the site. One pesticide (Endosulfan sulfate) was detected at a low concentration in CDM-4. PCBs were not detected in any of the samples.

Inorganics in groundwater were frequently detected with similar distribution patterns. Arsenic, antimony, aluminum, selenium and thallium were detected above MCLs. For arsenic, aluminum and antimony, the highest concentrations were detected in MW-8 at concentrations exceeding the NYSDEC and EPA MCLs (6 ug/L to 200 ug/L). Arsenic was detected in seven of the ten wells at concentrations ranging from 2.3 J ug/L (MW-2) to 10,200 ug/L (MW-8). Antimony was detected in three of the 10 wells, with the highest concentration detected in MW-8 (41.4 ug/L). Aluminum was detected in four of the 10 wells at concentrations ranging from 25.6 J ug/L (MW-5) to 254 E ug/L (MW-8).

Uranium and thorium series radionuclide concentrations were less than 2 pCi/L in all

surface water samples.

Surface Water

VOCs, SVOCs and pesticides were not detected from the three surface water samples collected from the east and west retention ponds and topographic depression in the southwestern portion of the Site near Area C and downgradient of Area A. In general, SW-3 (topographic depression) had significantly higher concentrations of inorganics detected than either of the two retention pond samples. In addition, SW-3 exceeded the surface water standards for aluminum (15,000 ug/L), cobalt (43.6 ug/L), copper (333 ug/L), iron (62,000 ug/L), lead (418 ug/L), manganese (1,840 ug/L), nickel (63.6 ug/L), and zinc (77e ug/L).

Sediment

Only two VOC compounds (acetone and 2-butanone) were detected at low concentrations from one of the two sediment samples collected from the topographic depression near Area C. SVOCs and PCB compounds were not detected in either SED-1 (west retention pond) or SED-3 (topographic depression). Several pesticide compounds were detected. Inorganics detected in SED-3 generally had higher concentrations than SED-1. For example, antimony, arsenic, cadmium, chromium, and nickel were detected at higher concentrations in SED-3 than in SED-1. The lead concentration, for example, was approximately 69 times greater in SED-3 (3.9 mg/Kg vs. 271 mg/Kg). Uranium and thorium series radionuclide concentrations were less than 2 pCi/g in all sediment samples.

Radiological Risk

Radionuclide analyses of soil samples showed that ROPC are present in Area A and Area G 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 exceeded 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, does not pose any above-background risk to current or future populations.

Site worker, resident adult and resident child exposure to groundwater via ingestion resulted in total excess lifetime cancer risks 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 came from 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 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. 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. Estimated cancer risks 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. For the resident adult and resident child, estimated cancer risks 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.

Radiological and Chemical Risk

Despite the differences in the quantitative approach to assessing radiological and chemical carcinogenic risks, it is not inappropriate to sum the risk estimates for populations that may be exposed to both types of contaminants. The resultant combined risks provide the best estimate of the total estimated carcinogenic impact of Captain's Cove site contaminants on potentially exposed populations.

Potential exposures to the current and future scenario adolescent trespasser, the future scenario site worker, resident adult and resident child in Area A and Area G result in total

cancer risk estimates which are greater than the USEPA acceptable risk range. The predominant contributor (i.e., radiological or chemical) and the predominant environmental medium (i.e., air, soil, or groundwater) to the total estimated cancer risks varies.

Non-carcinogenic risks do not result from exposure to the radiological contaminants present at the site, therefore, a combined radiological and chemical non-carcinogenic hazard can not be evaluated.

SECTION 7

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SECTION 8

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8.0 GLOSSARY

8.1 Abbreviations and Acronyms

ABBREVIATION/ACRONYM	
ARARs	Applicable or Relevant and Appropriate Requirements
ARCS	Alternative Remedial Contracting Strategy
ASTM	American Society of Testing Materials
AWQC	Ambient Water Quality Criteria
CAA	Clean Air Act
C & D	Construction and Demolition (debris)
CDM	Camp Dresser and McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
Ci	Curie
CLP	Contract Laboratory Program
cm	Centimeter
CPM	Counts Per Minute
CRQL	Contract Required Quantification Limit
DO	Dissolved Oxygen
DOE	Department of Energy
DOT	Department of Transportation
ER-L	Effects Range-Low
ER-M	Effects Range-Medium
FAR	Federal Acquisition Regulation
FFS	Focussed Feasibility Study
FS	Feasibility Study
FSP	Field Sampling Plan
GM	Geiger Mueller (Pancake Detector)

Hart	Fred C. Hart Associates, Inc.
HASP	Health and Safety Plan
KCPM	Counts Per Minute x 1,000
LLRWPA	Low Level Radioactive Waste Policy Act
LNAPL	Light Non-Aqueous Phase Liquid
LOAEL	Lowest Observed Adverse Effect Level
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MPI	Malcolm Pirnie, Inc.
mrem	millirem
mR/h	milliRoentgen per hour
MSL	Mean Sea Level
MW	Monitoring Well
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Unit
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSWQS	New York State Water Quality Standards and Guidance Values
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment

PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCE	Perchloroethylene
pCi/g	picoCurie per gram
pCi/L	picoCurie per Liter
PIC	Pressurized Ion Chamber
PID	Photoionization Detector
POC	Principal Organic Contaminant
PRP	Potentially Responsible Party(ies)
PVC	Polyvinyl chloride
QAPjP	Quality Assurance Project Plan
R	Roentgen
Ra	Radium
RCRA	Resource Conservation and Recovery Act
rem	rem
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
ROPC	Radionuclide of Potential Concern
Roux	Roux Associates
SARA	Superfund Amendments and Reauthorization Act of 1986
SAS	Special Analytical Services
SB	Soil Boring
SDWA	Safe Drinking Water Act
SED	Sediment Sample
SGVs	Sediment Guideline Values
SOP	Standard Operating Procedure(s)
SPT	Standard Penetration Test
SPDES	State Pollution Discharge Elimination System
SSI	Site Screening Investigation

SSL	Soil Screening Level
Sv	Sievert
SW	Surface Water Sample
SVOC	Semi-Volatile Organic Chemical
TAGM	Technical Assistance Guidance Memorandum (NYSDEC)
TAL	Target Analyte List
TBC	"To Be Considered" Material
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
Th	Thorium
TOC	Total Organic Carbon
TP	Test Pit
TRVs	Toxic Reference Values
µg/Kg	microgram per Kilogram
µg/L	microgram per Liter
µR/h	microRoentgen per hour
U	Uranium
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USRADS	Ultra-Sonic Ranging and Data System
VOC	Volatile Organic Compounds

8.2 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).

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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.

8.3 Baseline Risk Assessment Terms

Acute Effect:

A toxic effect resulting from exposure to one dose or multiple doses occurring within a short period of time.

Adsorption:

The adhesion of chemicals in a thin layer of molecules to the surfaces of solid bodies (e.g., soil) with which they come in contact.

Assessment Endpoint:

An explicit expression of the environmental value that is to be protected.

Avian:

Of, relating to, or derived from birds.

Baseline Risk Assessment:

An assessment (see Risk Assessment below) conducted to evaluate health risks in the absence of any action to remediate (or clean up) a site.

Benthic:

Of, relating to, or occurring at the bottom of a body of water.

Bioaccumulation:

The net uptake of chemicals by organisms directly from water and/or through consumption of food.

Carcinogen:

A chemical that is capable of increasing the risk of cancer.

Carcinogenesis:

The production of cancer, very likely a series of steps. The carcinogenic event so modifies the genetic material or molecular control mechanisms of the affected cells that they give rise to a population of altered cells, which eventually form a malignant tumor.

Carnivore:

A flesh-eating animal.

Central Tendency Analysis:

An analysis of risks estimated for the average or median individual exposure or dose for the exposed population conducted as an alternative to the Reasonable Maximum Exposure

(RME) analysis. It is based on average exposure point concentrations in the different environmental media and 50th percentile exposure parameters. The analysis provides alternative risk estimates which, when compared to the RME risk estimates, allows risks to be characterized as a range. In so doing, the comparison provides a measure of the uncertainty in the baseline risk assessment process.

Chemical of Potential Concern (COPC):

A chemical selected for detailed evaluation in the risk assessment that is representative of the chemical contamination at the site and the health risks posed by those chemicals.

Chronic Daily Intake (CDI):

Rate of exposure to a chemical, expressed as the amount of the chemical people contact each day, averaged over the period of exposure (units = milligrams of chemical per kilogram body weight per day = mg/Kg/d).

Chronic Effect:

A toxic effect resulting from exposure to multiple doses over an extended period of time, typically many years or a lifetime.

Critical Effect:

In the spectrum of toxicity produced by a chemical, the adverse effect that occurs at the lowest dose. As the dose is increased from a no effect level, the critical effect is the first adverse effect to occur.

Data Evaluation:

The component of the risk assessment where relevant site data are compiled and analyzed to select radionuclides and chemicals of potential concern.

Dose:

The amount of a chemical to which a person is exposed (units = milligrams of chemical per kilogram body weight per day = mg/Kg/d). In laboratory studies, the dose is the amount of the test chemical given to each animal every day. USEPA Exposure Assessment Guidelines (57 FR 22888 - 22938, 29 May 92) make the following distinctions:

Absorbed Dose: The amount of the chemical that crosses the outer boundary of the body (e.g., as with dermal exposure) and is available for interaction with biologically significant receptors.

Applied Dose: The amount of a chemical at the absorption barrier of the body (e.g., the lung or the digestive tract) available for absorption.

Dose-Response Relationship:

The quantitative relationship between the amount of exposure to a chemical and the extent of toxic effect produced by that exposure.

Epidemiological Study:

Study of human populations to identify causes of disease. Epidemiology studies often compare the health status of a group of persons who have been exposed to a suspect chemical with that of a comparable, but unexposed, group.

Equilibrium Partitioning (EqP) Approach:

The equilibrium partitioning (EqP) approach to sediment classification focuses on predicting the chemical interaction among sediment, interstitial water (i.e., the water between sediment particles), and contaminants. Chemically contaminated sediments are expected to cause adverse biological effects if the predicted interstitial water concentration for a given contaminant exceeds the chronic water quality criterion for that contaminant.

Excess Lifetime Risk:

The additional or extra risk incurred over the lifetime of an individual. Approximately 20% - 30% of the population will develop cancer during a lifetime; this is the background cancer rate. Excess risk is that level of risk which is in addition to the background rate.

Exposure:

Contact of an organism (human or animal) with a chemical agent. Exposure is quantified as the amount of the chemical coming into contact with the outer boundary of the body. Most of the time, the chemical is contained in air, water, soil or a commercial/industrial product and exposure to the chemical is a result of exposure to the media containing the chemical.

USEPA Exposure Assessment Guidelines (57 FR 22888 - 22938, 29 May 92) provide the following definition: Exposure to a chemical is the contact of that chemical with the external side of the boundary separating the "outside of the body" from the "inside of the body".

Exposure Assessment:

The component of risk assessment that involves determining or estimating the magnitude, frequency, duration, and route of exposure to a chemical in the environment. The exposure assessment considers the nature and size of the exposed population and can focus on past, current, or future exposures, based on different land uses, consumer usage and/or human activity patterns.

USEPA Exposure Assessment Guidelines (57 FR 2288 - 22938, 29 May 92) state that an exposure assessment describes the intensity, frequency and duration of contact, and often evaluates the rates at which the chemical crosses the outer boundary of the body, the resulting amount of the chemical that actually crosses the boundary, and the amount absorbed.

Exposure Pathway:

The physical course a chemical in the environment takes from its source to the point of human exposure. Soil or ground water can represent exposure pathways.

Exposure Point Concentration:

The estimated concentration of radionuclides and chemicals of potential concern at the location or point of contact between an organism and radionuclides or chemicals of potential concern. The exposure point concentration is estimated, for the period of exposure, using site data.

Exposure Route:

The way an environmental chemical enters the body (e.g., ingestion, inhalation, dermal absorption) after contact with a contaminated environmental medium (e.g., soil). Alternatively, the means by which an experimental animal is given a test chemical for evaluation of its toxic properties.

Exposure Scenario:

A set of facts and assumptions about how exposure to an environmental chemical takes place. The exposure scenario aids the risk assessor in quantifying the magnitude of exposure. An exposure scenario is usually defined in terms of human activity related to a specific land use (e.g., residential, occupational, recreational) or consumer activity (e.g., pesticide use, dry cleaning patronage).

Genotoxic:

Damaging to the genetic material (i.e., DNA) of cells in the body.

Gram:

A unit of measure for weight (mass) in the metric system. One gram is equivalent to 0.035 ounces; there are 28 grams in one ounce.

Hazard Quotient:

The ratio of an exposure level of a chemical (usually expressed as the chronic daily intake) to the reference dose or reference concentration for the chemical. The frequency and duration of exposure must be taken into account in estimating the exposure level used in evaluating the hazard quotient.

Herbaceous Vegetation:

Seed plants that lack woody tissue and die to the ground at the end of a growing season.

Herbivore:

A plant-eating animal.

Human Health Risk:

The likelihood (or probability) that an exposure or series of exposures to environmental chemicals may have or will affect the health of the exposed individuals; this health effect may be temporary or permanent.

Incidence:

The number of new cases of disease or a toxic effect in a population during a specified period of time. In a laboratory carcinogenicity study - the percentage of animals with tumors.

Individual Risk:

The probability that a theoretical individual person will experience an adverse effect - most often used in relation to cancer risk.

Intake:

A measure of exposure expressed as the mass of a chemical in contract with the exchange boundary of an individual's body. Intake is expressed in terms of the mass per unit body weight per day (milligrams of chemical per kilogram body weight per day = mg/Kg/d).

USEPA Exposure Assessment Guidelines (57 FR 22888- 22938, 29 May 92) provides the following definition: The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier.

Invertebrate:

An animal lacking a spinal column.

Kilogram:

One thousand grams. One kilogram is equivalent to 2.2 pounds.

Lifetime Average Daily Dose:

Rate of exposure to a chemical, expressed as the amount of the chemical people contact each day, averaged over an entire lifetime (units = milligrams of compound per kilogram body weight per day = mg/Kg/d).

Limited Evidence:

In relation to the Weight of Evidence classification scheme for carcinogens - a collection of facts and accepted scientific inferences which suggest that an agent may be causing an effect, but this suggestion is not strong enough to be considered established fact. Limited evidence indicates that other plausible factors cannot be ruled out as causes.

Linearized Multistage Model (LMS):

The USEPA's default low dose extrapolation model (see below). This is a conservative predictor of cancer risks based on a biological model of cancer initiation and development. At low (environmentally-relevant) doses the LMS model is linear and predicts an excess cancer risk for any exposure level above zero. In the absence of

scientific evidence to the contrary, the USEPA bases cancer risk estimates on an upper bound to the low-dose cancer potency predicted by the LMS model.

Lognormal Distribution:

Data that are distributed such that when plotted show a skewed graph.

Low Dose Extrapolation:

The process of predicting response rates to very low (environmentally-relevant) doses from observed response rates at high (laboratory) doses used in carcinogenicity studies. High-to-low dose extrapolation involves mathematically modeling the biologic processes in carcinogenesis to allow prediction of response rates many orders of magnitude below those observed in the laboratory.

Lowest Observed Adverse Effect Level (LOAEL):

The lowest concentration of a material used in a toxicity test that produces a statistically significant adverse effect on the exposed population of test organisms as compared with the controls.

Microgram (μg):

One-millionth of one gram (1μg = 3.5×10^5 oz. = 0.000000035 oz.). Also equivalent to one-thousand of one milligram.

Milligram (mg):

One-thousandth of one gram (1 mg = 3.5×10^5 oz. = 0.000035 oz.). Also equivalent to one thousand micrograms.

Modifying Factor:

An uncertainty factor used in derivation of reference doses (RfDs) or reference concentrations (RfCs) from experimental data. The modifying factor is set greater than zero and less than or equal to ten; its magnitude reflects professional judgement regarding the quality of the data used for the assessment (e.g., number of species tested, completeness of the overall database).

95% Upper Confidence Limit (95% UCL):

No Data:

In relation to the Weight of Evidence classification scheme for carcinogens - a category of human and animal evidence in which no studies are available to permit one to draw conclusions as to the induction of a carcinogenic effect.

No Evidence:

In relation to the Weight of Evidence classification scheme for carcinogens - a situation in which there is no increased incidence of cancer in at least two well-designed and will-conducted animal studies of adequate power and dose in different species.

No Observed Adverse Effect Level (NOAEL):

In a dose-response experiment, the highest experimental dose at which there was no statistically or biologically significant increase in a toxic effect of the chemical being tested.

Normal Distribution:

Data that are distributed such that when plotted show a bell-shaped graph.

Omnivore:

An animal which consumes both flesh and plants.

One-Hit Model:

Mathematical model based on the biological theory that a single interaction ("hit") of some minimum amount of a carcinogen at a cellular target (e.g., DNA) can initiate an irreversible series of events eventually leading to a tumor.

Phytotoxic:

Toxic to plants.

Potency:

The strength of a chemical at producing a toxic effect, especially cancer. The cancer slope factor is a measure of a carcinogen's potency; the greater the slope factor, the higher the cancer risk for a given level of exposure.

Radionuclide of Potential Concern (ROPC):

A radionuclide selected for detailed evaluation in the risk assessment that is representative of the radiological contamination at the site and the health risks posed by those chemicals.

RAGS:

Shorthand for the USEPA's Risk Assessment Guidance for Superfund which provides the basic guidance for conducting baseline risk assessments.

Reasonable Maximum Exposure (RME):

The usual exposure conditions recommended for evaluation in a risk assessment by the USEPA. RME is to represent the highest exposure that may reasonably be expected to occur at the site, that is, one that is well above the average case of exposure by within the range of possibility. In practice, RME is evaluated by considering average concentrations of the chemicals (or radionuclides) of concern and upper bound (i.e., 90th or 95th percentile) exposure parameters.

Receptor:

The entity (e.g. organism, population, community, ecosystem) that might be adversely affected by contact with or exposure to a substance of concern.

Reference Concentration (RfC):

An estimate (with uncertainty spanning perhaps an order of magnitude or greater) of the daily inhalation exposure level to the human population (including sensitive subpopulations) that is likely to be without appreciable risk of deleterious effects during a lifetime. The RfC is expressed in units of milligrams of chemical per cubic meter of air (mg/m^3).

Reference Dose (RfD):

An estimate (with uncertainty spanning perhaps an order of magnitude or greater) of the daily exposure to the human population (including sensitive subpopulations) that is likely to be without appreciable risk of deleterious effects during a lifetime. The RfD is expressed in units of milligrams of chemical per kilogram body weight per day (mg/Kg-day).

Respirable Particulates:

Particles (e.g., soil particles) that when suspended in air are of a size (i.e., usually less than 10 microns in mean aerodynamic diameter) that may penetrate into the deeper portions of the respiratory system of the body when inhaled.

RESRAD:

A computer model developed by researchers at Argonne National Laboratory for calculating exposure pathway-specific radiation dose equivalents and carcinogenic risk resulting from exposure to radioactive materials in soil.

RESRAD-Baseline:

A related computer model developed by researchers at Argonne National Laboratory which uses user-supplied, environmental medium-specific radionuclide concentrations in environmental media other than soil and, following RAGS methodology, calculates carcinogenic risk.

Risk:

Probability of injury, disease, or death under specific circumstances. In quantitative terms, risk is expressed in values ranging from zero (no possibility of harm) to one (a certainty that harm will occur). The following are some examples of the manner in which risk is expressed:

1E-4	$= 1x10^{-4}$	= 1/10,000	= 0.0001	= risk of one in ten thousand
1E-5	$= 1x10^{-5}$	= 1/100,000	= 0.00001	= risk of one in one hundred thousand
1E-6	$= 1x10^{-5}$	= 1/1,000,000	= 0.000001	= risk of one in one million
1.3E-4	$= 1.3x10^{-4}$	= 1.3/10,000	= 1/7700	= 0.00013 = risk of one in seven thousand seven hundred

Risk Assessment:

The process of evaluating the probability of injury, disease or death from exposure to chemicals in the environment. Risk assessment usually involves evaluating the toxic properties of a chemical and the conditions of human exposure to it both to ascertain the likelihood that exposed humans will be adversely affected, and to characterize the nature of the effects they may experience.

Risk Characterization:

Final component of risk assessment that involves integration of the data and analysis involved in data evaluation, exposure assessment, and toxicity assessment to determine the likelihood that humans will experience any of the various forms of toxicity associated with the chemical being assessed.

Route of Exposure:

See Exposure Route.

Slope Factor:

The slope of the dose-response curve in the very low dose range (typically between zero and approximately one percent response). The slope factor is a measure of the cancer potency of a chemical for use with exposures expressed in terms of dose as milligrams of chemical per kilogram body weight per day. The cancer slope factor is a plausible upperbound estimate of the probability of developing cancer from a unit exposure to the chemical being assessed. The slope factor is used to generate an upperbound estimate of excess cancer risk from a lifetime average daily dose expressed in mg/Kg/d.

Species:

A group of closely related, morphologically similar individuals which interbreed.

Stressor:

Any physical, chemical or biological entity that can induce an adverse response.

Sufficient Evidence:

In relation to the Weight of Evidence classification scheme for carcinogens - a collection of facts and scientific evidence which is definitive enough to establish that the adverse effect is caused by the agent in question.

Systemic Toxicity:

Toxic effects observed at a site or sites distant from the entry point of a chemical into the body. The chemical must be absorbed and distributed throughout the body to its site of toxic action. Most chemicals that produce systemic do not cause a similar degree of injury in all organs; they usually produce toxicity in only one or two organs (these are referred to as the target organs).

Target Organ:

See Systemic Toxicity.

400830

Threshold Dose:

The dose or level of exposure to a chemical below which no toxic effect occurs. Toxicity only becomes apparent when exposure exceeds the threshold. The implication of a threshold is that there are levels of exposure below which there is no risk of health impairment.

ToxicityAssessment:

Also termed the dose-response assessment, the component of risk assessment that describes the quantitative relationship between the amount of exposure to a chemical and the extent of toxic effects or disease. This involves evaluating toxicity information and characterizing the quantitative relationship between the chemical dose administered or received and the incidence of toxic effects in the exposed population (human or laboratory animals). From the quantitative dose-response relationship, toxicity values are derived that are used in the risk characterization step to estimate the likelihood of adverse effects occurring in humans at different exposure levels.

Toxicity Criterion:

A numerical expression of a chemical's dose-response relationship for use in risk assessment. The most common toxicity values are reference doses and reference concentrations (for assessment of non-cancer toxicity) and cancer slope factors (for assessment of cancer risk).

Uncertainty Factors:

Factors used in derivation of reference doses (RfDs) or reference concentrations (RfCs) form experimental data. The RfD/RfC is set by dividing a NOAEL ro LOAEL by uncertainty factors to account for:

(a) the variation in susceptibility among individuals of the human population;

(b) the uncertainty in extrapolating animal data to the case of humans;

(c) the uncertainty in extrapolating from data obtained in a less-than-lifetime study to a lifetime exposure level; and

(d) the uncertainty in using LOAEL data rather than NOAEL data.

Usually these factors are set equal to ten for each applicable area of uncertainty and are multiplied together, thus the total uncertainty adjustment may range form 10-fold to 10,000-fold.

Upperbound Estimate:

An estimate that is thought to be higher than a true, but unmeasurable, value. In cancer risk assessment, the upperbound risk estimate is thought to be a plausible upper limit to the risk that is consistent with a proposed mechanism of carcinogenesis. It is recognized that the true value of risk is likely to be lower than the upperbound estimate.

Weight-of-Evidence:

A USEPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen.

400832

ATTACHMENT A

400833

ATTACHMENT A

APPENDIX
CAPTAIN'S COVE ADJUNCT
Glen Cove, New York
Development Log MW7, May 1998

G:\USERS\...\TUNGSTEN\WELLDATA.XLS\GW ROUND1 May 1998

Time	Gallons Purged	pH (S.U.)	Turbidity (NTUs)	Temp. (°C)	Dissolved Oxygen (mg/l)	Conductivity (UMHO/cm)
1200	5	9.28	>1000	13.1	11.30	503
1210	15	9.27	>1000	12.8	11.90	479
1220	25	9.25	996	13.2	11.91	465
1230	40	9.30	368	13.5	11.90	454
1240	50	9.25	690	13.4	11.90	385
1250	60	9.22	308	13.4	11.99	439
1300	70	9.14	227	13.8	11.90	441
1310	80	8.53	218	13.7	11.75	446
1320	90	8.76	268	14.1	11.66	445
1330	100	8.23	164	13.7	11.72	444
1340	110	8.45	142	13.6	11.75	435
1350	120	8.37	137	13.7	11.86	431
1400	130	8.37	136	13.7	11.85	431
1410	140	8.36	136	13.6	11.85	432

APPENDIX
CAPTAIN'S COVE ADJUNCT
Glen Cove, New York
Development Log MW8, May 1998

G:\USERS\...\TUNGSTEN\WELLDATA.XLS\GW ROUND1 May 1998

Time	Gallons Purged	pH (S.U.)	Turbidity (NTUs)	Temp. (°C)	Dissolved Oxygen (mg/l)	Conductivity (UMHO/cm)
915	10	8.5	57	14.2	11.08	113
917	15	8.65	101	13.8	11.17	104
927	25	9.30	557	13.3	11.46	814
937	30	9.10	310	14.6	10.69	815
947	40	9.16	180	14.6	10.65	756
957	50	9.18	116	13.9	11.01	765
1007	60	9.14	106	14.1	10.85	766
1017	70	9.21	79	13.8	10.96	774
1027	80	9.08	91	13.8	11.04	735
1037	90	9.24	75	13.6	10.90	744
1047	100	9.22	77	13.6	11.26	767
1057	110	9.27	97	13.3	11.14	732
1107	120	9.20	56	13.6	10.91	718
1117	130	9.30	47	13.6	11.08	719
1130	135	9.31	49	13.8	10.97	715

ATTACHMENT B

400837

ATTACHMENT B

MW

Well No. COM3

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 800/202303

DATE: 5/21, Collected at 1230

SAMPLERS: JG/J.C Collected CC-MW-DUP-01 @ 1300

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 15.41'

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 5.48'

4) Volume of water in Casing (ga): 1.68/volume

V = 0.0408(# 2)² X (# 1 - # 3) = # 4

V = 0.0408( )² X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	In. 7.1	1	2	3							
Time (24 hr clock)	1140	1205	1212	1220							
Conductivity (MHO/cm)	.625	.595	.557	.559							
Eh (mV) DO mg/L	12.64	13.27	13.54	13.32							
pH (SU)	7.16	7.04	7.03	7.03							
Temp. (°C)	13.9	13.3	12.7	12.8							
Turbidity (NTUs)	263	105	80	55							
	5.17%	.02	.02	.02	.02						

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

FIGURE 3-14

400839

MW-

Well No. COM2

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Cap Tain's Cove

PROJECT NUMBER: 800 1 202 303

DATE: 5/21/98 Collected at 1015

SAMPLERS: J.G / J.G

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 24.95'

2) Casing Internal Diameter (in): 2"

3) Water Level Below Top of Casing: 3.98'

4) Volume of water in Casing (ga): 3.56 gallons/volume

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4						
Time (24 hr clock)	9:05	9:15	9:32	9:55							
Conductivity (MHO/cm)	.636	1.29	1.24	1.22							
Eh (mV) DO mg/L	9.24	12.58	13.62	13.63							
pH (SU)	6.56	6.46	6.42	6.43							
Temp. (°C)	23.7	15.8	15.1	15.2							
Turbidity (NTUs)	138	>999	>999	>999							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

FIGURE 3-14

400840

Well No. MW 3

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: _____

PROJECT NUMBER: _____

DATE: 5/19/98

SAMPLERS: J.G / J.C.

DATE OF INSTALLATION: _____

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 22.22

2) Casing Internal Diameter (in): 2"

3) Water Level Below Top of Casing: 12.26

4) Volume of water in Casing (ga): 1.69 gallons/volume

V = 0.0408(# 2)² X (# 1 - # 3) = # 4

V = 0.0408( )² X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	I.T.1	1.69	3.38	5.07							
Time (24 hr clock)	1421	/	1433	1445							
Conductivity (MHO/cm)	1.32	/	.678	.689							
~~Eh~~ (mV) DO	9.44	/	11.90	12.01							
pH (SU)	7.11	/	6.94	7.10							
Temp. (°C)	28.8	Dry @	23.8	22.7							
Turbidity (NTUs)	144	1425	999>	999>							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

Dry @ 1425 after 1 Volume

FIGURE 3-14

400841

Well No. MW7

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001202303

DATE: 5/22/98 Collected at 1005

SAMPLERS: J.G / J.C

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 18.3'

2) Casing Internal Diameter (in): 4" PVC

3) Water Level Below Top of Casing: 7.05'

4) Volume of water in Casing (ga): 7.42 gallons / volume

$V = 0.0408(\# 2)^2 X (\# 1 - \# 3) = \# 4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4						
Time (24 hr clock)	0915	0930	0942	0950	1000						
Conductivity (MHO/cm)	.426	.354	.356	.379	.374						
~~Eh~~ (mV) DO mg/L	14.19	13.11	12.70	13.31	13.44						
pH (SU)	9.29	9.14	9.03	8.98	8.99						
Temp. (°C)	13.4	14.5	14.9	14.0	13.9						
Turbidity (NTUs)	>999	912	881	459	85						
Salinity	.01	.01	.01	.01	.01						

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400842

Collected Sample @ 1005

FIGURE 3-14

Well No. MW8

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001202 303

DATE: 5/22/98 Collected at 1300

SAMPLERS: J-G / J.C

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 20.15'

2) Casing Internal Diameter (in): 4" PVC

3) Water Level Below Top of Casing: 11.60'

4) Volume of water in Casing (ga): 5.64 gallons / volume

$V = 0.0408(\#2)^2 \times (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 \times (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	1150	1204	1215	1230	1255						
Time (24 hr clock)	Initial	1	2	3	4						
Conductivity (MMO/cm) mS/cm	5.50	5.35	5.32	5.33	5.33						
~~Eh~~ (mV) DO	12.05	12.07	12.06	12.08	12.07						
pH (SU)	9.77	9.72	9.05	8.57	8.58						
Temp. (°C)	16.8	16.4	15.2	15.7	15.7						
Turbidity (NTUs)	>999	>999	>999	>999	>999						
SAL	.29	.26	.26	.26	.26						

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

400843

Single Color is Grey-Black
VOA's are effervescent

FIGURE 3-14

Mw-

Well No. CD7

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001202303

DATE: 5/21/98, Called at 1520

SAMPLERS: J. D/ J.C.

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): ~~13.14~~ 24.64'

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 13.14'

4) Volume of water in Casing (ga): 1.95 gallons/volume

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3							
Time (24 hr clock)	1440	1485	1505	1515							
Conductivity (~~MHO/cm~~) mS/cm	1.50	1.41	1.48	1.48							
~~Eh~~ (mV) DO mg/L	14.94	15.04	14.76	14.51							
pH (SU)	6.92	6.80	6.84	6.85							
Temp. (°C)	13.7	12.8	12.6	12.6							
Turbidity (NTUs)	62	781	711	832							
SAL %	.06	.06	.06	.06							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

400844

Sample Color - Root

FIGURE 3-14

Well No. MW-COM 4

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: _____

PROJECT NUMBER: _____

DATE: 5/20/98

SAMPLERS: J.C / J.C

DATE OF INSTALLATION: _____

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 19.90'

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 12.13'

4) Volume of water in Casing (ga): 1.32 gallons / Volume

V = 0.0408(# 2)² X (# 1 - # 3) = # 4

V = 0.0408( )² X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4						
Time (24 hr clock)	1223	1225	1230	1235							
Conductivity (MHO/cm)	2.10	1.51	1.44	1.42							
~~Eh (mV)~~ DO	13.97	15.30	15.07	15.06							
pH (SU)	6.86	7.00	6.83	6.84							
Temp. (°C)	16.0	13.2	13.7	13.6							
Turbidity (NTUs)	319	576	999	999							
Salinity		.09	.07	.06							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400845

FIGURE 3-14

Well No. MW6

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: _____

PROJECT NUMBER: _____

DATE: 5/20/98

SAMPLERS: JG / J.C

DATE OF INSTALLATION: _____

DEVELOPMENT / PURGING METHOD: Centrigal Pump 3/4" Poly-

1) Total Casing & Screen Length (ft): 21.49

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 10.91'

4) Volume of water in Casing (ga): 1.79 gallons/volume

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4						
Time (24 hr clock)	1141	1144	1145	1152							
Conductivity (~~MHO/cm~~) mS/cm	7.92	6.27	8.72	7.99							
~~Eh (mV)~~ DO mg/L	9.91	11.74	12.22	12.21							
pH (SU)	7.38	7.79	7.41	7.40							
Temp. (°C)	20.8	15.8	16.3	16.2							
Turbidity (NTUs)	330	321	315	300							
Sal	.43	.33	.47	.49							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

400846

Grey - Color - Turbid -

FIGURE 3-14

Well No. MW2

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: _____

PROJECT NUMBER: _____

DATE: 5/20/98

SAMPLERS: JG / J-C.

DATE OF INSTALLATION: _____

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 16.66

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 13.26

4) Volume of water in Casing (ga): .57 gallons / volume

V = 0.0408(# 2)² X (# 1 - # 3) = # 4

V = 0.0408( )² X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	In. 7.1	1	2	3	4						
Time (24 hr clock)	1028	1032	1035	1038							
Conductivity (MHO/cm)	1.63	1.65	1.62	1.61							
~~Eh~~ (mV) DO mg/L	12.53	13.42	13.41	13.42							
pH (SU)	7.02	7.05	7.03	7.03							
Temp. (°C)	14.8	13.4	13.2	13.1							
Turbidity (NTUs)	>999	>999	>999	>999							
Salinity %	.07%	.08	.08	.08							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

400847

Sample - orange-brown color. set Turbid.

FIGURE 3-14

Well No. MW1

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: 8001202303

PROJECT NUMBER: Captain Cove

DATE: 5/20/98

SAMPLERS: JG/J.C

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 21.25'

2) Casing Internal Diameter (in): 2" PVC

3) Water Level Below Top of Casing: 15.62'

4) Volume of water in Casing (ga): .95 gallons / volume

V = 0.0408(# 2)² X (# 1 - # 3) = # 4

V = 0.0408( )² X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4						
Time (24 hr clock)	0942	0946	0948	0952							
mS/cm Conductivity (~~MHO/cm~~)	1.91	1.81	1.83	1.82							
~~Eh~~(mV) DO	13.52	14.36	14.79	14.72							
pH (SU)	7.16	7.16	7.17	7.17							
Temp. (°C)	13.4	12.8	12.0	12.1							
Turbidity (NTUs)	>999	>999	>999	>991							
Sol Sp	.09	.08	.08	.08							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL (gal/ft)	0.17	0.66	1.50	2.60

400848

FIGURE 3-14

Well No. MW5

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001202 303

DATE: 5/19/98

SAMPLERS: J. G / J. C

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD:

1) Total Casing & Screen Length (ft): 20.05'

2) Casing Internal Diameter (in): 2"

3) Water Level Below Top of Casing: 14.16'

4) Volume of water in Casing (ga): 1.00 / volume

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	Initial	1	2	3	4	5					
Time (24 hr clock)	1025		/	1055	1059						
Conductivity (~~MHO~~ mS/cm)	2.05		Purged	1.77	1.75						
~~Eh~~ (mV) DO mg/L	10.68		Dry after 2 vols	12.99	13.46						
pH (SU)	7.02			7.14	7.00						
Temp. (°C)	20.7			18.3	17.3						
Turbidity (NTUs)	>999			>999	>999						

PHOTO NUMBER IF TAKEN: 00 10.68 WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400849

FIGURE 3-14

Well No. CDM-1

WELL DEVELOPMENT / PURGING LOG

PROJECT NUMBER: Captain's Cove

PROJECT NUMBER: 8001 202 303

DATE: June 9, 1998

SAMPLERS: J. Caragine / H. Venderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 24.64

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 13.54

4) Volume of water in Casing (ga): 1.9

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	2	4	6							
Time (24 hr. clock)	1405	1412	1422	1430							
Conductivity (MHO/cm)	1.57	1.39	1.38	1.35							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	6.85	6.80	6.79	6.74							
Temp. (°C)	13.5	12.7	12.5	12.4							
Turbidity (NTUs)	112	>999	715	423							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400850

Well No. CDM-2

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001 202 303

DATE: June 10, 1998

SAMPLERS: J. Caragine / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 24.95

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 4.38

4) Volume of water in Casing (ga): 3.5

$V = 0.0408(\# 2)^2 X (\# 1 - \# 3) = \# 4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	3.5	7	10.5							
Time (24 hr. clock)	0835	0848	0905	0920							
Conductivity (MHO/cm)	0.688	1.47	1.46	1.46							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	6.75	6.41	6.39	6.40							
Temp. (°C)	17.5	15.4	15.3	15.2							
Turbidity (NTUs)	87	>999	840	427							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400851

Well No. ODM-3

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001 202 303

DATE: June 10, 1998

SAMPLERS: J. Caraeinc / H. Yendegron

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 15.41

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 5.06

4) Volume of water in Casing (ga): 1.8

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	2	4	6							
Time (24 hr. clock)	1100	1115	1130	1140							
Conductivity (MHO/cm)	0.598	0.541	0.540	0.538							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	7.05	6.98	6.99	6.98							
Temp. (°C)	16.9	13.4	13.1	13.0							
Turbidity (NTUs)	110	81	65	47							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400852

Well No. CDM-4

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Cattan's Cove

PROJECT NUMBER: 8001-202-303

DATE: June 10, 1998

SAMPLERS: J. Cragwe / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 19.90

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 13.32

4) Volume of water in Casing (ga): 1.1

$V = 0.0408(\# 2)^2 X (\# 1 - \# 3) = \# 4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	1	2	3							
Time (24 hr. clock)	1255	1300	1310	1320							
Conductivity (MHO/cm)	1.97	1.48	1.97	1.48							
~~Eh(mV)~~	—	—	—	—							
pH (SU)	7.05	6.91	6.81	6.79							
Temp. (°C)	16.2	13.5	13.2	13.1							
Turbidity (NTUs)	151	>999	723	566							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400853

Well No. MW-1

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 800/202303

DATE: June 11, 1998

SAMPLERS: J. Cragine / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 21.25

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 16.20

4) Volume of water in Casing (ga): 0.8

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	1	2	3							
Time (24 hr. clock)	1105	1110	1115	1120							
Conductivity (MHO/cm)	2.03	1.90	1.89	1.86							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	7.81	7.20	7.14	7.13							
Temp. (°C)	16.6	15.1	14.8	14.6							
Turbidity (NTUs)	97	999	826	710							

PHOTO NUMBER IF TAKEN: _____ WATER LEVEL AFTER DEVELOPMENT: _____

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400854

Well No. MW-2

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: CAPTAIN'S COVE

PROJECT NUMBER: 8001 202 303

DATE: JUNE 11, 1998

SAMPLERS: J. CARAGNE / H. HENDERSON

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: CENTRIFUGAL PUMP

1) Total Casing & Screen Length (ft): 16.66

2) Casing Internal Diameter (in): ~~2~~ 2

3) Water Level Below Top of Casing: 13.79

4) Volume of water in Casing (ga): 0.5

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	1	2	3							
Time (24 hr. clock)	1245	1250	1255	1300							
Conductivity (MHO/cm)	2.22	1.63	1.64	1.60							
~~Eh (mV)~~	—			—							
pH (SU)	7.11	6.95	6.98	6.95							
Temp. (°C)	15.6	14.0	13.8	13.6							
Turbidity (NTUs)	81	>999	>999	789							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400855

Well No. MW-3

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 8001 202 303

DATE: June 10, 1998

SAMPLERS: J. Cardenas / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 22.22

2) Casing Internal Diameter (in): 13.64

3) Water Level Below Top of Casing: 2

4) Volume of water in Casing (ga): 1.5

V = 0.0408(# 2)^2 X (# 1 - # 3) = # 4

V = 0.0408( )^2 X (-) = _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	1.5	3.0	4.5							
Time (24 hr. clock)	0950	↑	1005	1015							
Conductivity (MHO/cm)	0.685		0.671	0.666							
~~Eh (mV)~~	—		—	—							
pH (SU)	6.99		6.94	6.90							
Temp. (°C)	18.1		16.4	15.9							
Turbidity (NTUs)	105	↓	7999	7999							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400856

Well No. MW-5

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: CAPTAIN'S COVE

PROJECT NUMBER: 8001-202-303

DATE: JUNE 10, 1998

SAMPLERS: I. CARAGINE / H. HENDERSON

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: CENTRIFUGAL PUMP

1) Total Casing & Screen Length (ft): 20.05

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 14.30

4) Volume of water in Casing (ga): 1.0

$V = 0.0408(\# 2)^2 X (\# 1 - \# 3) = \# 4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	1	2	3							
Time (24 hr. clock)	1415	↑	1445	1455							
Conductivity (MHO/cm)	1.89		1.64	1.63							
~~Eh (mV)~~	—	~~X~~	—	—							
pH (SU)	6.95	~~X~~	6.90	6.89							
Temp. (°C)	16.9		13.0	13.0							
Turbidity (NTUs)	87	↓	>999	>999							

PHOTO NUMBER IF TAKEN: - WATER LEVEL AFTER DEVELOPMENT: -

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400857

Well No. MW-6

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captains Cove

PROJECT NUMBER: 8001202303

DATE: June 11, 1998

SAMPLERS: J. Gracine / H. Yenderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 21.49

2) Casing Internal Diameter (in): 2

3) Water Level Below Top of Casing: 11.71

4) Volume of water in Casing (ga): 1.7

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	2	4	6							
Time (24 hr. clock)	0630	0635	0640	0845							
Conductivity (MHO/cm)	6.99	6.24	6.23	6.23							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	7.56	7.32	7.33	7.30							
Temp. (°C)	17.0	15.9	16.0	15.8							
Turbidity (NTUs)	141	>999	526	305							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400858

Well No. MW-7

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captain's Cove

PROJECT NUMBER: 6001-202-303

DATE: June 9, 1998

SAMPLERS: J. Caragne / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 18.30

2) Casing Internal Diameter (in): 4

3) Water Level Below Top of Casing: 8.12

4) Volume of water in Casing (ga): 6.7

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	7	14	21	28						
Time (24 hr. clock)	1300	1310	1320	1330	1340						
Conductivity (MHO/cm)	0.489	0.402	0.378	0.369	0.368						
~~Eh (mV)~~	—										
pH (SU)	9.35	9.06	9.05	9.04	9.05						
Temp. (°C)	13.8	13.6	13.4	13.4	13.2						
Turbidity (NTUs)	>999	>999	721	247	101						

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

400859

Well No. HW-8

WELL DEVELOPMENT / PURGING LOG

PROJECT NUNBER: Captains Cove

PROJECT NUMBER: 800/202303

DATE: June 11, 1998

SAMPLERS: J. Gragnani / H. Henderson

DATE OF INSTALLATION:

DEVELOPMENT / PURGING METHOD: Centrifugal Pump

1) Total Casing & Screen Length (ft): 20.15

2) Casing Internal Diameter (in): 4

3) Water Level Below Top of Casing: 12.52

4) Volume of water in Casing (ga): 6.5

$V = 0.0408(\#2)^2 X (\#1 - \#3) = \#4$

$V = 0.0408(\quad)^2 X (\quad - \quad) =$ _____ gallons

PARAMETER	ACCUMULATED VOLUME PURGED										
Gallons	INITIAL	6.5	13	20							
Time (24 hr. clock)	0925	0943	1000	1025							
Conductivity (MHO/cm)	5.91	4.98	5.04	5.03							
~~Eh (mV)~~	—	—	—	—							
pH (SU)	9.61	9.04	8.98	8.97							
Temp. (°C)	17.1	15.4	14.9	15.0							
Turbidity (NTUs)	>999	>999	>999	>999							

PHOTO NUMBER IF TAKEN: — WATER LEVEL AFTER DEVELOPMENT: —

CONSTANT FOR CALCULATING BOREHOLE & WELL WATER VOLUMES

WELL ID	2-inch	4-inch	6-inch	8-inch
VOL.(gal/ft)	0.17	0.66	1.50	2.60

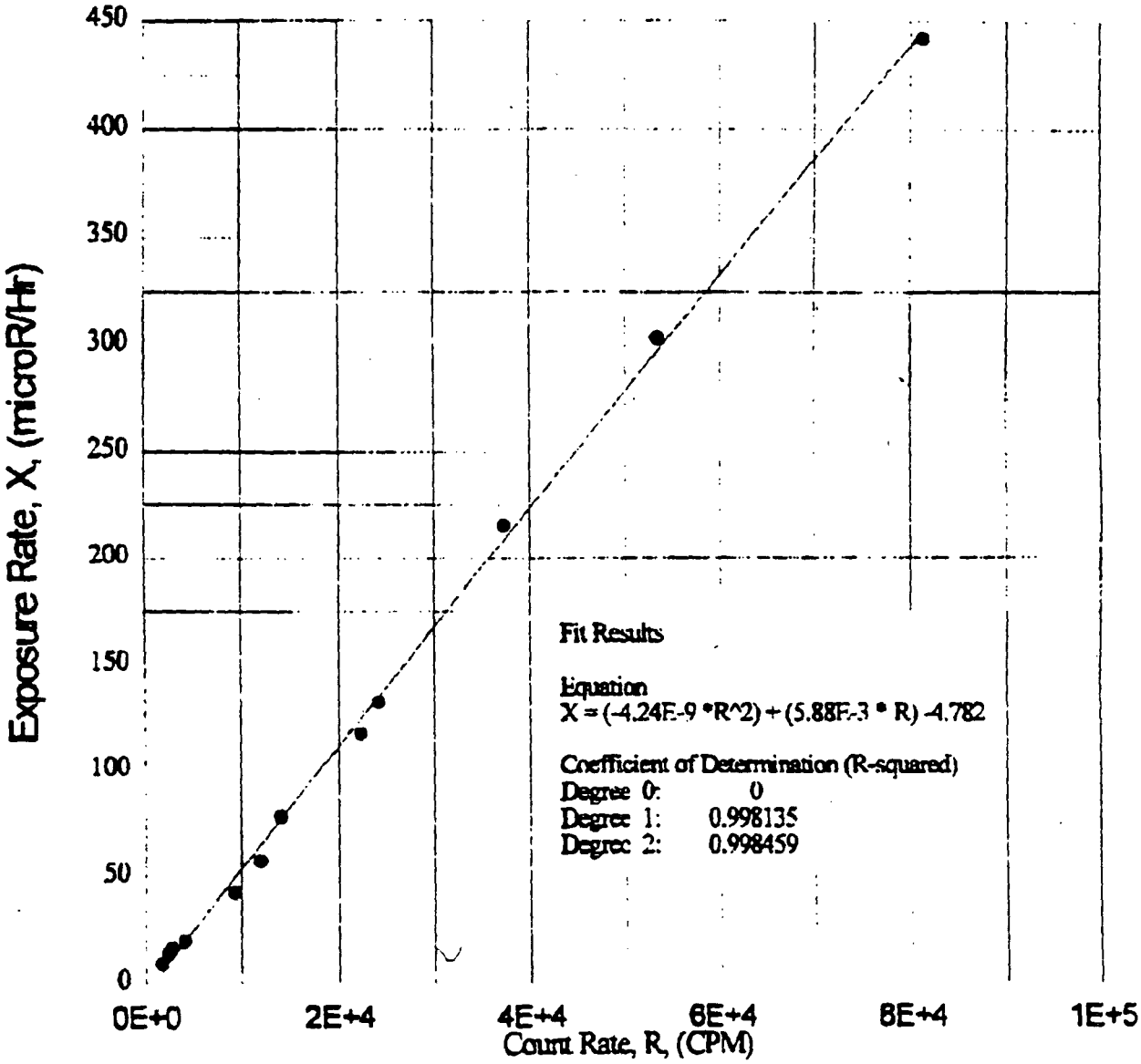
400860

ATTACHMENT C

400861

ATTACHMENT C

FIGURE - I
Observed Exposure Rate of Reuter Stokes Pressurized Ion Chamber
Model RSS-112 & 100 MicroR/hr
vs.
Observed Count Rate of Rate Meter Model
Ludlum 3 connected to a 1"x1" NaI Probe
At a Thorium Contaminated Site



Welsbach/General Gas Mantle RI/FS

Project # 8001-230

Conversion of Gamma Count Rates into Gamma Exposure Rates

INSTRUMENTS USED			
Instrument Type: Ratemeter	Model: Ludlum 3	Serial #: 83924	Cal. Due:
Associated Probe: 1"x 1" NaI			
PIC Type: Reuter-Stokes	Model: RSS-112 & 100 mR/hr	Serial #: J-151 & I-2410	Cal. Due: 4/25/98 & 4/24/98

FIELD DATA

Location: Captains Cove
Source Data

Data Point	Count Rate (cpm)
Top Center	1,500
Side 1, Center	1,700
Side 2, Center	1,800
Side 3, Center	1,800
Side 4, Center	1,800
Bottom	2,000
Average Count Rate (cpm) =	1,767
Average Exp. Rate (mR/hr) =	9.3

Location

Data Point	Count Rate (cpm)
Top Center	2,200
Side 1, Center	2,300
Side 2, Center	2,300
Side 3, Center	2,300
Side 4, Center	2,300
Bottom	2,800
Average Count Rate (cpm) =	2,367
Average Exp. Rate (mR/hr) =	13.9

Location:

Data Point	Count Rate (cpm)
Top Center	2,200
Side 1, Center	2,500
Side 2, Center	2,700
Side 3, Center	3,000
Side 4, Center	3,000
Bottom	3,200
Average Count Rate (cpm) =	2,767
Average Exp. Rate (mR/hr) =	16.2

Location:

Data Point	Count Rate (cpm)
Top Center	4,200
Side 1, Center	4,000
Side 2, Center	3,800
Side 3, Center	4,200
Side 4, Center	4,500
Bottom	4,200
Average Count Rate (cpm) =	4,150
Average Exp. Rate (mR/hr) =	19.5

Prepared By: _____ Date: _____

400864

Welsbach/General Gas Mantle RI/FS

Project # 8001-230

Conversion of Gamma Count Rates into Gamma Exposure Rates

INSTRUMENTS USED			
Instrument Type: Ratemeter	Model: Ludlum 3	Serial #: 83924	Cal. Due:
Associated Probe: 1"x 1" NaI			
PIC Type: Reuter Stokes	Model: RSS-112 & 100 mR/hr	Serial #: J-151 & J-2410	Cal. Due: 4/25/98 & 4/24/98

FIELD DATA

Location: Captains Cove Source Data		Location	
Data Point	Count Rate (cpm)	Data Point	Count Rate (cpm)
Top Center	9,000	Top Center	10,500
Side 1, Center	8,000	Side 1, Center	11,500
Side 2, Center	8,000	Side 2, Center	10,000
Side 3, Center	10,500	Side 3, Center	12,500
Side 4, Center	10,500	Side 4, Center	15,000
Bottom	10,000	Bottom	12,000
Average Total Background	9,333	Average Count Rate (cpm)	11,917
Average Net Count Rate (cpm)	42.6	Average Net Count Rate (cpm)	57.6
Location:		Location:	
Data Point	Count Rate (cpm)	Data Point	Count Rate (cpm)
Top Center	13,500	Top Center	50,000
Side 1, Center	17,500	Side 1, Center	75,000
Side 2, Center	14,000	Side 2, Center	68,000
Side 3, Center	10,500	Side 3, Center	90,000
Side 4, Center	15,500	Side 4, Center	95,000
Bottom	13,500	Bottom	110,000
Average Count Rate (cpm)	14,083	Average Count Rate (cpm)	81,333
Average Net Count Rate (cpm)	78.2	Average Net Count Rate (cpm)	442.4

Prepared By: _____ Date: _____

400865

Welsbach/General Gas Mantle RI/FS

Project # 8001-230

Conversion of Gamma Count Rates into Gamma Exposure Rates

INSTRUMENTS USED			
Instrument Type: Ratemeter	Model: Ludlum 3	Serial #: 83924	Cal. Due:
Associated Probe: 1"x 1" NaI			
PIC Type: Reuter Stokes	Model: RSS-112 & 100 mR/hr	Serial #: 1-151 & 1-2410	Cal. Due: 4/25/98 & 4/24/98

FIELD DATA

Location: Captains Cove
Source Data

Data Point	Count Rate (cpm)
Top Center	19,500
Side 1, Center	23,500
Side 2, Center	24,000
Side 3, Center	22,000
Side 4, Center	20,000
Bottom	25,000
Average Count Rate (cpm)	22,333
Average Exposure Rate (mR/hr)	117.4

Location

Data Point	Count Rate (cpm)
Top Center	19,000
Side 1, Center	25,000
Side 2, Center	25,000
Side 3, Center	24,500
Side 4, Center	20,000
Bottom	32,000
Average Count Rate (cpm)	24,250
Average Exposure Rate (mR/hr)	132.6

Location:

Data Point	Count Rate (cpm)
Top Center	32,000
Side 1, Center	36,000
Side 2, Center	36,500
Side 3, Center	42,000
Side 4, Center	37,500
Bottom	40,000
Average Count Rate (cpm)	37,333
Average Exposure Rate (mR/hr)	215.7

Location:

Data Point	Count Rate (cpm)
Top Center	42,000
Side 1, Center	52,000
Side 2, Center	55,000
Side 3, Center	54,000
Side 4, Center	53,000
Bottom	65,000
Average Count Rate (cpm)	53,500
Average Exposure Rate (mR/hr)	303.9

Prepared By: _____ Date: _____

400866

ATTACHMENT D

400867

ATTACHMENT D

400869

HTW DRILLING LOG

HOLE NO. SB-1

1. COMPANY NAME: Malcolm Pirnie	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area B/C
5. NAME OF DRILLER: Jeff	6. MANUFACTURER'S DESIGNATION OF DRILL: CT150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150 ConTerra; 3" S.S. / 2" S.S.; HNU 10.2eV; S.S. Bowls / Trowels; 3½" H.S.A; Ludlow Model 3 Survey Meter w/ 1"x1" NaI Detector + Model 2200 Scaler/Ratemeter	8. HOLE LOCATION: Exp - 1.3 KCPM
	9. SURFACE ELEVATION: 14.97
	10. DATE STARTED: 5/4/98 — 11. DATE COMPLETED: 5/4/98
12. OVERBURDEN THICKNESS: +300'	15. DEPTH GROUNDWATER ENCOUNTERED: —
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
14. TOTAL DEPTH OF HOLE: 10'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
N/A				✓ Rad 6-8'		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MATRIX SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		Lt. brown s. lt. 1. Tr/c f-m-sand, Trace gravel Roots in Top 1"	0 ppm .02 KCPM .05 KCPM (0 ppm)	0843		5 6 16 27	8" 6"
	2	S.A.A.	0 ppm .02 KCPM .05 KCPM (0 ppm)	0856		23 50/1	2" KCPM
	4		0 ppm .02 KCPM .05 (KCPM)			26 50/5	

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-1

HTW DRILLING LOG

HOLE NO. SB-1

PROJECT: Captains Cove Adjunct | INSPECTOR: [signature] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
				0921			
		S.A.A 3-4" Rock in basket					1" Recov
	6	LT. Brown To dk brn + LT. grey clay + silT. Trace f-c sand, gravel. 1/16" rounded. 3" Cobble at 7.0' dry.	.02 - .05 kcpm 0 ppm (0 ppm)	0929	X Collected SB-1 6-8' for Rad Analysis @1055	22 24 38 35	18" Recov
	8	9" S.A.A 10" LT. brown f-vf- silT, sand, w/ grey-1" clay lens at 9.5' 3" LT. brown f-m sand + silT, Trace c-gravel, dry	0 ppm .05 (kcpm) (0 ppm)	0949		10 12 14 17	22" Recov
	10	10' B.O.B. Installed 3" PVC logging for Gamma					Offset borehole 5' South due To obstruction @1008
	12						
	14						

PROJECT: Captains Cove Adjunct | HOLE NO. SB-1

400870

HTW DRILLING LOG

HOLE NO. SB-2

1. COMPANY NAME: Malcolm Pirnie Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area B/C
5. NAME OF DRILLER: Jeff	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150, CanTerra; 3" S.S / 2" S.S; HNU 10.2 eV; S.S. Bowls / Trowels; 3 1/4" H.S.A; Ludlow Model 3 Survey Meter	8. HOLE LOCATION: Exp 1.1 KCPM
	9. SURFACE ELEVATION: 13.50
	10. DATE STARTED: 5/4/98 — 11. DATE COMPLETED: 5/4/98
12. OVERBURDEN THICKNESS: 7.300'	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cut Grout.				

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	UNDISTURBED SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		Lt. brn Silt - Little f-m sand, occ - f-m gravel,	.02 - .05 KCPM (0 ppm)	1254		10, 22, 45, 48	18"
	2						
		S.A.A. 6" Dk Silt. 7" Gray - Silt. Lt Brown - Silt. Glass from metal (fill)	.02 - .05 (0 ppm)	1301	X, SB-2 2-4 1344 for Grad	14, 44, 44, 14	22"
	4						

PROJECT | HOLE NO

400871

HTW DRILLING LOG

HOLE NO. SB-2

PROJECT | INSPECTOR | SHEET OF SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
4	1/16	S.A.A, grey silt, occ gravel Tan brown f-c Sand, little f-c gravel - Trace silt	.05 Kcpm 0ppm	1315		1 22 28 32	22"
6	8	S.A.A.	.05 Kcpm 0ppm	1319		10 25 27 22	12"
8	10	S.A.A except silt + shell fragments in 11.5-12'	.05 Kcpm 0ppm	1324		3 6 7 4	17"
10	12	6" Silty-f-m Tan brown sand, Trace clay 4" Grey-Silt+Clay 8" - Grey - m-c - Sand, occ gravel - 11/16	.05 Kcpm 0ppm	1328		2 3 25 10	16"
12	14						

PROJECT 12-14 14" Peaty - Grey-Clay 2-5 - HOLE NO. 2-10

400872

HTW DRILLING LOG

HOLE NO: SB-3

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: Ad. G
5. NAME OF DRILLER: Jeff
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 ConTerra; 3" S.S / 2" S.S; HNu 10.2 eV; S.S. Bowls / Trowels; 3"x4" H.S.A.; Yellow Model 3 Survey Meter w/ 1"x1" + Pancake Detector + Model 2200 Ratemeter
8. HOLE LOCATION: Exp = 1.3 kcpm
9. SURFACE ELEVATION: 16.10
10. DATE STARTED: 4/24/98
11. DATE COMPLETED: 4/24/98
12. OVERBURDEN THICKNESS: + 300'
15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: N/A
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 15'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: N/A — VOC: — METALS: — OTHER (SPECIFY): ✓ SB-03-0-2' Rad — OTHER (SPECIFY): — OTHER (SPECIFY): —
21. TOTAL CORE RECOVERY: —
22. DISPOSITION OF HOLE: Grout — BACKFILLED: — MONITORING WELL: — OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MUSTER SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		Brown VF-M Silty Sand w/ some gravel / trace roots / brick fragments	RAD=0.01 HNu=0.0 (0 ppm) 0 ppm	1002	X Co 11.07 SB-03 0-2' for Rad. Analysis	4 6 12 16	18"
	2	6" SDA 5" Gray VF-M SAND w/ some Gravel & silt	RAD=0.01 HNu=0.0 (0 ppm) (0 ppm)	1015		14 16 50/5 —	4"
	4	Gray VF-M Silty Sand w/ some Gravel [illegible]	RAD=0.01 0 ppm (0 ppm)	1024		7 6 12 15	6"

400873

PROJECT | HOLE NO

HTW DRILLING LOG

HOLE NO. SB-3

PROJECT: Captain's Cove Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	Black VF-M Sand; trace Silt; gravel & wood & some asphalt in mat	RAD=0.01 HNu=BKGD (0 ppm) 0 ppm	1034		11 6 12 5	6"
	8	3" SAA 10" Brown Silt & Clay 2" Gray-brown Silt trace VF Sand & Clay	RAD=0.12 HNu=BKGD 0 ppm (0 ppm)	1039		2 4 6 6	15"
	10	2" SAA 6" Brown-gray VF Sandy Silt; trace clay 9" Brown clay; trace VF Sand	RAD=0.01 HNu=BKGD 0 ppm (0 ppm)	1042		6 5 7 6	17"
	12	SAA	RAD=0.01 HNu=BKGD (0 ppm)	1100		8 12 17 10	4"
	14						

PROJECT: Captain's Cove Adjunct | HOLE NO. SB-03

400874

HTW DRILLING LOG

HOLE NO. SB-4

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: Adj. To Area G
5. NAME OF DRILLER: Jeff / Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150 CanTerra; 3" S.S / 2" S.S; HWU 10.2 & U; S.S Bowls / Trowels; 3"x" HSA; Ludlum Model 3 Survey Meter w/ 1"x1" + Pancake Detector
8. HOLE LOCATION:
9. SURFACE ELEVATION: ±
10. DATE STARTED: 4/28/98
11. DATE COMPLETED: 4/28/98
12. OVERBURDEN THICKNESS: +300'
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: SB-4-2'-4', 4'-6' — VOC: ✓ — METALS: ✓ — OTHER (SPECIFY): — OTHER (SPECIFY): Rad ✓ — OTHER (SPECIFY): —
21. TOTAL CORE RECOVERY: ✓
22. DISPOSITION OF HOLE: Grout — BACKFILLED: ✓ — MONITORING WELL: — OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	HISTORY SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNTS (g)	REMARKS (h)
	2	6" Dk brown-silty-sand Trace Clay, Organics-moist Roots - 12" CT To dk brown Dk Grey-f-m-sand, Trace gravel, Trace Clay-glass fragments present.	0 ppm (0 ppm) .01 kcpm	1142		3, 17, 36, 48	18" Rec.
	4	DK Grey To Dk brown clayey-silt, Trace gravel, 1" of greenish-grey & orange clay at ≈ 3.0' red brick fragments present. 1" wood block fragment at ≈ 3.9'. Creosote odor,	1-2 ppm (3 ppm) .01 kcpm	1154	Collected SB-4-2-4 for Chem + Rad (1235)	15, 12, 24, 29	20" Rec.
		6" - Dk Grey-Sandy-Silt with wood fragments present Trace gravel, strong odor as 2-4	5 ppm (7 ppm) .01 kcpm	1211	Collected SB-4 4-6 for Chem Only 1248	12, 21	22" Rec

PROJECT: HOLE NO.

400875

HTW DRILLING LOG

HOLE NO. SB-4

PROJECT

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
		13" LT brown To LT gray f-m Silty sand, Trace clay, Trace gravel	0 ppm (0 ppm)			36 15	Rec
	6	No Recovery - wet;	.01 kcpm	1228		2 9 9 10	0" Recov
	8	S.A.A - wet	.01 kcpm	1240		4 12 1 1	0" Recov
	10	Wood fragments in 9.7-10'					
	12	Dk. Gray - Silty - f-m - sand and gravel Trace Clay	.01 kcpm	1244		Wt. Hammer	(1" Recov)
	14	Same A.A.; wood fragments present	.01 kcpm	1253		1 1 2 3	1" Recov

PROJECT

Drilled To 15' B.O.H.

HOLE NO.

400876

HTW DRILLING LOG

HOLE NO. SB-5

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area B+C
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 CanTerra; 3" S.S. / 2" S.S; HNu 10.2 eV; S.S. Bowls / Trowels; 3½" HSA; Ludlow Model 3 Survey Meter w/ 1"x1" + Pancake Det.	8. HOLE LOCATION: Exp = 1 kCPM
	9. SURFACE ELEVATION: 13.58
	10. DATE STARTED: 5/1/98 — 11. DATE COMPLETED: 5/1/98
12. OVERBURDEN THICKNESS: +30'>	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-5-2-4 Clean + Red	✓	✓	Red ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	1" Topsoil, roots - 21" Lt. brown To Tan silt. Trace fine sand, + gravel. 1/8", Trace clay - asphalt - cement. glass frgm	.06-.08 KCPM (0 ppm) (0 ppm)	0915		11 18 15 15	22"
	4	S.A.A. Glass fragments occ, Rags occ, wood fragments - glass fragments, asphalt	.06-.08 KCPM (0 ppm) (0 ppm)	0922	Collected SB-5 2-4 @ 1025 for Chem + Rad	10 12 16 10	
		No Recov - (Obstruction)	NR	0933		31 50/5½	

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-5

400877

HTW DRILLING LOG

HOLE NO. SB-5

PROJECT: Captain's Cove Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
		No Recov.		0938			No Recov
	6	LT Tan f-c sand; little gravel 1/8"-1/4" Trace to little silt. moist	.03-.04 (KCPM) (0 ppm) (0 ppm)	0941		15 22 20 21	13"
	8	S.A.A. except more gravel. Trace cobbles - 2"	.03-.04 KCPM (0 ppm) (0 ppm)	1007		8 14 13 9	14"
	10	S.A.A. except grading to vf-f- silty sand, Trace gravel - 1/16", saturated at 11.5-12.0'	.03-.04 KCPM 0 ppm (0 ppm)	1013		3 2 1 2	12"
	12	S.A.A (3") silty sand, Trace gravel 9" Dk black - to grey f-c sand, little gravel 1/32", Trace silt.	.03-.04 KCPM (0 ppm) 0 ppm -	1022		WT Ham 2 5 4	12"
	14						

400878

PROJECT: C.C Adj | HOLE NO. SB-5

Drilled To 15'

HTW DRILLING LOG

HOLE NO. SB-6

1. COMPANY NAME Malcolm Pirnie	2. DRILLING SUBCONTRACTOR EPTS
SHEET 1 OF 1 SHEETS 2	
3. PROJECT Captain's Cove Adjunct	4. LOCATION CC-SB-6 adjacent To existing MW5
5. NAME OF DRILLER EPTS; Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL CT 150 CanTerra
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 CanTerra; 2" S.S / 3" S.S; S.S. Bowls Trowels; 3 1/4" H.S.A; Ludlow Model 3 Survey Meter w/ 1"x1" + Pancake Det; Rotameter 2200	8. HOLE LOCATION As 4
	9. SURFACE ELEVATION Exposure 0.8 KCPM at hole
	10. DATE STARTED 9/22/98
	11. DATE COMPLETED 9/22/98
12. OVERBURDEN THICKNESS 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
		✓	N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Rad Only SB-0-2' SB-4-6'			Rad ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout			Rad ✓	

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE NO. OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		LT. Brown To dk brown Silt; some f-m LT br. Sand; few f-m gravel To some	(0.0 ppm) .09-.10 (KCPM) 0 ppm	Collected SB-06 0-2 for Rad X		5 6 13 17	0810 Recov 12"
	2	Same As Above; trace dk black To gray soil present + glass present. 1/4" m. TO br. S. Pt	(0.0 ppm) .08 KCPM 0 ppm			10 9 18 12	0821 Recov 13"
	4			Collected SB-06 4-6 for Rad X		3 2	0829 14" Recov

PROJECT Captain's Cove Adjunct HOLE NO. SB-06

400879

HTW DRILLING LOG

PROJECT: Captain's Cove Adjunct | INSPECTOR: [illegible] | HOLE NO. SB-6 | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	Dk black To Dk brown Silt and 1.77/e f-m sand; few gravel - 1/16" rounded; moist	(0.0 ppm) .10 (KCPM) 0 ppm			3 6	Recov 14"
	8	Dk black To dk brown silt and f-m sand; Rag fragments; few gravel moist; no odor	(0.0 ppm) .08 (KCPM) 0 ppm			3 2 4 3	0839 Recov 12"
	10	Tan brown f-m sand, Trace silt; few-some gravel	(0.0 ppm) .08 KCPM (2" Recov only) 0 ppm			2 3 50	0851 Refusal Augered To 10' 2" Rec
	12	No Recovery S.A.A 8-10 - in basket	NR			3 50+	0855 Augered To 12' Refusal
	14	Gry black To Tan brown f-m sand; Trace silt wet	(0.0 ppm) .05 (KCPM) 0 ppm			3 7 10 15	0915 6" Rec

400880

PROJECT | HOLE NO. SB-6

Augered To 15' To insert 3" PVC Pipe for gamma logging

HTW DRILLING LOG

HOLE NO. SB-7

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captains Cove Adjunct	4. LOCATION: Area D+E
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 CaTerra; 2" / 3" S.S Bowl Trowel; 3 1/4" H.S.A; Cullex Model 3 Survey Meter w/ 1" x 1" + Pancake Detector; Ratemeter / Scaler 2200	8. HOLE LOCATION: Area D+E, Exp. 0.9 KCPM
	9. SURFACE ELEVATION: 13.98
	10. DATE STARTED: 5/5/98
	11. DATE COMPLETED: 5/5/98
12. OVERBURDEN THICKNESS: + 300 >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-7-0-2' Chem; SB-7-4-6' Rad	—	—	Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	BLOCK SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
				1509	Collect		
			.04 KCPM. (3 ppm) 0 ppm		SB-7 0-2 @ 1559 for Chem		
		8" CT Bodk brown f-m sand, Trace gravel 1/64" pieces of brick (red) roots organics					2" Run
	2	Plastic, cling, metal (coils) wire		1511		3	
		S.A.A, Mag + wood fragments (occ) Trace silt.	.04-.05 KCPM (0 ppm)			3	
						3	
						7	
	4	S.A.A	NR				

400881

PROJECT: Captains Cove Adjunct HOLE NO. SB-7

HTW DRILLING LOG

HOLE NO. SB-7

PROJECT | INSPECTOR | SHEET OF SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
		S.A.A. Metal coils in Tip - Size light Tan - f.m - sand		1518	SB-7 4-6 for Bad	10 11 23 10	6" Rec
	6	LT Tan To orange-reddish brn - f-c sand, little silt - little gravel To 1/4" rounded.	.05 kcpm 0 ppm	1525	(553)	6 12 17 10	15"
	8	6" S.A.A except about shell fragments at 9.0' 12" DK black - To light grey - Silt + clay - Trace f-m sand, no gravel to little, saturated	.05 kcpm 0 ppm	1535		3 3 4 17	18"
	10	12" Clayey - Silt - w/ little vf - f LT - Tan sand grading To silty - gray - black - To Tan - vf - f sand, Trace clay - no gravel.	.05 kcpm 0 ppm	1537		7 9 10 10	15" Rec
	12	9" - LT. brown To Tan Silty - vf - f sand Trace clay 2" Tan Clay, little vf - f - sand 7" Tan (light) vf - f silty - sand Trace clay no gravel	.05 kcpm 0 ppm	1547		1 7 4 7	18"
	14						

PROJECT | HOLE NO. SB-7.

To 15' DG

400882

HTW DRILLING LOG

HOLE NO. SB8

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+J
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: between SB-22 + 23 (Cont.)
5. NAME OF DRILLER: Jeff / Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 ConTerra; 3" S.S. / 2" S.S; 3 1/4" HSA; Lujlex Model 3 Surveyor Meter w/ 1"x1" + Ponente Attenuator; Ratometer / Scaler 2200
8. HOLE LOCATION: 2.2 KCPM at Surface
9. SURFACE ELEVATION: 14.46
10. DATE STARTED: 5/6/98
11. DATE COMPLETED: 5/6/98
12. OVERBURDEN THICKNESS: +300 >+
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: SB-08-0-2 (Chem), 4-6, 8-8 (Red)

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
✓	—	Red ✓		

21. TOTAL CORE RECOVERY: —
22. DISPOSITION OF HOLE: Grout

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
✓		

23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	5" Dk brown To lt. brn silt; little f-m-sand Trace gravel, Trace clay 18" Lt. Orange-brn-v f-f-sand, Trace To little silt, no gravel (Backfill Material), T	.12 kcpm .07 kcpm 0 ppm (0 ppm)	0912	X SB8 0-2 for Chem @ 10/15	4 6 8 10	23"
	4	S.A.A, or-br sand; except more silt →	.07 (kcpm) 0 ppm (0 ppm)	0921		6 7 12 13	22"
		5" Lt. brown-To grey brn-silt-little f-m sand, Trace gravel Trace Clay	.07 (kcpm)			4 8	

PROJECT: Captain's Cove Adjunct HOLE NO. SB-08

400883

HTW DRILLING LOG

HOLE NO. SB8

PROJECT: Captain's Cove Adj. | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		8" Dk black silt. 1.Title f-m sand, Trace Clay- Trace gravel-1/8" 6" Gray-brn-f-m-sand	.20- .24 kcpm .07 kcpm		SB8 4-6 for Rad X @ 1010	25 18	24"
	6	Trace silt, Trace gravel- w/ shell fragment, moist.	0 ppm (0 ppm)	0933	SB-8 6-8 for Rad X 1010	3 7 8 3	
		Dk. black silt + Dk black clay- saturated. Trace to 1.Title f-m sand & gravel.	1.0 * kcpm 0 ppm (0 ppm)				8"
	8	8" Decomposed wood fragments w/ organics w/ dk black silt + lt brn clay- no gravel. / organic odor	.05- .08 kcpm 0 ppm (0 ppm)	0941		2 4 7 5	8"
	10	6" of LT Tan Tan yellow Tan silt. + 2 [illegible] 1.[illegible]le f-c-Tan sand, [illegible] gravel-1/16", sa[illegible]d.	.06 kcpm 0 ppm (0 ppm)	0948		3 4 5 14	6"
	12	S.A.A. w/ opt. more sand + 1.Title f-m gravel.	.06 kcpm 0 ppm (0 ppm)	0952		3 11 13 15	6"
	14						

PROJECT: 15' B.O.H C.C. Adjunct | HOLE NO. SB-08

400884

HTW DRILLING LOG

HOLE NO. SB-9

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 2 SHEETS	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Adj To G
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 Contam; 3"/2" S.S; 3 1/4" H.S.A; Ludlow Model 3 Survey Meter w/ 1"x1" + Pancake Beta Jan; Ratemeter / Scaler 2200	8. HOLE LOCATION: Exp = 1.2 KCPM at Surf.
	9. SURFACE ELEVATION: 16.13
	10. DATE STARTED: 4/23/98 — 11. DATE COMPLETED: 4/23/98
12. OVERBURDEN THICKNESS: +300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-09-0-2' Chem + Rad	✓	—	—	Rad		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		6" Brown VF-M Silty Sand w/some organics & gravel; 8" Brown VF-C Sand; some gravel, trace silt; + asphalt in nose of spoon	RAD = 0.06; HNu-BKGD (0 ppm)	0503		29, 35, 50/3", —	18"; Chem & Rad Sample
2		10" SAA; 8" Brown VF-M Silty Sand w/ some gravel, clay, asphalt frags.	RAD = 0.05; HNu-BKGD (0 ppm)	0518		16, 18, 21, 26	18"
4		SAA; + wood in nose of spoon	RAD = 0.04; 0 ppm; 0 ppm	0532		8, 8, 50/3", —	12"

400885

PROJECT: Captains Cove Adjunct — HOLE NO. SB-9

HTW DRILLING LOG

PROJECT: Captain's Cove Adj. | INSPECTOR: [illegible] | HOLE NO. SB-9 | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
6							
		2" Brown VF-M Silty Sand; some gravel 6" Black VF-M Sand; trace silt & gravel	RSD: 0.05 (0 ppm) (0 ppm)	1543		6 7 12 14	8" * wet at base
8							
		—	— .04 kcpm 0 ppm (0 ppm)	1555		8 12 16 19	0" No recovery
10							
		Black VF-M Sand trace Silt & Gravel	RSD: 0.02 (0 ppm) 0 ppm	1605		7 9 10 15	5"
12							
		SAA w/ rock in base of gravel	RSD: 0.02 0 ppm (0 ppm)	1624		20 18 6 4	6"
14			—				

PROJECT: Captain's Cove Adjacent | HOLE NO. SB-9

400886

HTW DRILLING LOG

HOLE NO: SB-10

1. COMPANY NAME: Malcolm Pirnie Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: Area G
5. NAME OF DRILLER: Jeff/Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 Contera; 3"/2" SS; 3 1/4" H.S.A; Ludlow Model 3 Sump Pump w/ 1"x1" + Pneumatic Detector; Ratemeter/Scaler 2200
8. HOLE LOCATION: Exposure = 1.3 KCPM at Surface
9. SURFACE ELEVATION: 11.64
10. DATE STARTED: 4/24/98
11. DATE COMPLETED: 4/24/98
12. OVERBURDEN THICKNESS: +300+ >
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED:
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: SB-10-2-4 for Rad — VOC: — METALS: — OTHER (SPECIFY): Rad ✓ — OTHER (SPECIFY): — OTHER (SPECIFY):
21. TOTAL CORE RECOVERY:
22. DISPOSITION OF HOLE: Cement Grout — BACKFILLED: — MONITORING WELL: — OTHER (SPECIFY):
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	UNDISTURBED SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		Brown VF-M Silty Sand; some Gravel & organics	RAD: 0.04 HNu-BKGD (0 ppm) 0 ppm	1301		5 7 13 17	12"
	2	3" SAA 5" Gray-brown Clay 5" Orange-brown VF-M Silty Sand; trace Gravel 7" Gray VF Sandy Clay; trace Silt & Gravel	RAD: 0.05 (0 ppm) 0 ppm	1312	X Collected SB-10 2-4 for Rad	6 9 10 10	20"
	4	6" SAA 2" Brown VF-M Silty Sand 6" Brown-Gray VF-M Silty Sand with trace gravel & clay	RAD: 0.05 0 ppm (0 ppm)	1324		5 7 11 13	14"

PROJECT: Captain's Cove Adjunct — HOLE NO: SB-10

400887

HTW DRILLING LOG

PROJECT: Captain's Cove Adjunct | INSPECTOR: [illegible] | HOLE NO. SB-10 | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	3" SAA 8" Black VF-M Sand, trace Gravel & Silt	RAD 0.06 HNu= 0KCD (0 ppm) 0 ppm)	1333		4 6 5 3	11"
	8	2" Gray Silty Clay w/ trace VF Sand 6" Black VF-M Sand, trace Silt & Gravel 3" Brown Gray VF-M Sand, trace Silt & Gravel 3" Black VF-M Sand, trace organics & silt	RAD= 0.07 HNu= 0KCD (0 ppm)	1342		3 5 5 3	14"
	10	5" SAA 3" Wood Fragment	RAD= 0.04 HNu= 0KCD (0 ppm) (0 ppm)	1353		3 8 11 15	8"
	12	SAA	Rad .04 KCPM 0 ppm (0 ppm)	1358			
	14						

PROJECT: Overburden Sp To 13 Captain's Cove Adjunct | HOLE NO. SB-10

400888

HTW DRILLING LOG

HOLE NO. SB-11

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150 Ca-Terra
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 Ca-Terra; 2" S.S; Bowls Tools - S.S; CT 150 Ca-Terra; 3 1/4" H.S.A; Ludlex Model 3 Survey; 1" x 1" - Dorcule Detector	8. HOLE LOCATION: SB-11 associated w. Th MW-6
	9. SURFACE ELEVATION: 11.70, Exp = 1.5 KCPM
	10. DATE STARTED: 9/22/98
	11. DATE COMPLETED: 9/22/98
12. OVERBURDEN THICKNESS: +300+ >	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-11-6-8'			✓ Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	LABORATORY SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		8" Brown VF-M Silty Sand w/ trace gravel 8' Brownish gray VF-M Silty Sand, trace Gravel & Clay	RAD = 0.05 0 ppm 0 ppm	1132		3 8 9 10	16"
	2	SAA	RAD: 0.06 0 ppm 0 ppm	1140		8 7 9 12	12"
	4	9" Grayish Brown VF-M Silty Sand; trace Gravel 10" Dark brown VF-M Sand w/ trace Silty sand, gravel, trace clay	RAD = 0.14 0 ppm 0 ppm	1150		3 6 9 14	19"

400889

PROJECT: Captain's Cove Adj | HOLE NO. SB-11

HTW DRILLING LOG

HOLE NO. SB-11

PROJECT Captain's Cove Adjunct | INSPECTOR [illegible] | SHEET OF 2 SHEETS 2

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	~~Peat~~ SAA	RAD = 0.24 0 ppm 0 ppm	1210	RAD Sample	8 10 13 17	14"
	8	6" SAA 2" Black VF-M Sand; trace Silt	RAD = 0.13 0 ppm (0 ppm)	1215		1 4 9 12	8"
	10	4" SAA 3" Gray Silty Clay 7" Gray Peat	RAD = 0.10 0 ppm (0 ppm)	1222		1 1 1 2	14"
	12	9" Gray Peat 6" Gray Clay; trace Silt 2" Gray VF-F Sand; some Silt	RAD = 0.06 0 ppm (0 ppm)	1233		1 2 2 3	17"
	14		—				

PROJECT B.O.H. 15' Captain's Cove Adj | HOLE NO. SB-11

400890

HTW DRILLING LOG

HOLE NO. SB-12

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: E P + S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area D + E
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 Con Terra; 2"/3" S.S. Bowl, Tube; 3 1/4" H.S.A.; Ludlow Model 3 Survey Meter w/ 1"x1" + Pancake Detector; HNu 10.2 eV	8. HOLE LOCATION: Exposure = 1.5 KCPM
	9. SURFACE ELEVATION: 14.23
	10. DATE STARTED: 5/5/98 — 11. DATE COMPLETED: 5/5/98
12. OVERBURDEN THICKNESS: +300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-12-4-6 Chem						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SCETCH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	7" of Lt. brn silt-, little f-m-sand, Trace gravel, Trace wood fragments 10" - f-vf-brn sand little silt, Trace gravel	.10 KCPM (0ppm)	1305			17" Recov
	4	DK black silt, little-f-m-sand, occ. gravel - 1/2"	.10 KCPM 0ppm (0ppm)	1317		20 20 18 11	4" Recov
						5 9	

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-12

400891

HTW DRILLING LOG

HOLE NO. SB-12

PROJECT | INSPECTOR | SHEET OF SHEETS 2

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
		S.A.A. except - glass fragments present	.10 KCPM (0ppm) (0ppm)		X SB-12 4-6 for Chem	8 17	1" Rec
	6	No Recov		1339		16 12 7 12	
	8	No Recov		1350		7 9 10 15	
	10	Silty - Black Sand f-vf	.05KCPM 10ppm (0ppm)	1400		5 9 18 12	6" Rec
	12	S.A.A. except little gravel To Trace gravel glass fragments in spoon	.05 KCPM 0ppm (0ppm) -	1406		7 10 15 12	6" Recov
	14						

PROJECT Captain's Cove Adjunct | HOLE NO. SB-12

400892

HTW DRILLING LOG

HOLE NO. SB-13

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 2 SHEETS	
3. PROJECT: C.C. Adjunct	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150 ConTerra; 3" S.S To WT; 2" S.S below WT; CT 150; HNU 10.2 eV; Ludlow Meter Model 3 Sum	8. HOLE LOCATION: Exp at Surface = 2.0 kCPM
	9. SURFACE ELEVATION: 13.23
	10. DATE STARTED: 4/30/98 — 11. DATE COMPLETED: 4/30/98
12. OVERBURDEN THICKNESS: + 300 >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-13-4-6' (Che/Rad; SB-13-6-7 - Rad)						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	2" Topsoil w/abund roots; 16" LT brown to LT. grey silt; Trace f-m sand; Trace gravel	.05 kCPM; 0 ppm; (0 ppm)	1001		2, 5, 2, 4	18"
	4	S.A.A. except Trace-To little f-m sand, occ. gravel. 11/8"	.05 kCPM; 0 ppm; (0 ppm)	1005		50/5	6" Recov
				Collected SB-13 4-6 for VOA, BNA, Pest/PCB, Cyanide, TAL Metals & Rad @ 1120			Offset borehole 5' West due To obstacl, @ 1024 @ 4'

400893

PROJECT: C.C. Adjunct — HOLE NO. SB-13

HTW DRILLING LOG

HOLE NO. SB-13

PROJECT: C.C Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		6" LT brown To LT grey S. IT w. Th dk black specs Throughout, 3" Dk black To yellow-brn-bright orange f-m sand w. Th abund. glass fragments O.C.C. gravel 1/8	.05-.10 0ppm (0ppm)				18" Recov
	6	9" Grey-Dk brown f-m sand some S. IT; moist, wood frag-Tr glass		Collected SB-13-6-7 for Rad Analysis @ 1053		11	
		6" S.A.A fill material Black	1.4 (KCPM)			12	18" Recov
		12" Grey S. IT Trace To little f sand - moist	.10 To .15 (0ppm) 0ppm			15 16	
	8			1058		2	
		LT. To dk grey -f-c- sand, little silt, Trace gravel 1/8", saturated	.05-.06 KCPM (0ppm) 0ppm			4 6 9	14" Recov
12		Please note This is 12-14' interval - 10-12' shown below		1108		4	2" S.S.
		4" S.A.A, 4" LT brown To Tan f-c-sand, Trace silt, w/ little gravel 1/8", satur. 4" Dk. black f-m-sand + gravel - 1/8-1/16" max.	.04-.05 KCPM 0ppm (0ppm)			5 7 5	12"
14	10	B.O.H 15'		1105		2	
		4" S.A.A. 4" Dk black To grey peaty clay 7" LT. yellow-brn peaty clay 3" Dk black To grey S. IT, sat.	.04-.05 KCPM 0ppm (0ppm)			1 2 2	15" Recov.
12							

PROJECT: Drilled To 15' C.C Adjunct | HOLE NO. SB-13

400894

HTW DRILLING LOG

HOLE NO. SB-14

1. COMPANY NAME: Malcolm Pirnie, Inc.
2. DRILLING SUBCONTRACTOR: FP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: Area A
5. NAME OF DRILLER: Jeff/Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 Centerra; 2-3" S.S. Bowls, Trowels; HNU 10.2 eV; 3"x" H.S.A; Ludlow Model 3 Survey Meter; 1"x1" + Pancake Det. Jo.
8. HOLE LOCATION: Exposure at Surface = 2.4 KCPM
9. SURFACE ELEVATION: 11.91
10. DATE STARTED: 4/30/98
11. DATE COMPLETED: 4/30/98
12. OVERBURDEN THICKNESS: 300+ >
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: SB-14-2-4' Chem/Rad; SB-14-5-5.5 Rad — VOC: — METALS: — OTHER (SPECIFY): Rad — OTHER (SPECIFY): — OTHER (SPECIFY): —
21. TOTAL CORE RECOVERY: —
22. DISPOSITION OF HOLE: Cement Grout — BACKFILLED: — MONITORING WELL: — OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		2" Sandy-Topsoil, about Roots, Trace silt + gravel 1/16"	.05 KCPM	1256		8	8
						3	3
			0 ppm			4	4
		14" Lt. brown Silt. Trace f-m sand, Trace gravel 1/8" 1"-2" Wood fragments at 1.5'	(0 ppm)			9	9
	2						16" Re-
		9" Dk brown Silt; Trace sand + clay, no gravel	4-5 KCPM	1302	X Collected SB-14 2-4 for Chem + Rad @ 1337	5	
		3" Purple-grey Silt. Trace clay, no gravel, moist	(0 ppm)			8	18" Re-
		6" Dk black Silt, f-m sand, little gravel, moist	(0 ppm)			15	
						32	
			.2 KCPM	1315		6	
						>	

400895

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-14

HTW DRILLING LOG

HOLE NO. SB-14

PROJECT: C.C. Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		6" S.A.A - Dk Black Silt Trace f-m-sand. 9" Lt. To dk Grey and Brn - F-C sand, Trace silt with	0ppm 0ppm	Collected SB-14-5-55 @ 1329		8 7	15"
	6	little gravel 1/2" max - quartz present.		1323		6 12	
		12" Lt. Brown To Tan f-c sand, Trace silt with little f gravel To 1/16", Saturated.	.04- .05 KCPM (0ppm) (0ppm)			16 10	12" Rec.
	8	S.A.A	.05 KCPM (0ppm) 0ppm	1331		13 8 9 11	15" Reco.
	10	S.A.A.	.03- .05 (KCPM) (0ppm) (0ppm)	1335		12 9 7 11	11" Reco
	12	Dk To Light grey - Peaty Clay, Some silt, wood fibes present, organic odor moist To saturated, Trace gravel - 1/64" max.	.05 KCPM (0ppm) (0ppm) -	1346			15"
	14						

PROJECT: drilled To 15' B.O.H | C.C. Adjunct | HOLE NO. SB-14

400896

HTW DRILLING LOG

HOLE NO. SB-15

1. COMPANY NAME: Malcolm Pirnie Inc	2. DRILLING SUBCONTRACTOR: E P + S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150; 2"/3" S.S.; Model 3 Survey Meter w/ 1"x1" NaI + Pancake HNU 10.2 eV; 3"/4" Auger	8. HOLE LOCATION: Exp at Surface = 1.7 KCPM
	9. SURFACE ELEVATION: 15.41 MSL
	10. DATE STARTED: 4/21/98
	11. DATE COMPLETED: 4/21/98
12. OVERBURDEN THICKNESS: 300" >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A.	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-15-2-4-Chem 0-2 Physical						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		10" Brown vf-c silty sand w/some gravel 7" Brown/gray vf-m sand w/silt + clay w/ Trace gravel	0 ppm (0 ppm) .03 - .04 KCPM		X Collected SB-15 0-2 for physical properties	1 12 15 13	17" Recovery
	2	8" S.A.A. 4" Black vf-m silty sand w/ Clay + Trace gravel + glass 3" Red Clay w/ Trace f-sand + gravel	0 ppm (0.4 ppm) .50 KCPM	Collected Red Sample	X Collected Chem SB-15 2-4 + Red from 4" layer	17 21 25 26	15" Recovery
	4						

400897

PROJECT: Cap Tain's Cove Adjunct | HOLE NO. SB-15

HTW DRILLING LOG

HOLE NO. SB-15

PROJECT C.C. Adjunct | INSPECTOR [illegible] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
		3" S.A.A w/ brick fragments 12" Brown vf-m silty sand w/ Trace clay + gravel	0 ppm (0 ppm) .10- .11 KCPM			5 14 11 6	15" Recovery
	6	6" S.A.A 3" Gray vf-m sand Trace gravel 5" Lt. brown vf-m sand, Trace gravel	0.11 KCPM 0 ppm (0 ppm)			5 5 20 33	14" Recovery
	8	10" LT brown vf-c sand; some gravel 4" brown vf-m sand; Trace gravel	0.09 KCPM 0 ppm (0 ppm)			6 17 13 20	14" Recovery
	10	2" S.A.A 15" Black vf-c sand; some gravel	0.10- 0.11 KCPM (0 ppm) 0 ppm			7 9 14 17	17" Recovery
	12	S.A.A	0.09 KCPM (0 ppm) 0 ppm			7 9 16 12	15" Recovery
	14		—				

400898

PROJECT B.O.H. 15' Cuyahoga Cove Adjunct | HOLE NO. SB-15

HTW DRILLING LOG

HOLE NO. SB-16

1. COMPANY NAME: Malcolm Pirnie	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150 — CT 150 Cantorra; S.S - 3"; S.S Bowls Trowels; HNU 10.2 eV; Model 3 Survey Meter w/ 1"x1" + Pancake Probe	8. HOLE LOCATION: Area A
	9. SURFACE ELEVATION: Exp. at hole 1.5 KCPM
	10. DATE STARTED: 4/23/98 — 11. DATE COMPLETED: 4/23/98
12. OVERBURDEN THICKNESS: 7.300 >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
1 8-10 Radiation	—	—	Rad			%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SUBMITTED SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		8" Brown VF-M Silty SAND w/ Trace Gravel & Organics	0.13	0911		5	~~HO: 0.13 ppm~~
		10" Brown VF-M SAND w/ Some Silt & Trace Gravel	0 ppm (0 ppm)			6 8 9	18"
	2	16" SAA	0.06 -	0921		5	18"
		2" Dark Brown VF-M Silty SAND w/ Trace Clay & Gravel	0.15 (0 ppm)			6 8 11	
	4	3" SAA	0.10 -	0928		4	15"
		6" Dark Brown VF-M Silty SAND & Clay w/ Some Gravel	0			5 6	
		6" Black VF-M Silty SAND & Clay; Trace Gravel	0.60		RAD	9	

400899

PROJECT: Captain's Cove Adjacent — HOLE NO. SB-16

HTW DRILLING LOG

HOLE NO. SB-16

PROJECT C.C. Adjunct | INSPECTOR [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
	6						
		12" SAA	RAD 0.60 0 ppm 0 ppm	0935	~~B~~ ~~2~~ ~~1~~ ~~3~~ ICP sample	3 2 1 3	12"
	8						
		Brick VF-M SAND & TRACE GRAVEL & STONE	RAD 0.25 0 ppm 0 ppm	0942	RAD & CPM SAMPLE	9 13 28 12	14"
	10						
		SAA	RAD 0.15 0 ppm 0 ppm	0950	* MOIST	10 24 26 44	13"
	12						
		SAA	RAD 0.06 0 ppm 0 ppm	1010	wet	3 6 9 8	3"
	14						

400900

PROJECT 15' B.O.H Captain's Cove Adjunct | HOLE NO. SB-16

HTW DRILLING LOG

HOLE NO. SB-17

1. COMPANY NAME: Malcolm Pirnie	2. DRILLING SUBCONTRACTOR: E Pt S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captains Cove Adjunct	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: ConTerra CT150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150; 2"/3 S.S.; 3"/4 HSA; Model 3 Survey Meter w 1"x1" + Pancake Probes; HNU 10.2 eV	8. HOLE LOCATION: Exposure at hole = 2.0 KCPM
	9. SURFACE ELEVATION: 13.51
	10. DATE STARTED: 4/20/98
	11. DATE COMPLETED: 4/20/98
12. OVERBURDEN THICKNESS: 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Rad = 8-10' / Chem 2-4 Chem + 10-12' (bottom)	✓	—				

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout	✓			[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		6" Asphalt; 4" Brown VF-C Silty Sand w/ some gravel; 3" LT. brn VF-m sand s/silt + gravel; 11" brn. VF-m silty sand w/ some gravel + gray clay + brick frag	0 ppm (0 ppm) .07 KCPM			12; 6; 9; 14	18" Recovery
	2	11" Dk brown VF-C sand. Trace silt, some gravel/ brick fragment + fill; 4" wood fragment.	0 ppm (0 ppm) .12 KCPM		X collected SB-17 2-4 for chem	8; 9; 11; 50/2½"	15" Recovery; Refusal @ 3' Mod 1' North
	4	10" brown VF-C silty sand; some gravel + brick	0 ppm (0 ppm) .15 KCPM			13; 9	

400901

PROJECT: Captains Cove Adjunct HOLE NO. SB-17

HTW DRILLING LOG

HOLE NO. SB-17

PROJECT: Captain's Cove Adjunct

INSPECTOR: [illegible]

SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		4" Wood fragments 3" Gray vf-m sand+gravel /Concrete /rags present				8 12	17" Recovery
	6	NR / Wood fragments in spoon	↓				NR ↓
	8	5" dk brown vf-m silty sand w/ some gravel 3" wood fragments present 4" black vf-m silty sand + gravel / wet	0 ppm (0 ppm) .22 KCPM		X Collected Rad Sample (2 bottles)	8 7 6 9	12" Recovery
	10	7" S.A.A 7" Black vf-m sand w/ some gravel + silt	0 ppm (0 ppm) .40 KCPM		X Collected Rad Sample of Top 7" only (1 jar)	9 10 7 8	14" Recovery
	12	Material was 3' in Augers Advanced Augers To 13' S.A.A as 10-12' last 7"	0 ppm (0 ppm) .12 KCPM			5 6 7 5	7" Recovery
	14 15						

400902

PROJECT: BOH 15' Captain's Cove Adjunct

HOLE NO. SB-17

HTW DRILLING LOG

HOLE NO. SB-18

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: C. Cove Adjunct
4. LOCATION: Area A
5. NAME OF DRILLER: Jeff/Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150
3" S.S
2" S.S. bowls, Trowels
CT 150
HNU 10.2 eV
Model 3 Survey Meter
2200 Ratemeter/Scale
8. HOLE LOCATION: Exposure at hole = 2.3 KCPM
9. SURFACE ELEVATION: 15.49
10. DATE STARTED: 4/29/98
11. DATE COMPLETED: 4/29/98
12. OVERBURDEN THICKNESS: +300 >
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: Rad = SB-18-2-4' Chem + Rad = SB-18-4-6
VOC: ✓ — METALS: ✓ — OTHER (SPECIFY): ✓ Rad — OTHER (SPECIFY): — OTHER (SPECIFY): —
21. TOTAL CORE RECOVERY: \
22. DISPOSITION OF HOLE: Cement Grout
BACKFILLED: ✓ — MONITORING WELL: — OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		1" LT. brown Topsoil, abundant Roots + organics 18" LT. brown silt, little To some fine-med. sand, Trace gravel, dk-gray-coaltr fragments at 2'.	.04 KCPM .08 KCPM (0ppm) (1-2ppm)	0914		5 6 7 9	19" Recov.
	2	S.A.A., except Trace shell fragments -, moist	.04 - .07 KCPM (0ppm) (0ppm)	0925	Collected Rad Sample SB-18 2-4 @ 1153	5 8 7 9	19" Recov.
	4		2.4 (KCPM)	0935		4 4	

PROJECT | HOLE NO

400903

HTW DRILLING LOG

HOLE NO. SB-18

PROJECT: Captain's Cove Adj. | INSPECTOR: [illegible] | SHEET OF SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		4" dk. brown sandy silt; occ - gravel To Trace gravel 6" Dk Grey Clayey-S. IT 8" Dk. br. To red-brn. sandy-silt, moist, Trace glass	0ppm (1ppm)		Collected SB-18 4-6 for Chem + Rad 1149	3 12	18" Reco
6				0955		25 50/4	
		3" Rock fragment - concrete in Tip. w/dk brown silt	.2 kcpm (0ppm) 0ppm)				3" Reco.
8				1000 (offset) 1030 (Offset		10 9 7 9	Offset borehole 5' West due To obstruction at 8' (No Recov)
		2" Rock fragment concrete in Tip					
10		4" Dk. brn To dk grey Silt, 2" - Grn-grey-peat-organics 6" - gry - f - To C - sand. little silt, little gravel wet	.13 kcpm (0ppm) (0ppm)	1036		5 7 6 9	12" Reco
12		No Recovery					
14							

PROJECT: Augered to 15' B.O.H Captain's Cove Adjacent | HOLE NO. SB-18

400904

HTW DRILLING LOG

HOLE NO. SB-19

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area B+C
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150. 3" S.S. / 2" S.S; HNU 10.3 eV; Model 3 Surveyor MeTa w/ 1"x1" NaI + Pancake Det; 3"x4" H.S.A	8. HOLE LOCATION: Exposure at Surf 1.6 kcpm
	9. SURFACE ELEVATION: 14.27
	10. DATE STARTED: 4/30/98 — 11. DATE COMPLETED: 4/30/98
12. OVERBURDEN THICKNESS: 300+>	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-19-0-2' Chem; SB-19-2-4 Rad	✓	✓	Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SECTION SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		1" Topsoil - roots, organics; 17" Lt. brown silt, Trace f-m sand, Trace gravel; 14.8' - 3" Quartz gravel, glass fragments, wood fragments	.04 kcpm; 0 ppm; (0 ppm)	1440	Collected Chem Sample @ 1445	5; 7; 10; 7	18"
	2	S.A.A., except alternating layers of dk Gray and Lt brown silt; 1" of Lt. Brown f-m Sand - Trace silt, Trace gravel - 1/32"	.09 To .10 kcpm; 0 ppm; (0 ppm)	1443	Collected Rad Sample @ 1455	4; 9; 9; 6	22"
	4			1452		4; 11	

400905

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-19

HTW DRILLING LOG

HOLE NO. SB-19

PROJECT: C.C. Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
		~~4" of~~ S.A.A except vf-f- Sand, Trace silt, Trace gravel grading To m-c- brown- Sand at 5.7-6.0' with little gravel To "2" + quartz	.04- .05 (KCPM) 0ppm (0ppm)			13 20	21" Recov
	6	LT brown To LT. Tan little f-c- sand, Trace silt little To Some gravel To 1/2", moist	.05 (KCPM) 0ppm (0ppm)	1502		5 10 17 21	16" Recov
	8	S.A.A. moist To wet;	.05 (KCPM) 0ppm (0ppm)	1507		9 11 12 15	15" Recov
	10	6" S.A.A. 6" Dk black vf-f- Sand, Trace silt, Trace gravel 1/32", Saturated.	.04 KCPM (0ppm) 0ppm	1519		9 8 7 5	12" Recov
	12	6" S.A.A. 4" greenish-grey- petroleum odor, Sulfide odor 8" Dk black vf-f- Sand, Trace To little silt, Trace-gravel 1/32"	.04 KCPM (0ppm) 0ppm -	1523		2 1 2 2	18" Recov
	14						

PROJECT: Trace clay- B.O. @ 15' | HOLE NO. SB-19

400906

HTW DRILLING LOG

HOLE NO. SB-20

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EPTS
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captains Cove
4. LOCATION: SB-20
5. NAME OF DRILLER: Jeff / Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150
3" S.S / 2" S.S.
Bowls, Trowel, S.S
HNu 10.2 eV
Model 3 Survey Meter
220c RaTangTen / Scaler
1"x1" NaI + Probate Det.
8. HOLE LOCATION: Area D+E, 15.92 MSL
9. SURFACE ELEVATION: 1.3 KCPM
10. DATE STARTED: 4/22/98
11. DATE COMPLETED: 4/22/98
12. OVERBURDEN THICKNESS: 300+ >
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSES: SB-20-4-6' Chem/Rad

VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)
✓	—	Rad ✓		

21. TOTAL CORE RECOVERY:
22. DISPOSITION OF HOLE: Cement Grout

BACKFILLED	MONITORING WELL	OTHER (SPECIFY)
—		

23. SIGNATURE OF INSPECTOR:

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		LT brown - silt and Trace f-m - sand roots, dry - no odor	0.0 ppm .05 (KCPM)	1038		6 10	Recov.
		Dk brown - grey - silt and Trace f-m - sand, some gravel - no odor	(0 ppm)			11 10	
	2	A/T. Layers LT brown silt and grey-brown silt. Trace f-m - sand glass fragments grading To LT. brown f-m - sand some gravel; glass fragments; no odor	.05 KCPM (0 ppm) 0 ppm	1048		6 22 14 12	Recov 1.5'
	4			Collected SB-20 4-6 for Chem + Rad			

400907

PROJECT

HOLE NO. SB-20

HTW DRILLING LOG

HOLE NO. SB-20

PROJECT: C.C. Adjunct | INSPECTOR: [signature] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
		Dk black To grey - To Dk. grey - f-m - sand Trace silt with some gravel - 1/16" - 1/8" rounded - glass fragment, wood present	.05 (KCPM) 0.0 ppm (0.0 ppm)	1055			1.0' Reco
	6			1109			
		S. A. A.	.05 (KCPM) (0.0 ppm) (0 ppm)				6" Reco
	8	LT grey v-f silty-sand Trace silt w. Th fen. gravel grading To f-m-c - LT grey - Sand Trace silt w Th gravel 1/8" rounded, moist	.05 (KCPM) (0.0 ppm) 0 ppm	1117		6 5 9 15	1.8' Reco
	10	LT. To dk grey and LT Tan f-m sand with gravel, Trace silt moist.	.05 (KCPM) (0.0 ppm) 0 ppm	1130		9 10 6 8	1.7' Reco
	12	S. A. A.	.05 (KCPM) (0-0 ppm) 0 ppm	1136		14 9 8 7	1.0'
	14		—				

Overdrilled To 15'

PROJECT: C.C. Adjunct | HOLE NO. SB-20

400908

HTW DRILLING LOG

HOLE NO. SB-21

1. COMPANY NAME Malcolm Pirnie	2. DRILLING SUBCONTRACTOR EP+S
SHEET 1 OF 1 SHEETS 3	
3. PROJECT Captain's Cove	4. LOCATION Area D+E
5. NAME OF DRILLER Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT CT 150	3" S.S.; S.S. Bowls / Trowels; HNU 10.2 eV; Model 3 Survey Meter w/ 1"x1" NaI + Pancake; 2200 Ratemeter / Scaler
8. HOLE LOCATION Exp. at Surface 1.8 KCPM	
9. SURFACE ELEVATION 15.05 MSL	
10. DATE STARTED 4/22/98	11. DATE COMPLETED 4/22/98
12. OVERBURDEN THICKNESS 500+>	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 16'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-21-0-2'-Chem/Rad	✓	✓	Rad			
SB-21-2-4 - "						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SECTION SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		LT brown Tan - s. lt with some f-m. sand, Trace gravel glass fragments present, no odor, metal fragments	.05-.07 (KCPM) (0 ppm) 0 ppm Headspace	1350	X Collected VOA's, BNA/Pest/PCB TAL Metals + Cyanide + Rad @ 1506	9, 8, 10, 9	Recov 1.5'
2		S.A.A. - except + Trace Clay wood + glass fragments present Throughout no odor Also; Concrete fragments present Fill	.05-.09 (KCPM) (0 ppm) 0 ppm	1355	X Collected VOA's BNA Pest/PCB TAL Metals Cyanide Rad	17, 12, 13, 19	
4				1403	@ 1515	14, 16	

PROJECT

HOLE NO

400909

HTW DRILLING LOG

HOLE NO. SB-21

PROJECT: Captain's Cove Adjunct

INSPECTOR: [illegible]

SHEET 2 OF 2 SHEETS 3

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	White (Glass frag) Concrete - present (debris) (Refusal) Dk bl. S. IT in (basket) (fill)	(0 ppm) 0 ppm.			11 10	X No Recovery
	8	S.A.A. White concrete - Rubble present in basket (fill)	.07 (KCPM) (0 ppm) 0 ppm	1415		11 7 12 10	X No Recov
	10	Fill → Wood fragments with some organics -	(0 ppm) .07 (KCPM)	1422		12 13	
		Altern. layers of dk black to grey f-m sand with LT. to LT Tan sand with some gravel (1/8" rounded) moist	.05 (KCPM) (0.0 ppm) (0 ppm)			12 11	1.5' Recovery
	12	S.A.A. except more (25%) gravel present (1/8") moist to saturated	(0.0 ppm) .05 (KCPM) (0 ppm)	1430		6 7 8 7	1.0' Recov
	14	Dk grey to IT. grey - f-m sand with some gravel as 10-12. (Qa Turnte.)	0.0 ppm .05 (KCPM) 0 ppm	1441		9 8 8 6	1.0' Recov

PROJECT: Captain's Cove Adjunct

HOLE NO. SB-21

400910

HTW DRILLING LOG

HOLE NO. SB-21

PROJECT Captain's Cove Adjunct | INSPECTOR [illegible] | SHEET 3 OF 3 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
	14			1458			
		S.A.A; saturated	.05 KCPM (0.0 ppm 0.0 ppm)				6" Recov
	16	Overdrilled hole to 15' depth					

PROJECT Captain's Cove Adjunct | HOLE NO. SB-21

400911

HTW DRILLING LOG

HOLE NO. SB-22

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2
3. PROJECT: Captain's Cove Adjunct
4. LOCATION: Area G
5. NAME OF DRILLER: Jeff / Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150
2 - 3" S.S.
AMV 10.2 e.V.
3"/4" H.S.A.
Nal 3 Sigma Meter
2200 Ratemeter Scaler
1" x 1" NaI / Pancake
8. HOLE LOCATION: Exp at Surf = 3 kcpm
9. SURFACE ELEVATION: 14.86
10. DATE STARTED: 4/27/98
11. DATE COMPLETED: 4/27/98
12. OVERBURDEN THICKNESS: 30'>
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: DISTURBED / UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: 2-4', 4-6'
VOC: ✓ METALS: — OTHER (SPECIFY): Rad OTHER (SPECIFY): OTHER (SPECIFY):
21. TOTAL CORE RECOVERY:
22. DISPOSITION OF HOLE: Cement Grout
BACKFILLED / MONITORING WELL / OTHER (SPECIFY)
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		9" Dark brown VF-M Silty Sand w/ trace gravel & some organics 7" Brown VF-M Silty Sand w/ trace gravel & wood	RAD = 0.13 kcpm 0 ppm 0 ppm	0913		4 6 22 34	16" Collected RAD sample
	2	SAA	RAD 0.13 kcpm 0 ppm 0 ppm	0935	Collected CMM SMPM & CMM DUP	25 27 22 17	DUP ID: DUP1-2-4 SB-22 CHEM ID SB-22-2-4
	4	8" SAA 16" Dark brown VF-M Sandy Silt, trace gravel	RAD = 0.16 kcpm	0939	Collected 2ND RAD & RAD DUP	1 2 3 2	24" RAD DUP ID = SB-DUP1-4-6

PROJECT

HOLE NO.

400912

HTW DRILLING LOG

HOLE NO. SB-22

PROJECT: Captain's Cove Ad. | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
			0 ppm 0 ppm				
	6	SAA # RACK IN SPOON NOSE	RAD: 0.09 kcpm 0 ppm 0 ppm	0951		4 6 8 10	3"
	8	BLACK VF-M SILTY SAND, SOME GRAVEL, TRACE CLAY	RAD: 0.05 KCPM 0 ppm 0 ppm	1001		6 7 16 14	12" & wet
	10	BLACK VF-M SILTY SAND, SOME GRAVEL	RAD: 0.08 kcpm 0 ppm 0 ppm	1007		2 11 16 8	6"
	12	SAA	RAD: 0.05 0 ppm 0 ppm	1035		50/4	4"
	14		—				

PROJECT: 15' B.O.H | HOLE NO. SB-22

400913

HTW DRILLING LOG

HOLE NO. SB-23

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 2 SHEETS	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area G
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150; 2"/3" S.J.; 3 1/4" H.S.A; 10.2 eV; Model 3 Sum NaTe w/ 1"x1" NaI / Probe	8. HOLE LOCATION: Area G
	9. SURFACE ELEVATION: 14.26
	10. DATE STARTED: 4/27/98 — 11. DATE COMPLETED: 4/27/98
12. OVERBURDEN THICKNESS: +300 >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
4-6 - Rad/Chem; 6-8 Rad						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	22. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MATRIX SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		6" Dark Brown VF-M Sandy Silt w/ Trace Gravel & Organics	RAD: 0.10 kpm	1413		2, 10, 20, 18	20"
		8" Dark Brown VF-M Silty Sand w/ Trace Gravel; Clay; Brick; Glass	(0 ppm) (0 ppm)				
		6" Orange Brown VF-M Sand; Trace Silt					
	2	3" SAA	RAD: 0.11	1458		5, 8, 9, 8	14"
		2" Orange Brown Clay Trace VF Sand	(0 ppm)				
		9" Orange Brown VF-M Sand; Trace Silt & Gravel	(0 ppm)				
	4	3" SAA	RAD: 0.15	1509		14, 18, 17, 12	21" collected RAD/CHEM
		Dark Brown VF-M Sandy Silt; Trace Gravel & Clay	(0 ppm) (0 ppm)				

PROJECT: Captain's Cove Adjunct | HOLE NO. SB-23

400914

HTW DRILLING LOG

HOLE NO. SB-23

PROJECT Captain's Cove Adjunct | INSPECTOR [illegible] | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
	6	SAA	RAD= 0.70 0.0 ppm (0 ppm)	1518		4 6 13 21	11" collected 2nd RAD x wet at last 4"
	8	4" SAA 5" Black VF-M Sand (Clay & Silt. 2" Black VF-M Sand 5" Black Silt/Clay; trace VF Sand/ organics	RAD: 0.15 0 ppm (0 ppm)	1525		2 1 1 2	16" wet
	10	9" Gray Silt/Clay trace organics	RAD: 0.13 0 ppm (0 ppm)	1531		2 5 7 9	9"
	12	SAA	RAD = 0.10 0 ppm (0 ppm)	1538		4 10 6 8	3"
	14						

PROJECT Captain's Cove Adjunct | HOLE NO. SB-23

400915

HTW DRILLING LOG

HOLE NO. SB-24

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area G
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT 150; 3 1/2" S.S; HNU 10.2 eV; Model 3 Survey Meter w/ 1"x1" NaI + Probe	8. HOLE LOCATION: Expt hole = 4 kCPM
	9. SURFACE ELEVATION: 14.18 MSL
	10. DATE STARTED: 4/27/98
	11. DATE COMPLETED: 4/27/98
12. OVERBURDEN THICKNESS: 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	—	Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		6" Dark Brown VF-M Sandy SILT w/some cobbles; TRACE GRAVEL	RAD= 0.13 kcpm	1144		8 13 11 7	15"
		9" Brown VF-M Silty SAND TRACE GRAVEL / wood	0 ppm (0 ppm)				
	2	SAA	RAD= 0.13 kcpm	1155		3 2 22 20	6"
			0 ppm (0 ppm)				
	4	4" SAA		1207		15 18 20 22	24"
		6" Orange Brown VF-M SAND; TRACE SILT	RAD= 0.10				

400916

HTW DRILLING LOG

HOLE NO. SB-24

PROJECT

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
		14" DARK BROWN VFM SILTY SAND; TRACE GRAVEL, BRICK, CLAY; WOOD	RAD= 0.24 0 ppm (0 ppm)				Collected TCLP; RAD SAMPLE FROM LAST 14"
	6	DARK BROWN VF-M SILTY SAND; TRACE GRAVEL & CLAY; WOOD	RAD= 0.40 0 ppm (0 ppm)	1223		5 3 40 2	20" Collected RAD; CHEM; GRAIN SIZE.
	8	DARK BROWN VF-M SANDY SILT; TRACE CLAY & GRAVEL	RAD= 0.05 0 ppm (0 ppm)	1226		1 2 1 1	& SATURATED 15"
	10	4" BLACK VF-M SANDY SILT & CLAY; TRACE GRAVEL 10" BROWN-GRAY PEAT 2" GRAY SILT & CLAY	RAD = 0.08 0 ppm (0 ppm)	1235		1 1 1 1	16"
	12	8" SAA W/SHELLS 9" GRAY VF-F SANDY CLAY; TRACE SILT	RAD= 0.10 0 ppm (0 ppm)	1243		WT 1 2 1	17"
	14	BOH 15	–				

PROJECT C.C. Adjunct

HOLE NO. SB-24

400917

HTW DRILLING LOG

HOLE NO. SB-25

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EPJ
SHEET 1 OF 2 SHEETS	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area B+C
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150; 3 1/4" H.S.A.; S.S. 2-3" Bowls Tools; HNU 10.2 eV; Model 3 Sum Meter w/ 1"x1" NaI + Pancake	8. HOLE LOCATION: Exp at Surf. 1.4 KCPM
	9. SURFACE ELEVATION: 14.07 ft MSL
	10. DATE STARTED: 5/1/98
	11. DATE COMPLETED: 5/1/98
12. OVERBURDEN THICKNESS: 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-25-2-4 Chem Rad	✓	—	Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MONITOR SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		1-2" Dk brown Topsoil - w/ grass roots; 16" Lt. brown To Tan silt, Trace f-m sand, Trace gravel - 1/32" rounded increasing f-m sand at 1.5-2.0', wood fragments, peat, glass fragments	~~1142~~ .04-.05 KCPM; 0 ppm (0 ppm)	1142		7, 8, 13, 25	18" Rec
	2	17" S.A.A. wood, glass + brick fragments, peat Throughout; 5" Dk Grey Silt - little To Trace f-m sand, Trace Clay + gravel.	.04-.05 KCPM; (0 ppm); 0 ppm	1157	X Collect SB-25 2-4 for Chem + Rad. @ 1225	7, 17, 15, 15	22"
	4			1200		9, 27	

400918

PROJECT: Captain's Cove Adjunct HOLE NO. SB-25

HTW DRILLING LOG

HOLE NO. SB-25

PROJECT C. C. Adjunct | INSPECTOR [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		3" LT. brown To Tan vf f- silty sand Trace (1/32") gravel + clay 9" LT. Tan To brown f-c sand Trace silt + gravel (1/16") w/ occ cobble - 3"	.04-.05 KCPM (0 ppm) 0 ppm			29 30	12"
	6	9" S.A.A. except increasing silt-content. 3" - f-vf silty-sand, Trace gravel (1/32") + cobble (2")	.04-.05 (KCPM) 0 ppm (0 ppm)	1211		9 12 15 16	16" Reco
	8	~~13" LT brown To Tan~~ S.A.A., moist	.04-.05 (KCPM) (0 ppm) (0 ppm)	1217		9 13 12 8	13" Reco
	10	3" S.A.A., except - little To some gravel. 9" Dk black To dk grey-banded vf-f-silty sand Trace gravel - 1/64" 3" greenish-grey peaty clay-, moist To wet.	.04-.05 (KCPM) 0 ppm (0 ppm)	1222		3 2 1 1	15" Recco
	12 14	15" f-vf-silty-grey To black sand Trace gravel moist To saturated.	.04-.05 KCPM (0 ppm) (0 ppm)	1233		3 6 9 9	15" Recov

PROJECT | HOLE NO. SB-25

B.O.H 15'-

400919

HTW DRILLING LOG

HOLE NO. SB-26

1. COMPANY NAME: Malcolm Pirnie, Inc
2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 2 SHEETS

3. PROJECT: C. Cove Adjunct
4. LOCATION: Area G
5. NAME OF DRILLER: Jeff/Vince
6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" S.S.; S.S. Bowls; Model 3 Survey Meter; 1"x1" NaI Pancake; 2200 Ratemeter/Scaler
8. HOLE LOCATION: 14.82 MSL
9. SURFACE ELEVATION: Exp. at Surface: 1.3 kcpm
10. DATE STARTED: 4/28/98
11. DATE COMPLETED: 4/28/98
12. OVERBURDEN THICKNESS: 300+>
13. DEPTH DRILLED INTO ROCK: N/A
14. TOTAL DEPTH OF HOLE: 15'
15. DEPTH GROUNDWATER ENCOUNTERED:
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: N/A — DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES: N/A
20. SAMPLES FOR CHEMICAL ANALYSIS: 2-4 Rad; 6-8 Chem/Rad — VOC: ✓ — METALS: ✓ — OTHER (SPECIFY): Rad — OTHER (SPECIFY): — OTHER (SPECIFY): —
21. TOTAL CORE RECOVERY: \
22. DISPOSITION OF HOLE: Cement Grout — BACKFILLED: — MONITORING WELL: — OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR: [signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SECTION SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		1½" dk. brown Topsoil, Roots, Organics	.06 kcpm	0857		3	
		17" Dk. brown-vf-silty sand, Trace gravel + organics.	0 ppm			7	
		Conc. debris in 1"	(0 ppm)			9	18" Recov.
						11	
	2	3" Lt brown vf. sand Trace clay + gravel	~~.5 kcpm~~	0908	Collect Rad Anys	20	
		18" Dk brown-vf-To silty Dk Black-vf sand; To dk black clayey sand. Trace gravel	(0 ppm)		SB-26 2-4 1019	24	21"
			(.5 kcpm)			25	
			(0 ppm)			27	
	4			0918		17	
						49	

400920

PROJECT: C. C Adjunct — HOLE NO. SB-26

HTW DRILLING LOG

HOLE NO. SB-26

PROJECT | INSPECTOR | SHEET OF SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		D.k. Brown Silty Sand Trace Gravel Red Brick Debris - 2"	.15 KCPM 0ppm 0ppm			49 7	6" Recov
	6	Dk brown vf- [redacted] Sandy-silt, Trace clay + gravel moist, Red brick in bt of 1" S.S	0ppm .12 KCPM 0ppm	0936	Collected SB-26 6-8 for Chem + Rad Analysis	11 17 25	Recov 22"
2" S.S.	8	1" Peat Layer-Organics 10" Dk Red-brick fragments 9" LT Gray To LT brown Silt, Trace Clay, saturated LT Tan-sandy silt Trace clay in bt	0ppm .12 KCPM 0ppm	0943		25 18 11 10	20" Recov
	10	LT. Tan-sandy silt To LT gray Trace clay, Trace gravel.	.12 KCPM 0ppm 0ppm	1001		C 8 10 8	15" Recov
	12	S.A.A. 6" V.F. LT. brown silty sand, Trace Clay	.05 KCPM. 0ppm 0ppm	1011			14" Recov
	14						

PROJECT 15' B.O.H. HOLE NO. SB-26

400921

HTW DRILLING LOG

HOLE NO. SB-27

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain Cove Adjunct	4. LOCATION: Area B+C
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-3" SS; HNU 10 ZeV; Model 3 Survey Meter w/ 1"x1" NaI + Ratemeter; 2200 Ratemeter/Scaler	8. HOLE LOCATION: Exp at hole = 1.4 kCPM
	9. SURFACE ELEVATION: 15.86 MSL
	10. DATE STARTED: 5/4/98 — 11. DATE COMPLETED: 5/4/98
12. OVERBURDEN THICKNESS: 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
SB-27-0-2' Chem/Rad -2-4 Chem/Rad						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	22. SIGNATURE OF INSPECTOR
—				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MATRIX SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	3" Dk. brown Topsoil, Roots, organics 17" Lt. brown-m-sand, little silt, Trace gravel-1/8", asph. frag rounded.	.03-.05 kCPM (0ppm)	1447	Collected Chem + Rad SB-27 0-2	10, 13, 20, 13	23'
	4	S.A.A, brown + Trace Clay. no asph. Trace cobble 4-5"	.03-.05 kCPM (0ppm)	1454	Collected SB-27 DUP-02 for Chem + Rad of SB-27-02	6, 12, 8, 32	

400922

PROJECT: Captain's Cove Adjunct — HOLE NO. SB-27

HTW DRILLING LOG

PROJECT: Captain's Cove Al. | INSPECTOR: [illegible] | HOLE NO. SB-27 | SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
		LT. brown To Tan - f-m Sand, little silt;	.04-.05 kcpm (0 ppm) 0 ppm.	1501		17 20 22 24	12" Rec
	6	LT. brown To Tan brn f-c sand + gravel - rounded - (1/16"), Trace silt	.04-.05 (kcpm) 0 ppm	1509		20 24 25 24	12"
	8	S.A.A	.04-.05 (kcpm) 0 ppm (0 ppm)	1513		3 9 30 40	12"
	10	S.A.A, saturated.	.04-.05 (kcpm) (0 ppm)	1522		25 30 9 17	4" Rec.
	12	S.A.A. 4" Grey S.A.A	.04-.05 (kcpm) 0 ppm (0 ppm)	1528		25 15 20 15	12"
	14						

PROJECT: B.O.H 15' | HOLE NO. SB-27

400923

SB-28

HTW DRILLING LOG

HOLE NO. SB-28

1. COMPANY NAME: Malcolm Pirnie Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area G
5. NAME OF DRILLER: Jeff/Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: CT150; 2"/3" S.S Bowl, Trowel, HNU 10 zeV; 3 1/4" H.S.A; Model 3 Survey Meter with 1"x1" NaI / Ratemeter / Scaler	8. HOLE LOCATION: Exp at hole = 1.5 KCPM
	9. SURFACE ELEVATION: —
	10. DATE STARTED: 5/6/98
	11. DATE COMPLETED: 5/6/98
12. OVERBURDEN THICKNESS: 300+ >	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 15'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	—	—			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cement Grout				[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	UNDISTURBED SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	Dk br. To or. brn Silt, little f-m sand, Trace gravel, 11/16"	.05 KCPM 0ppm (0ppm)	1108		7 20 27 21	17"
	4	3" S.A.A 10" Lt. grey-To dk grey clay. Trace gravel - 11/16'	.07 KCPM 0ppm (0ppm)	1113		4 10 11 13	13" Recov
				1122		50/5	

HTW DRILLING LOG

HOLE NO. SB-28

PROJECT: Captain's Cove Adjunct | INSPECTOR: [illegible] | SHEET 2 OF 2 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
		No Recovery (4" Rock in Tip)					
	6	DK Gray - Silty f-c sand, Trace Some gravel 1½", fibrous wood fragments, organic odor, Trace clay (Saturated)	.07 - (KCPM) .09 0ppm (0ppm)	1138	X SB-28 6-8 @ 1204 for Bed	2 4 10 15	8" Recov.
	8	S.A.A, except Trace gravel, + f-vf Silty sand, + wood fragments (SAT)	.05 (KCPM) 0ppm (0ppm)	1142		3 8 18 12	12"
	10	10" S.A.A. 2" fibrous layer - (Peaty) organic odor. - Clay - DK Gray - Peaty Clay.	.05 KCPM 0ppm (0ppm)	1144		WT Hamm	12"
	12	12" S.A.A, Peaty Gray Clay 10" Peat, Organic odor - DK brn -	.05 KCPM 0ppm (0ppm)	1157			22'
	14						

PROJECT: B.O.T. 15' | HOLE NO. SB-28

400925

HTW DRILLING LOG

HOLE NO. MW7

1. COMPANY NAME Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR EP+S
SHEET 1 OF 3 SHEETS	
3. PROJECT C. Cove Adjunct	4. LOCATION Area G
5. NAME OF DRILLER Jeff/Vince.	6. MANUFACTURER'S DESIGNATION OF DRILL CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" S.S. CT 150; S.S. Bowls, Trowels; 6"/4" Augers; for 4" PVC Well Inst. Model 3 Rotarite	8. HOLE LOCATION Area G, 14.34 MSL
	9. SURFACE ELEVATION Exp at Surf 1.8 KCPM
	10. DATE STARTED 4/28/98
	11. DATE COMPLETED 4/28/98
12. OVERBURDEN THICKNESS 300" >	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE 16'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
2 - 4' - Chem/Rad	—	—	Rad			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Monitoring Well				

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	MATRIX SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
		2" Topsoil 6" LT To Dk brown - clayey - silt w/roots, organics 12" LT To dk brown f-m sand Trace silt, Trace gravel Wood fragments present. glass " "	0.0 ppm (0.0 ppm) .05 KCPM	1443		8 20 19 18	20"
	2	S.A.A., wood, glass frag. fill	0.0 ppm (0.0 ppm) .05 KCPM	1503	Collected MW7 2-4 for Chem + Rad. @ 1545	7 17 20 22	20
	4	B.T. Tan-orange m-f sand - Trace clay, silt; glass frag at 4.2.	0.0 ppm (0.0 ppm) .05 KCPM	1520		8 12	20"

PROJECT C. C. Adjunct HOLE NO. MW7

400926

HTW DRILLING LOG

PROJECT

INSPECTOR

HOLE NO. MW7

SHEET 2 OF 2 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
						10 15	
	6	backfill m.					
3" S.S		2"-LT br-dk br silty-Sand-Trace gravel, wood frag shell frag present. 19" VF-m-Sandy-silty Trace Gravel + Clay. shell fragment, glass frag present Throughout (moist)	0.0 ppm (0 ppm) .05 kcpm	1525		20 14 11 9	21" Rec
	8						
8" S.S		6" Dk black silt + Clay; Trace V.F sand, organics. (Saturated)	0.0 ppm (0 ppm) .05 kcpm	1537		4 7 10 12	6"
	10						
12" S.S.		4" Dk Gray Sandy Clay - Trace gravel, Trace organics 5" - Peat - Layer - Grayish - Sulfide odor Gray 1" Gray Silty Clay	0.0 ppm (0 ppm) .05 kcpm	1549		2 5 4 2	10" Recov
	12						
		5" S.A.A. 11" Clayey-Silty-Sand. Trace gravel (saturated) Trace organics	(0.0 ppm) .05 kcpm	1603		1 3 5 4	16"
	14		—				

PROJECT C.C. Adjunct

HOLE NO. MW7

6-16

400927

HTW DRILLING LOG

HOLE NO. MW7

PROJECT: C.C. Adjunct | INSPECTOR: [illegible] | SHEET 3 OF 3 SHEETS

ELEV	DEPTH	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX NO	ANALYTICAL SAMPLE NO	BLOW COUNTS	REMARKS
14							
		5" Dk Gray - Sandy Clay					
15		11" Orange-brn. mt sand, Trace gravel.	0.0ppm (0.ppm) .05LEL	1620			16" Recov
16		B.O.H = 16					
18							
20							
22							

PROJECT: C.C. Adjunct | HOLE NO. MW7

6-16.

400928

HTW DRILLING LOG

HOLE NO. MW 8

1. COMPANY NAME: Malcolm Pirnie, Inc	2. DRILLING SUBCONTRACTOR: EP+S
SHEET 1 OF 1 SHEETS 3	
3. PROJECT: Captain's Cove Adjunct	4. LOCATION: Area A
5. NAME OF DRILLER: Jeff / Vince	6. MANUFACTURER'S DESIGNATION OF DRILL: CT 150
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" S.S. / 2" S.S.; 6 1/4" Auger; PID 10.2 eV; Model 3 Survey Meter	8. HOLE LOCATION: Exp at Surface = 1.7 KCPM
	9. SURFACE ELEVATION: 13.72 MSL
	10. DATE STARTED: 5/5/98 — 11. DATE COMPLETED: 5/5/98
12. OVERBURDEN THICKNESS: +30.0 +>	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 9'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
N/A			N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0-2 Rad 2-4 Chem						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Monitoring Well		✓		[signature]

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	2	CT To dk brown / Tan S. IT, l. TTle f-m sand Trace gravel to 1/8" rounded Wood fragments at 1.0'.	.06 KCPM 0 ppm (0 ppm)	0906	X SB-MW8-0-2' 1100 for Rad.	3 8 17 34	19" Recov
	4	S.A.A, except metal fragments at 3.8'.	.06 (KCPM) 0 ppm (0 ppm)	0920	X SB-MW8-2-4' 1055 for Chem	4 10 16 19	17"
			.05 KCPM 0 ppm 0 ppm	0939		7 29	

PROJECT: | HOLE NO.:

400929

HTW DRILLING LOG

HOLE NO. MW 8

PROJECT C.C. Adjunct | INSPECTOR [illegible] | SHEET 3 OF 3 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
		1" - Grey-brn silt, Trace To little f-m sand. LT. brn / Tan f-c - sand little f-m gravel 1/2" max Trace silt				44 45	18" Rec'd
	6	(LT. br/Tan f-c sand) S.A.A. except gravel 1/32" max size.	.05 KCPM 0 ppm (0 ppm)	0951		2 3 12 22 30	17"
	8	S.A.A., except gravel max size = 1/2", moist To wet at 8.5' Saturated at 9.7'	.05 KCPM (0 ppm) 0 ppm	0957		6 16 19 19	16"
	10	Dk black f-c sand, little silt. Trace To little f-m gravel - 1/32" max, wet. Odor - (Trace clay + organics)	.05 KCPM 0 ppm (0 ppm)	1000		5 9 11 11	14"
	12	5" LT. brown To grey Silty f-c - sand, little gravel To 1/16" 7" Black f-vf silty sand, Trace gravel 5": Greenish / grey Peaty Clay	.05 KCPM 0 ppm (0 ppm) —	1010		1 1 1 2	17"
	14						

8-18'

PROJECT Odor. C.C. Adjunct | HOLE NO. MW 8

400930

HTW DRILLING LOG

HOLE NO. MW 8

PROJECT: C.C. Adjunct | INSPECTOR: [illegible] | SHEET 3 OF 3 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO e	ANALYTICAL* SAMPLE NO f	BLOW COUNTS g	REMARKS h
14				1016		2 2	
	15	OK Gray To black - f-vf black sand + greenish-gray - peat - highly organic odor & clay	0 ppm 0 ppm			5 7	9" Recov
16		Advanced -					
17		(17-19') bk Gray - Black - f-vf Silt and clay: little f-m-sand.. highly organic odor.		1029			
18		S.S To 18'					12"
19		7.7 Set well 17.7 To Screen: Sand To 5.7					
20							
21							
22							

PROJECT: C.C. Adjunct | HOLE NO. MW 8

400931

ATTACHMENT E

400932

ATTACHMENT E

OVERBURDEN
MONITORING WELL SHEET

WELL NO. MW7

PROJECT Captain's Cove START DATE 4/28/98 END DATE 4/28/98

PROJECT NO. 800,202 FIELD GEOLOGIST [illegible]

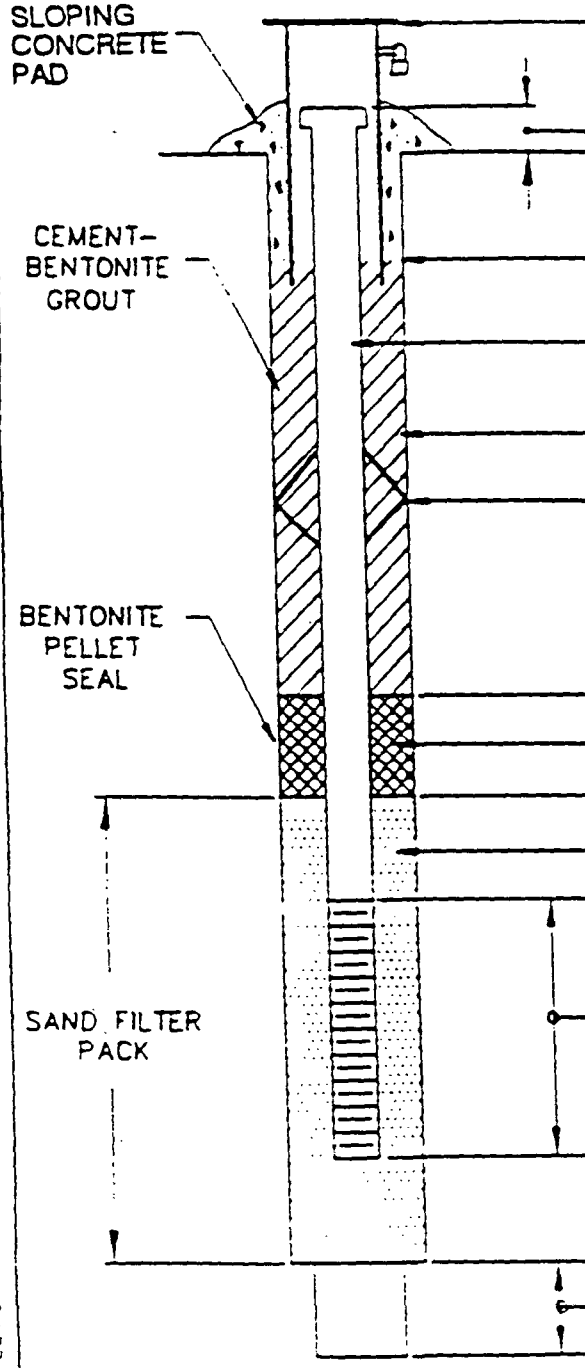
LOCATION Downgradient of Area G

DRILLING CO. Environmental Probes + Services Inc

DRILLER(S) Jeff / [illegible]

DRILLING METHOD(S) Hollow-Stem Auger

DEVELOPMENT METHOD(S) Pump / Surge



SIZE AND LENGTH OF LOCKABLE PROTECTIVE STEEL CASING 4"

LOCKED? ___ YES ✓ NO

STICK-UP 2.49'

3'x3' Concrete Pad, 4" Thick

DEPTH TO TOP OF GROUT/BOTTOM OF CONCRETE .5

RISER DIAMETER AND MATERIAL 4" PVC

BOREHOLE DIAMETER 8"

DEPTH TO CENTRALIZERS —

DEPTH 2.0'

PELLET SIZE Hydrated Pellets

DEPTH 4.0'

SAND SIZE #1 Well Gravel

DEPTH 6.0'

SCREEN DIAMETER, SLOT SIZE, AND MATERIAL .020 PVC

DEPTH 16.0'

DEPTH 16.5'

BACKFILL MATERIAL Sand

BOTTOM OF BOREHOLE 17

NOTE: DEPTHS ARE FEET BELOW GRADE

OKWSHEET DWG 9-20-90

400934

OVERBURDEN
MONITORING WELL SHEET

WELL NO. MW 8

PROJECT Captain's Cove START DATE 5/5/98 END DATE 5/5/98

PROJECT NO. 800.202 FIELD GEOLOGIST [illegible]

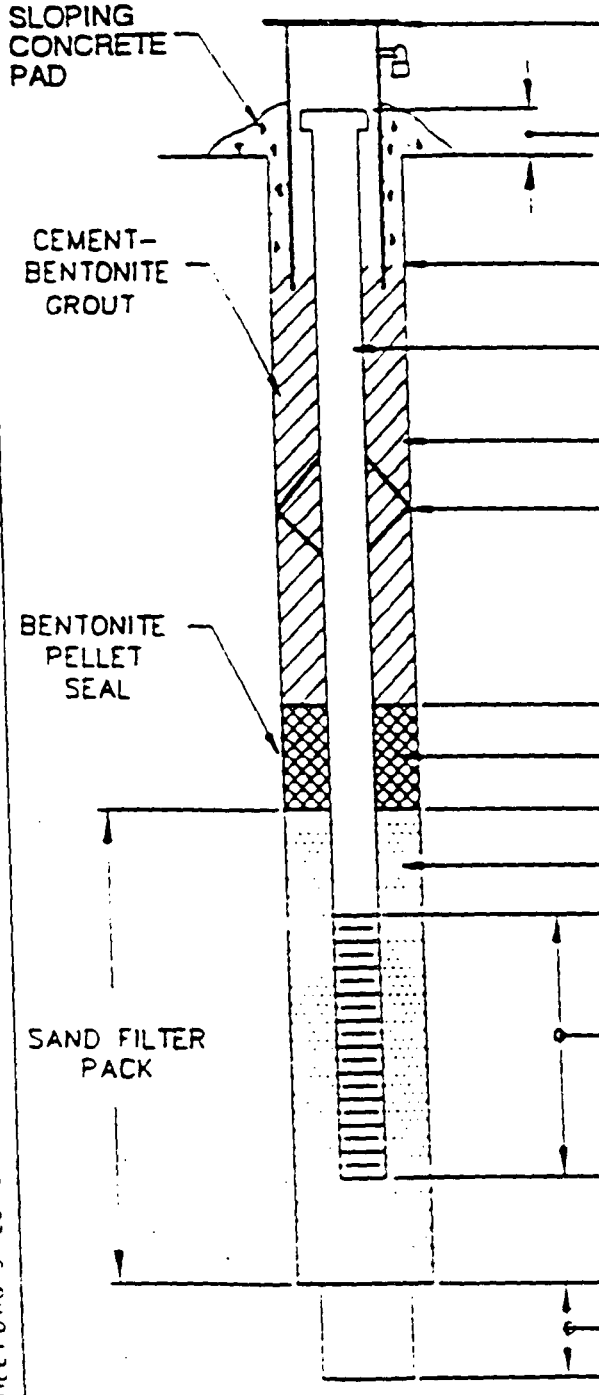
LOCATION Downgradient of Area A.

DRILLING CO. [illegible]

DRILLER(S) Jeff/[illegible]

DRILLING METHOD(S) Hollow-Stem Auger

DEVELOPMENT METHOD(S) Pump/Surge



SIZE AND LENGTH OF LOCKABLE PROTECTIVE STEEL CASING 4"

LOCKED? ___ YES ✓ NO

STICK-UP 2.11

3'x3' Concrete Pad, 4" Thick

DEPTH TO TOP OF GROUT/ BOTTOM OF CONCRETE ___

RISER DIAMETER AND MATERIAL 4" PVC

BOREHOLE DIAMETER 8"

DEPTH TO CENTRALIZERS ___

DEPTH 3.7'

PELLET SIZE Holeplug Pellets

DEPTH 5.7

SAND SIZE ___

DEPTH 7.7'

SCREEN DIAMETER, SLOT SIZE, AND MATERIAL .020 PVC

DEPTH 17.7'

DEPTH 18.2'

BACKFILL MATERIAL Sand

BOTTOM OF BOREHOLE 18.7

NOTE: DEPTHS ARE FEET BELOW GRADE

400935

OWSHEET DWG 9-20-90

ATTACHMENT F

400936

ATTACHMENT F

ATTACHMENT F
RADIOLOGICAL AND CHEMICAL RISK ASSESSMENT METHODOLOGY

- Data Utilization
- Respirable Particulates Model
- Home-Grown Produce Model
- Concentration-Toxicity Screen and Chemicals of Potential of Concern Selection
- Essential Nutrient Screen
- Indoor Shower Model
- Permeability Coefficients
- Data Useability Worksheets
- Toxicological Profiles

DATA UTILIZATION

Before calculating 95% upper confidence limits (UCL) on the arithmetic average concentrations of the radionuclides and chemicals of potential concern, the Shapiro and Wilk W test (for sample sizes ≥ 10 and ≤ 50) were run on the data to determine if the data sets are consistent with a normal distribution (Gilbert, 1987).

If the data set was found to be consistent with the normal distribution, the 95% UCL was calculated from the following equation (USEPA, 1992):

$$UCL = x + t(s/\sqrt{n})$$

where:

- x = the arithmetic average of the data
- s = the standard deviation of the data
- t = Student-t statistic
- n = sample size

If the data set was not found to be consistent with the normal distribution, the 95% UCL concentration was calculated from the following equation (USEPA, 1992):

$$UCL = e^{(x + 0.5s^2 + sH/\sqrt{n} - 1)}$$

where:

- UCL = 95% upper confidence limit on the arithmetic average
- e = constant (base of the natural log)
- x = the arithmetic average of the transformed data
- s = the standard deviation of the transformed data
- H = statistic for a one-sided 95% confidence limit on a lognormal average
- n = sample size

The results of the W tests, the maximum detected concentration, the appropriate 95% UCL concentration, and the exposure point concentration for each radionuclide and chemical of potential concern with a sample size ≥ 10 in each medium are presented in their respective Rad Table 3 in Attachment G, for ROPC and in their respective Standard Table 3 in Attachment H, for COPC.

References

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. New York, NY: Van Nostrand Reinhold. 320 p.

U.S. Environmental Protection Agency. 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Publication 9285.7-08. Washington, DC: Office of Solid Waste and Emergency Response.

RESPIRABLE PARTICULATES MODEL

The methodology to evaluate the potential exposure of construction workers to respirable particulates emitted during the course of excavating soil during construction or utility maintenance activities is described below. The modeling required determination of an emission rate, an emission flux, and the concentration of respirable particulates in the ambient air at the excavation.

Emission Rate and Emission Flux

The emission rate calculation considered the digging of an 1.5 m wide x 5.0 m long x 5.0 m deep excavation by a bulldozer. A bulldozer was assumed for this analysis since an emission rate equation is available for a bulldozer and not a backhoe. Only emissions from the digging of the excavation were calculated; the soil removed from the excavation was assumed to be placed on the side of the excavation and covered to prevent wind-generated respirable particulates.

The following equation (USEPA, 1989) was used to derive an emission rate (in g/s) for respirable particulates:

$$[0.45\ (s)^{1.5}\ (M)^{-1.4}]$$

where:

s = silt content of the soil in weight %
M = moisture content of the soil in weight %

Since the exposure point concentrations in soil are for all surface and subsurface soil, silt content and moisture content data obtained during the field investigation for all surface and subsurface soil are used. A silt content of 32 % is used; this value represents the average of the data that pass through the grain size No. 200 sieve (0.075 mm). All samples collected for grain size analysis were used to calculate the average. A moisture content of 18 % is used; this value represents the average moisture content, as reported for chemical analyses, of all soil samples at Area A and Area G. Solving the above equation resulted in a respirable particulate emission rate of 0.38 g/s, as presented below:

$$= [0.45\ (32)^{1.5}\ (18)^{-1.4}]$$
$$= [0.45\ (181)\ (0.017)]$$
$$= 1.38 \text{ kg/hour}$$
$$= 0.38 \text{ g/s}$$

An emission flux of 0.05 g/s-m^2 was derived by dividing the emission rate by the surface area of the excavation (0.38 g/s ÷ 7.5 m^2).

Air Concentrations

Ambient air concentrations for workers exposed to the excavation emissions were determined using the USEPA-approved Point, Area and Line source (PAL2.1) model, version 89272, (USEPA, 1987) assuming that the excavation represents an area source of emissions. Unlike other area source models, such as the Industrial Source Complex (ISC) model and SCREEN3, PAL2.1 has the capability of determining impacts above area sources, as well as downwind of a source. PAL2.1 is a diverse model that can be used to estimate dispersion for point, area and line sources using Gaussian-plume steady-state assumptions. Simultaneous modeling of multiple sources and source types can be performed to calculate impacts of non-reactive chemicals at a large number of receptors. Also, user-specified meteorological options allow for input of site-specific conditions that are representative of the site being modeled.

For this analysis, the source was modeled as a 1.5 m x 5.0 m flat area source. Nine receptors were used in the analysis. Eight receptors were placed along the edge of the excavation; one at each of the four corners, and one at the center of each side. In addition, one receptor was placed over the center of the excavation. All receptors were placed at a height of 1.8 m to simulate the height of a worker. The meteorological data consisted of an array of 54 meteorological conditions as used in the USEPA-approved screening level model, SCREEN3 (USEPA, 1995). These conditions represented 54 combinations of stability classes (1 to 6) and wind speeds (1 m/s to 20 m/s) that could occur in the atmosphere. The wind directions were set so that the wind would blow directly towards each of the receptors. Model options selected for the analysis included: a typical anemometer height of 6.1 meters, a mixing height of 5000 m, and an average temperature of 293 °K. The wind was assumed to be constant below 10 meters (as fixed by PAL2.1). The analysis was performed for both the rural and urban land use classifications. The emission rate of the area source was set at 1 g/s-m^2. Output was then in the form of g/m^3 per g/s-m^2.

Results

The rural and urban modeling analyses predicted maximum 1-hour average unitized impacts of 0.0268 and 0.1302 g/m^3 per g/s-m^2, respectively, at the corners of the excavation. The maximum 1-hour average respirable particulate concentration (in kg/m^3) in the ambient air at the excavation was calculated from the following equation.

$$C = [\text{1-hour unitized impact in g/m}^3 \text{ per g/s-m}^2] \times [\text{emission flux in g/s-m}^2] \times [0.001 \text{ kg/g}]$$

Based on the urban land use classification, the maximum 1-hour average respirable particulate concentration is 1.34E-06 kg/m^3, as presented below.

$$= [0.0268 \text{ g/m}^3 \text{ per g/s-m}^2] * [0.05 \text{ g/s-m}^2] * [0.001 \text{ kg/g}]$$
$$= 0.00000134 \text{ kg/m}^3$$

Concentrations of the non-volatile radionuclides and chemicals of potential concern associated with this respirable particulate concentration are calculated in the Human Health Evaluation.

References

U.S. Environmental Protection Agency. 1995a. SCREEN3 Model User's Guide. EPA-454/B-95-004. Research Triangle Park, NC: U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. 1989. Estimation of Air Emissions from Clean-up Activities at Superfund Sites, Report ASF-3. Air Superfund National Technical Guidance Study Series. Volume. 3. Research Triangle Park, NC: U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. 1987. User's Guide for PAL 2.0. EPA-600/8-87/009. Research Triangle Park, NC: U. S. Environmental Protection Agency.

HOME-GROWN PRODUCE MODEL

Root Vegetables

The carrot serves as a surrogate for root vegetables grown in home gardens. Carrots are assumed to accumulate radionuclides of potential concern only through uptake from soil. It is further assumed that the carrots are washed before eaten, so that soil adherence to the carrots will not contribute to the chemical intake. To calculate radionuclide concentrations in carrots, the 95% UCL concentration or the maximum concentration in soil is multiplied by a radionuclide-specific root uptake factor (RUF).

RUFs for the radionuclides are based upon transfer coefficients developed by Baes et al. (1984) for tuber crops. The values presented in the following table have been adjusted to reflect the wet weight of each vegetable or fruit. For carrots, the moisture content accounts for approximately 88% of the total wet weight (Baes et al., 1984). Therefore the transfer coefficient is multiplied by 12%. Additional factors affect the bioavailabilty of radionuclides and the extent of root uptake including characteristics of the plant (species, age) and the soil properties (pH, organic content, cation exchange capacity, concentration of other metals, temperature, and aeration). Thus, in the absence of information regarding site-specific soil characteristics, the calculated RUFS should be considered best approximations.

Above-Ground Vegetables

To evaluate the potential exposure from eating "above-ground" vegetables and fruits (i.e., lettuce and tomatoes), the accumulation of radionuclides in the edible parts of the plant must be considered. The effective uptake of radionuclides from the soil depends upon the efficiency of root absorption and translocation to the edible portions. The radionuclide concentration in the edible portions of lettuce and tomato plants can be estimated by multiplying the 95% UCL concentrations or the maximum concentrations of each radionuclide of potential concern in soil by a plant uptake factor (PUF). Similarly to the roots, the potential for radionuclide translocation to the above-ground plant parts depends largely upon the characteristics of the radionuclide and the plant.

The PUFs for the uptake and translocation of the radionuclides to above-ground plant parts are based on transfer coefficients developed by Baes et al. (1984), similarly to those applied in evaluating carrots. Presented PUFs for radionuclides in lettuce are based upon transfer coefficients developed for vegetative plant parts (leaves and stems). The values presented in Table O-1 incorporate a dry-wet weight conversion factor assuming that lettuce typically has a 95% moisture content (Baes et al., 1984). For tomatoes, transfer coefficients developed for fruits were used in the intake estimates, assuming that the typical tomato has a 94% moisture content (Baes et al., 1984).

ROOT AND PLANT UPTAKE FACTORS			
RADIONUCLIDE	PUF LETTUCE	RUF CARROTS	PUF TOMATOES
Uranium-234	4.25E-04	4.80E-04	5.10-04
Uranium-238	4.25E-04	4.80E-04	5.10-04
Radium-226	7.50E-04	1.56E-04	9.00E-04
Radium-228	7.50E-04	1.56E-04	9.00E-04
Thorium-228	4.25E-05	1.02E-05	5.10-05
Thorium-230	4.25E-05	1.02E-05	5.10-05
Thorium-232	4.25E-05	1.02E-05	5.10-05
Lead-210	2.25E-03	1.08E-03	2.70E-03

References

Baes. C.F., III. R.D. Sharp, A.L. Sjoreen and R.W. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radio nuclides through Agriculture. ORNL-5786. Oak Ridge, TN: Oak Ridge National Laboratory.

CONCENTRATION-TOXICITY SCREEN AND CHEMICALS OF POTENTIAL CONCERN SELECTION

A concentration-toxicity screen was performed in accordance with USEPA guidance (USEPA, 1989). The purpose of the screen is to identify chemicals in a particular medium that most likely contribute significantly to the risk estimates. The screen is based on the maximum detected concentrations and USEPA toxicity criteria as represented by reference doses for non-carcinogenic effects and slope factors for carcinogenic effects. Individual chemical scores or risk factors are calculated by dividing the maximum detected concentration by the reference dose or multiplying by the slope factor. The individual risk factors are summed for a total risk factor and then the ratio of the individual risk factors to the total risk factor approximates the relative risk of each individual chemical. Chemicals with relative risks greater than 1% (0.01) are selected as chemicals of potential concern (COPC). Chemicals with relative risks less than 1% are eliminated from the human health evaluation.

The screen was performed using only oral toxicity criteria since no air quality data were collected. However, since inhalation of respirable particulates is a pathway of concern, for those chemicals detected in all soil at Area A and Area G and with inhalation toxicity criteria a second concentration/toxicity screen was performed to determine if the chemicals are likely to contribute significantly to the risk estimates for the inhalation pathway.

Chemicals without toxicity criteria were selected as chemicals of potential concern if they could not be eliminated based on the other criteria (i.e., frequency of detection, background concentration, or nutrient screening concentration); they are evaluated qualitatively in the human health evaluation.

Finally, chemicals with a weight-of-evidence classification of A, known human carcinogens, were also selected as COPC.

The results of the screen, including the reason for selection or elimination as chemicals of potential concern where not based solely on the screen, are presented on the following pages.

References

U.S. Environmental Protection Agency. 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. Washington, DC: Office of Emergency and Remedial Response.

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
SURFACE SOIL AREA A

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen mg/kg	Other Reason for Selection or Elimination
Acetone	0.011		1.00E-01	0.11	0.00	NO	--	D	0.00	0.00	NO				
Chlorobenzene	0.042		2.00E-02	2.10	0.00	NO	--	D	0.00	0.00	NO				
Anthracene	0.065		3.00E-01	0.22	0.00	NO	--	D	0.00	0.00	NO				
Benzo(g,h,i)perylene	0.15		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Fluoranthene	0.44		4E-02	11	0.00	NO	--	D	0.00	0.00	NO				
Fluorene	0.045		4.00E-02	1.13	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene	0.31		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Pyrene	0.3		3E-02	10	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	0.24		--	0.00	0.00	NO	7.30E-01	B2	0.18	0.00	NO				
Benzo(a)pyrene	0.25		--	0.00	0.00	NO	7.30E+00	B2	1.83	0.01	YES				
Benzo(b)fluoranthene	0.43		--	0.00	0.00	NO	7.30E-01	B2	0.31	0.00	NO				
Chrysene	0.17		--	0.00	0.00	NO	7.30E-03	B2	0.00	0.00	NO				
Indeno(1,2,3-cd)pyrene	0.13		--	0.00	0.00	NO	7.30E-01	B2	0.09	0.00	NO				
total PCBs	5.5		2.00E-05	275000	0.19	YES	2.00E+00	B2	11.00	0.08	YES				
beta-BHC	0.015		--	0	0.00	NO	1.80E+00	B2	0.03	0.00	NO				
delta-BHC	0.017		--	0	0.00	NO	1.80E+00	B2	0.03	0.00	NO				
Chlordane (total)	0.13		6.00E-05	2166.667	0.00	NO	1.30E+00	B2	0.17	0.00	NO				
4,4'-DDE	0.0081		--	0	0.00	NO	3.40E-01	B2	0.00	0.00	NO				
4,4'-DDT	0.018		5.00E-04	36	0.00	NO	3.40E-01	B2	0.01	0.00	NO				
Endosulfan I	0.1		6.00E-03	16.66667	0.00	NO	--	--	0.00	0.00	NO				
Heptachlor epoxide	0.0022		1.30E-05	169.2308	0.00	NO	9.10E+00	B2	0.02	0.00	NO				
Aluminum	9140	6603	1.00E+00	9140	0.01	YES	--	--	0.00	0.00	NO	9790	19580		NO; <2X
Antimony	216	120	4.00E-04	540000	0.37	YES	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic	83.9	35	3.00E-04	279667	0.19	YES	1.50E+00	A	125.85	0.90	YES	6.3	12.6		
Barium	236	157	7E-02	3371	0.00	NO	--	--	0.00	0.00	NO	49.0	98.1		
Beryllium	0.37	0.313333	2.00E-03	185	0.00	NO		B2	0.00	0.00	NO	0.85	1.7		
Cadmium	4	2.55	1.00E-03	4000	0.00	NO	--	B1	0.00	0.00	NO	ND	ND		NO; <2X
Calcium	14400	8350	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070.3	2140.6	>1E+06	NO; < nsc
Chromium	28.4	20	2E+00	18.93333	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt	22.2	11	6.00E-02	370	0.00	NO	--	ND	0.00	0.00	NO	7.3	14.5		NO; <2X
Copper	395	222	3.7E-02	10676	0.01	YES	--	D	0.00	0.00	NO	16.0	32.0		
Iron	63000	36307	3.00E-01	210000	0.14	YES	--	--	0.00	0.00	NO	20591.4	41182.9	100,000	NO; <2X
Lead	512	335	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		YES; no toxcrit, >2X
Magnesium	2480	1913	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147.1	4294.3	8.00E+05	NO; < nsc
Manganese	1850	893	2.30E-02	80435	0.06	YES	--	D	0.00	0.00	NO	676.6	1353.1		NO; <2X
Mercury	0.14	0.11	3.00E-04	466.67	0.00	NO	--	D	0.00	0.00	NO	0.085	0.17		
Nickel	36.7	23	2E-02	1835	0.00	NO	--	--	0.00	0.00	NO	12.7	25.5		
Potassium	805	716	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427.3	2854.6	>1E+06	NO; < nsc
Selenium	5.4	5	5.00E-03	1080	0.00	NO	--	D	0.00	0.00	NO	2.00	4		
Silver	11.3	5	5E-03	2260	0.00	NO	--	D	0.00	0.00	NO	0.47	0.94		
Sodium	688	425	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75.0	149.9	>1E+06	NO; < nsc
Thallium	2.6	2	8.00E-05	32500.00	0.02	YES	--	ND	0.00	0.00	NO	1.1	2.2		NO; <2X
Vanadium	23.2	18	7.00E-03	3314	0.00	NO	--	ND	0.00	0.00	NO	25.2	50.4		
Zinc	714	397	3.00E-01	2380	0.00	NO	--	D	0.00	0.00	NO	43.9	87.8		
		Total Relative Risk:		1459112			Total Relative Risk:		139.52						

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.

400947

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA A

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
Acetone	0.39		1.00E-01	3.90	0.00	NO	--	D	0.00	0.00	NO				
2-Butanone	0.089		6.00E-01	0.15	0.00	NO	--	D	0.00	0.00	NO				
Carbon disulfide	0.012		1.00E-01	0.12	0.00	NO	--	--	0.00	0.00	NO				
Chlorobenzene	42		2.00E-02	2100.00	0.00	NO	--	D	0.00	0.00	NO				
Tetrachloroethene	0.004		1.00E-02	0.40	0.00	NO	5.20E-02	--	0.00	0.00	NO				
Acenaphthene	0.36		6E-02	6.00	0.00	NO	--	ND	0.00	0.00	NO				
Anthracene	0.7		3.00E-01	2.33	0.00	NO	--	D	0.00	0.00	NO				
Benzo(g,h,i)perylene	1.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Fluoranthene	5.8		4E-02	145	0.00	NO	--	D	0.00	0.00	NO				
Fluorene	0.25		4.00E-02	6.25	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene	3		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Pyrene	4.5		3E-02	150	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	2.7		--	0.00	0.00	NO	7.30E-01	B2	1.97	0.00	NO				
Benzo(a)pyrene	3.2		--	0.00	0.00	NO	7.30E+00	B2	23.36	0.01	YES				
Benzo(b)fluoranthene	5.6		--	0.00	0.00	NO	7.30E-01	B2	4.09	0.00	NO				
Benzo(k)fluoranthene	0.21		--	0.00	0.00	NO	7.30E-02	B2	0.02	0.00	NO				
Chrysene	1.9		--	0.00	0.00	NO	7.30E-03	B2	0.01	0.00	NO				
Dibenz(a,h)anthracene	0.31		--	0.00	0.00	NO	7.30E+00	B2	2.26	0.00	NO				
Indeno(1,2,3-cd)pyrene	1.5		--	0.00	0.00	NO	7.30E-01	B2	1.10	0.00	NO				
Carbazole	0.48		--	0.00	0.00	NO	2.00E-02	B2	0.01	0.00	NO				
Dibenzofuran	0.13		4.00E-03	33	0.00	NO	--	D	0.00	0.00	NO				
Naphthalene	0.041		2.00E-02	2.05	0.00	NO	--	ND	0.00	0.00	NO				
total PCBs	5.5		2.00E-05	275000	0.02	YES	2.00E+00	B2	11.00	0.00	NO				
alpha-BHC	0.0044		--	0	0.00	NO	6.30E+00	B2	0.03	0.00	NO				
beta-BHC	0.015		--	0	0.00	NO	1.80E+00	B2	0.03	0.00	NO				
delta-BHC	0.017		--	0	0.00	NO	1.80E+00	B2	0.03	0.00	NO				
Chlordane (total)	0.43		6.00E-05	7166.66667	0.00	NO	1.30E+00	B2	0.56	0.00	NO				
4,4'-DDD	0.18		--	0	0.00	NO	2.40E-01	B2	0.04	0.00	NO				
4,4'-DDE	0.12		--	0	0.00	NO	3.40E-01	B2	0.04	0.00	NO				
4,4'-DDT	0.1		5.00E-04	200	0.00	NO	3.40E-01	B2	0.03	0.00	NO				
Dieldrin	0.0049		5.00E-05	98	0.00	NO	1.60E+01	B2	0.08	0.00	NO				
Endosulfan I	0.1		6.00E-03	16.6666667	0.00	NO	--	D	0.00	0.00	NO				
Endrin aldehyde	0.0084		--	0	0.00	NO	--	--	0.00	0.00	NO				YES; no toxcrit
Heptachlor	0.0041		5.00E-04	8.2	0.00	NO	4.50E+00	B2	0.02	0.00	NO				
Heptachlor epoxide	0.034		1.30E-05	2615.38462	0.00	NO	9.10E+00	B2	0.31	0.00	NO				

400948

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA A

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
Aluminum	19700	8678.3684	1.00E+00	19700	0.00	NO	--	--	0.00	0.00	NO	9790	19580		
Antimony	1160	289.2	4.00E-04	2900000	0.19	YES	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic	2760	568.7	3.00E-04	9200000	0.61	YES	1.50E+00	A	4140	0.99	YES	6.3	12.6		
Barium	1200	283	7E-02	17143	0.00	NO	--	--	0.00	0.00	NO	49.0	98.1		YES; inhalation risk, >2X
Beryllium	6.8	1.50	2.00E-03	3400	0.00	NO	--	B2	0.00	0.00	NO	0.85	1.7		
Cadmium	174	30.99	1.00E-03	174000	0.01	YES	--	B1	0.00	0.00	NO	ND	ND		
Calcium	87400	29762	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2140.6	>1E+06	NO; <nsc
Chromium	91.2	30.7	2E+00	60.8	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt	379	83	6.00E-02	6316.66667	0.00	NO	--	ND	0.00	0.00	NO	7.3	14.5		YES; inhalation risk, >2X
Copper	11300	1574	3.7E-02	305405	0.02	YES	--	D	0.00	0.00	NO	16.0	32.0		
Iron	203000	60567	3.00E-01	676667	0.04	YES	--	--	0.00	0.00	NO	20591	41182.9	100,000	
Lead	29500	3515	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		YES; no toxcrit, >2X
Magnesium	39100	5888	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294.3	8.00E+05	NO; < nsc
Manganese	30900	4711	2.30E-02	1343478	0.09	YES	--	D	0.00	0.00	NO	677	1353.1		
Mercury	2.4	0.40	3.00E-04	8000.00	0.00	NO	--	D	0.00	0.00	NO	0.085	0.17		
Nickel	145	46	2E-02	7250	0.00	NO	--	--	0.00	0.00	NO	12.7	25.5		
Potassium	2500	927	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2854.6	>1E+06	NO; < nsc
Selenium	72	18.0	5.00E-03	14400	0.00	NO	--	D	0.00	0.00	NO	2	4		
Silver	245	47.55	5E-03	49000	0.00	NO	--	D	0.00	0.00	NO	0.47	0.94		
Sodium	14100	2399	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75.0	149.9	>1E+06	NO; < nsc
Thallium	2.6	2	8.00E-05	32500.00	0.00	NO	--	ND	0.00	0.00	NO	1.1	2.2		
Vanadium	41.7	23.3	7.00E-03	5957	0.00	NO	--	ND	0.00	0.00	NO	25.2	50.4		
Zinc	17300	3065	3.00E-01	57666.6667	0.00	NO	--	D	0.00	0.00	NO	43.9	87.8		
Cyanide	0.79	0.70	2.00E-02	39.5	0.00	NO	--	D	0.00	0.00	NO	0.23	0.46		
		Total Relative Risk:		15108538				Total Relative Risk:		4184.98					

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.
inhalation risk = Chemical does not pass a similar inhalation concentration/toxicity screen.

400949

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA A

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Inhalation Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
Acetone	0.39		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
2-Butanone	0.089		3.00E-01	0.30	0.00	NO	--	D	0.00	0.00	NO				
Carbon disulfide	0.012		2.00E-01	0.06	0.00	NO	--	--	0.00	0.00	NO				
Chlorobenzene	42		6.00E-03	7000	0.00	NO	--	D	0.00	0.00	NO				
Tetrachloroethene	0.004		--	0.00	0.00	NO	2.00E-03	--	0.00	0.00	NO				
Acenaphthene	0.36		--	0.00	0.00	NO	--	ND	0.00	0.00	NO				
Anthracene	0.7		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Benzo(g,h,i)perylene	1.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Fluoranthene	5.8		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Fluorene	0.25		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene	3		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Pyrene	4.5		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	2.7		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(a)pyrene	3.2		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(b)fluoranthene	5.6		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(k)fluoranthene	0.21		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Chrysene	1.9		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Dibenz(a,h)anthracene	0.31		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Indeno(1,2,3-cd)pyrene	1.5		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Carbazole	0.48		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Dibenzofuran	0.13		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Naphthalene	0.041		9.00E-04	45.56	0.00	NO	--	ND	0.00	0.00	NO				
total PCBs	5.5		--	0.00	0.00	NO	2.00E+00	B2	11.00	0.00	NO				
alpha-BHC	0.0044		--	0.00	0.00	NO	6.30E+00	B2	0.03	0.00	NO				
beta-BHC	0.015		--	0.00	0.00	NO	1.90E+00	B2	0.03	0.00	NO				
delta-BHC	0.017		--	0.00	0.00	NO	1.80E+00	B2	0.03	0.00	NO				
Chlordane (total)	0.43		--	0.00	0.00	NO	1.30E+00	B2	0.56	0.00	NO				
4,4'-DDD	0.18		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
4,4'-DDE	0.12		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
4,4'-DDT	0.1		--	0.00	0.00	NO	3.40E-01	B2	0.03	0.00	NO				
Dieldrin	0.0049		--	0.00	0.00	NO	1.60E+01	B2	0.08	0.00	NO				
Endosulfan I	0.1		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Endrin aldehyde	0.0084		--	0.00	0.00	NO	--	--	0.00	0.00	NO				
Heptachlor	0.0041		--	0.00	0.00	NO	4.60E+00	B2	0.02	0.00	NO				
Heptachlor epoxide	0.034		--	0.00	0.00	NO	9.10E+00	B2	0.31	0.00	NO				
Aluminum	19700	8678.3684	--	0.00	0.00	NO	--	--	0.00	0.00	NO	9790	19580		
Antimony	1160	289.2	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic	2760	568.7	--	0.00	0.00	NO	1.50E+01	A	41400	0.97	YES	6.3	12.6		
Barium	1200	283	1E-04	12000000	0.01	YES	--	--	0.00	0.00	NO	49.0	98.1		
Beryllium	6.8	1.50	6.00E-03	1133	0.00	NO	8.40E+00	B2	57.12	0.00	NO	0.85	1.7		
Cadmium	174	30.99	--	0.00	0.00	NO	6.30E+00	B1	1096	0.03	YES	ND	ND		NO; < 2X
Calcium	87400	29762	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2141	>1E+06	
Chromium	91.2	30.7	--	0.00	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt	379	83	5.71E-06	66374781	0.03	YES	--	ND	0.00	0.00	NO	7.3	14.5		
Copper	11300	1574	--	0.00	0.00	NO	--	D	0.00	0.00	NO	16.0	32.0		
Iron	203000	60567	--	0.00	0.00	NO	--	--	0.00	0.00	NO	20591	41183	100,000	
Lead	29500	3515	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		
Magnesium	39100	5888	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294	800000	
Manganese	30900	4711	1.43E-05	#########	0.96	YES	--	D	0.00	0.00	NO	677	1353		
Mercury	2.4	0.40	9.00E-05	26667	0.00	NO	--	D	0.00	0.00	NO	0.085	0.17		
Nickel	145	46	--	0.00	0.00	NO	--	--	0.00	0.00	NO	12.7	25.5		
Potassium	2500	927	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2855	>1E+06	
Selenium	72	18.0	--	0.00	0.00	NO	--	D	0.00	0.00	NO	2	4		
Silver	245	47.55	--	0.00	0.00	NO	--	D	0.00	0.00	NO	0.47	0.94		
Sodium	14100	2399	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75.0	150	>1E+06	
Thallium	2.6	2	--	0.00	0.00	NO	--	ND	0.00	0.00	NO	1.1	2		
Vanadium	41.7	23.3	--	0.00	0.00	NO	--	ND	0.00	0.00	NO	25.2	50.4		
Zinc	17300	3065	--	0.00	0.00	NO	--	D	0.00	0.00	NO	43.9	87.8		
Cyanide	0.79	0.70	--	0.00	0.00	NO	--	D	0.00	0.00	NO	0.23	0.46		
		Total Relative Risk	#########				Total Relative Risk		42565						

no toxcrit = Oral toxicity information is not available
2X = Two times average background
nsc = Nutrient screening concentration

400950

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
SURFACE SOIL AREA G

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen: Average Concentration mg/kg	Background Screen: 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
Benzo(g,h,i)perylene	0.077		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Fluoranthene	0.17		4E-02	4.25	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene	0.16		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Pyrene	0.2		3E-02	6.67	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	0.054		--	0.00	0.00	NO	7.30E-01	B2	0.04	0.00	NO				
Benzo(a)pyrene	0.13		--	0.00	0.00	NO	7.30E+00	B2	0.95	0.09	YES				
Benzo(b)fluoranthene	0.26		--	0.00	0.00	NO	7.30E-01	B2	0.19	0.02	YES				
Benzo(k)fluoranthene	0.064		--	0.00	0.00	NO	7.30E-02	B2	0.00	0.00	NO				
Chrysene	0.14		--	0.00	0.00	NO	7.30E-03	B2	0.00	0.00	NO				
Indeno(1,2,3-cd)pyrene	0.092		--	0.00	0.00	NO	7.30E-01	B2	0.07	0.01	YES				
Aluminum	6150		1.00E+00	6150	0.06	YES	--	--	0.00	0.00	NO	9790	19580		NO; <2X
Arsenic	6.6		3.00E-04	22000	0.23	YES	1.50E+00	A	9.9	0.89	YES	6.3	13		
Barium	52.5		7E-02	750	0.01	YES	--	--	0.00	0.00	NO	49.0	98		
Beryllium	0.43		2.00E-03	215	0.00	NO	--	B2	0.00	0.00	NO	0.85	1.7		
Cadmium	0.42		1.00E-03	420	0.00	NO	--	B1	0.00	0.00	NO	ND	ND		
Calcium	1150		--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2140.6	>1E+06	No; < nsc
Chromium	10.9		2E+00	7.26667	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt	7.5		6.00E-02	125	0.00	NO	--	ND	0.00	0.00	NO	7.3	14.5		
Copper	24.7		3.7E-02	668	0.01	YES	--	D	0.00	0.00	NO	16.0	32		
Iron	13800		3.00E-01	46000	0.48	YES	--	--	0.00	0.00	NO	20591	41183	100,000	NO; <2X
Lead	31.1		--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		YES; no toxcrit
Magnesium	1460		--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294.3	8.00E+05	NO; <nsc
Manganese	372		2.30E-02	16174	0.17	YES	--	D	0.00	0.00	NO	677	1353		NO; <2X
Mercury	0.02		3.00E-04	66.67	0.00	NO	--	D	0.00	0.00	NO	0.085	0.2		
Nickel	10.5		2E-02	525	0.01	YES	--	--	0.00	0.00	NO	12.7	25		NO; <2X
Potassium	853		--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2854.6	>1E+06	NO; <nsc
Silver	1.1		5E-03	220	0.00	NO	--	D	0.00	0.00	NO	0.47	0.9		
Sodium	30		--	0.00	0.00	NO	--	--	0.00	0.00	NO	74.96	149.9	>1E+06	NO; <nsc
Vanadium	18.4		7.00E-03	2629	0.03	YES	--	ND	0.00	0.00	NO	25.2	50		NO; <2X
Zinc	52.9		3.00E-01	176	0.00	NO	--	D	0.00	0.00	NO	43.89	87.8		
		Total Relative Risk:		96136			Total Relative Risk:		11						

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.

400951

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA G

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
2-Butanone	0.012		6.00E-01	0.02	0.00	NO	--	D	0.00	0.00	NO				
Xylenes	0.018		2E+00	0.01	0.00	NO	--	D	0.00	0.00	NO				
Acenaphthene	4.1		6E-02	68.33	0.00	NO	--	ND	0.00	0.00	NO				
Acenaphthylene	0.077		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Anthracene	4.6		3.00E-01	15.33	0.00	NO	--	D	0.00	0.00	NO				
Benzo(g,h,i)perylene	0.45		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Fluoranthene	8.6		4E-02	215	0.00	NO	--	D	0.00	0.00	NO				
Fluorene	3.7		4E-02	92.50	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene	8.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Pyrene	9.5		3E-02	317	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	4		--	0.00	0.00	NO	7.30E-01	B2	2.92	0.01	YES				
Benzo(a)pyrene	1.6		--	0.00	0.00	NO	7.30E+00	B2	11.68	0.02	YES				
Benzo(b)fluoranthene	3.7		--	0.00	0.00	NO	7.30E-01	B2	2.70	0.00	NO				
Benzo(k)fluoranthene	0.57		--	0.00	0.00	NO	7.30E-02	B2	0.04	0.00	NO				
Chrysene	3.1		--	0.00	0.00	NO	7.30E-03	B2	0.02	0.00	NO				
Indeno(1,2,3-cd)pyrene	0.49		--	0.00	0.00	NO	7.30E-01	B2	0.36	0.00	NO				
Carbazole	2.7		--	0.00	0.00	NO	2.00E-02	B2	0.05	0.00	NO				
Dibenzofuran	2.5		4.00E-03	625	0.00	NO	--	D	0.00	0.00	NO				
Di-n-butylphthalate	0.098		1.00E-01	0.98	0.00	NO	--	D	0.00	0.00	NO				
2,4-Dimethylphenol	0.12		2.00E-02	6.00	0.00	NO	--	--	0.00	0.00	NO				
2-Methylnaphthalene	3.2		4.00E-02	80.00	0.00	NO	--	D	0.00	0.00	NO				
Naphthalene	6.1		2.00E-02	305	0.00	NO	--	ND	0.00	0.00	NO				
N-nitrosodiphenylamine	0.14		2.00E-02	7.00	0.00	NO	4.90E-03	B2	0.00	0.00	NO				
4-Methylphenol	0.13		--	0.00	0.00	NO	--	C	0.00	0.00	NO				
Phenol	0.2		6.00E-01	0.33	0.00	NO	--	D	0.00	0.00	NO				
total PCBs	12		2.00E-05	600000	0.05	YES	2.00E+00	B2	24.00	0.04	YES				
beta-BHC	0.0021		--	0.00	0.00	NO	1.80E+00	B2	0.00	0.00	NO				
delta-BHC	0.0019		--	0.00	0.00	NO	1.80E+00	B2	0.00	0.00	NO				
Chlordane (total)	0.065		6.00E-05	1083	0.00	NO	1.30E+00	B2	0.08	0.00	NO				
Dieldrin	0.012		5.00E-05	240	0.00	NO	1.60E+01	B2	0.19	0.00	NO				
4,4'-DDD	0.061		--	0.00	0.00	NO	2.40E-01	B2	0.01	0.00	NO				
4,4'-DDE	0.014		--	0.00	0.00	NO	3.40E-01	B2	0.00	0.00	NO				
4,4'-DDT	0.028		5.00E-04	56.00	0.00	NO	3.40E-01	B2	0.01	0.00	NO				
Endosulfan I	0.25		6.00E-03	41.67	0.00	NO	--	D	0.00	0.00	NO				
Endosulfan sulfate	0.0052		--	0.00	0.00	NO	--	--	0.00	0.00	NO				YES; no toxcrit
Endrin ketone	0.024		--	0.00	0.00	NO	--	--	0.00	0.00	NO				YES; no toxcrit
Heptachlor	0.0039		5.00E-04	7.80	0.00	NO	4.50E+00	B2	0.02	0.00	NO				
Heptachlor epoxide	0.0057		1.30E-05	438	0.00	NO	9.10E+00	B2	0.05	0.00	NO				
Aluminum	8230	5738	1.00E+00	8230	0.00	NO	--	--	0.00	0.00	NO	9790	19580		
Antimony	201	53.9	4.00E-04	502500	0.04	YES	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic	341	115	3.00E-04	1136667	0.09	YES	1.50E+00	A	512	0.92	YES	6.3	12.6		
Barium	855	373.3	7E-02	12214	0.00	NO	--	--	0.00	0.00	NO	49.0	98.1		
Beryllium	5.4	1.42	2.00E-03	2700	0.00	NO	--	B2	0.0	0.00	NO	0.85	1.7		NO; < 2X
Cadmium	37.2	10.2	1.00E-03	37200	0.00	NO	--	B1	0.00	0.00	NO	ND	ND		YES; inhalation risk, >2X
Calcium	204000	54093	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2140.6	>1E+06	NO; < nsc
Chromium	244	48.2	2E+00	163	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt	172	64	6.00E-02	2867	0.00	NO	--	ND	0.00	0.00	NO	7.3	14.5		
Copper	1850	535	3.7E-02	50000	0.00	NO	--	D	0.00	0.00	NO	16.0	32.0		
Iron	132000	54100	3.00E-01	440000	0.04	YES	--	--	0.00	0.00	NO	20591	41183	100,000	

400952

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA G

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
Lead	3000	680	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		YES; no toxcrit; >2X
Magnesium	2990	1769	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294.3	8.00E+05	NO; < nsc
Manganese	215000	36843	2.30E-02	9347826	0.76	YES	--	D	0.00	0.00	NO	677	1353.1		
Mercury	4.1	0.73	3.00E-04	13667	0.00	NO	--	D	0.00	0.00	NO	0.085	0.2		
Nickel	82.2	34	2E-02	4110	0.00	NO	--	--	0.00	0.00	NO	12.7	25.5		
Potassium	1310	740	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2854.6	>1E+06	NO; < nsc
Selenium	133	38.63625	5.00E-03	26600	0.00	NO	--	D	0.00	0.00	NO	2.00	4.0		
Silver	72.2	21	5E-03	14440	0.00	NO	--	D	0.00	0.00	NO	0.47	0.9		
Sodium	9150	2402	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75.0	149.9	>1E+06	NO; < nsc
Thallium	3.9	4	8.00E-05	48750	0.00	NO	--	ND	0.00	0.00	NO	1.1	2.2		
Vanadium	31.6	20	7.00E-03	4514	0.00	NO	--	ND	0.00	0.00	NO	25.2	50.4		
Zinc	1780	586	3.00E-01	5933	0.00	NO	--	D	0.00	0.00	NO	43.9	87.8		
		Total Relative Risk:		12261980			Total Relative Risk:		554						

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.
inhalation risk = Chemical does not pass a similar inhalation concentration/toxicity screen.

400953

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA G

CHEMICAL	Frequency of Detection	Detected Concentrations Range mg/kg	Detected Concentrations Average mg/kg	Inhalation Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/kg	Background Screen 2X Average mg/kg	Nutrient Screen	Other Reason for Selection or Elimination
2-Butanone		0.012		3.00E-01	0.04	0.00	NO	--	D	0.00	0.00	NO				
Xylenes		0.018		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Acenaphthene		4.1		--	0.00	0.00	NO	--	ND	0.00	0.00	NO				
Acenaphthylene		0.077		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Anthracene		4.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Benzo(g,h,i)perylene		0.45		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Fluoranthene		8.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Fluorene		3.7		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Phenanthrene		8.6		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Pyrene		9.5		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene		4		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(a)pyrene		1.6		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(b)fluoranthene		3.7		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Benzo(k)fluoranthene		0.57		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Chrysene		3.1		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Indeno(1,2,3-cd)pyrene		0.49		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Carbazole		2.7		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
Dibenzofuran		2.5		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Di-n-butylphthalate		0.098		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
2,4-Dimethylphenol		0.12		--	0.00	0.00	NO	--	--	0.00	0.00	NO				
2-Methylnaphthalene		3.2		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Naphthalene		6.1		9.00E-04	6778	0.00	NO	--	ND	0.00	0.00	NO				
N-nitrosodiphenylamine		0.14		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
4-Methylphenol		0.13		--	0.00	0.00	NO	--	C	0.00	0.00	NO				
Phenol		0.2		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
total PCBs		12		--	0.00	0.00	NO	2.00E+00	B2	24.00	0.00	NO				
beta-BHC		0.0021		--	0.00	0.00	NO	1.90E+00	B2	0.00	0.00	NO				
delta-BHC		0.0019		--	0.00	0.00	NO	1.80E+00	B2	0.00	0.00	NO				
Chlordane (total)		0.065		--	0.00	0.00	NO	1.30E+00	B2	0.08	0.00	NO				
Dieldrin		0.012		--	0.00	0.00	NO	1.60E+01	B2	0.19	0.00	NO				
4,4'-DDD		0.061		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
4,4'-DDE		0.014		--	0.00	0.00	NO	--	B2	0.00	0.00	NO				
4,4'-DDT		0.028		--	0.00	0.00	NO	3.40E-01	B2	0.01	0.00	NO				
Endosulfan I		0.25		--	0.00	0.00	NO	--	D	0.00	0.00	NO				
Endosulfan sulfate		0.0052		--	0.00	0.00	NO	--	--	0.00	0.00	NO				
Endrin ketone		0.024		--	0.00	0.00	NO	--	--	0.00	0.00	NO				
Heptachlor		0.0039		--	0.00	0.00	NO	4.60E+00	B2	0.02	0.00	NO				
Heptachlor epoxide		0.0057		--	0.00	0.00	NO	9.10E+00	B2	0.05	0.00	NO				
Aluminum		8230	5738	--	0.00	0.00	NO	--	--	0.00	0.00	NO	9790	19580		
Antimony		201	53.9	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic		341	115	--	0.00	0.00	NO	1.50E+01	A	5115	0.94	YES	6.3	12.6		
Barium		855	373.3	1E-04	8550000	0.00	NO	--	--	0.00	0.00	NO	49.0	98.1		
Beryllium		5.4	1.42	6.00E-03	900	0.00	NO	8.40E+00	B2	45.4	0.01	YES	0.85	1.7		
Cadmium		37.2	10.2	--	0.00	0.00	NO	6.30E+00	B1	234	0.04	YES	ND	ND		
Calcium		204000	54093	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2141	>1E+06	
Chromium		244	48.2	--	0.00	0.00	NO	--	D	0.00	0.00	NO	18.3	36.7		
Cobalt		172	64	5.71E-06	30122592	0.00	NO	--	ND	0.00	0.00	NO	7.3	14.5		
Copper		1850	535	--	0.00	0.00	NO	--	D	0.00	0.00	NO	16.0	32.0		
Iron		132000	54100	--	0.00	0.00	NO	--	--	0.00	0.00	NO	20591	41183	100,000	
Lead		3000	680	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.3	48.6		
Magnesium		2990	1769	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294	>1E+06	
Mang[illegible]		215000	36843	1.43E-05	15034965035	1.00	[illegible]	--	D	0.00	0.00	NO	677	1353		[illegible]
Mer[illegible]		4.1	0.73	9.00E-05	45556	0.00	[illegible]	--	D	0.00	0.00	NO	0.085	0.17		[illegible]

400954

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
ALL SOIL AREA G

CHEMICAL	Frequency of Detection	Detected Concentrations		Inhalation Reference Dose	Risk Factor	Relative Risk	Screen	Inhalation Slope Factor	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen		Nutrient Screen	Other Reason for Selection or Elimination
		Range mg/kg	Average mg/kg	mg/kg-day				(mg/kg-day)$^{-1}$					Average Concentration mg/kg	2X Average mg/kg		
Nickel		82.2	34	--	0.00	0.00	NO	--	--	0.00	0.00	NO	12.7	25.5		
Potassium		1310	740	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2855	>1E+06	
Selenium		133	38.63625	--	0.00	0.00	NO	--	D	0.00	0.00	NO	2.00	4.00		
Silver		72.2	21	--	0.00	0.00	NO	--	D	0.00	0.00	NO	0.47	0.94		
Sodium		9150	2402	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75.0	150	>1E+06	
Thallium		3.9	4	--	0.00	0.00	NO	--	ND	0.00	0.00	NO	1.1	2		
Vanadium		31.6	20	--	0.00	0.00	NO	--	ND	0.00	0.00	NO	25.2	50.4		
Zinc		1780	586	--	0.00	0.00	NO	--	D	0.00	0.00	NO	43.9	87.8		
			Total Relative Risk:	15073690860				Total Relative Risk:	5419							

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.

400955

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
GROUNDWATER

CHEMICAL	Maximum Concentration mg/L	Average mg/L	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Classification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/L	Background Screen 2X Average mg/L	Nutrient Screen mg/L	Reason for Selection or Elimination
Benzene	0.013		--	0	0.00	NO	2.9E-02	A	0.00	0.00	NO				YES; A carcinogen
Chlorobenzene	0.5		2E-02	25.00	0.00	NO	--	D	0.00	0.00	NO				YES; inhalation risk
Chloroform	0.61		1E-02	61	0.00	NO	6.1E-03	B2	0.00	0.00	NO				YES; inhalation risk
1,2-Dichloroethane	0.0042		3.00E-02	0	0.00	NO	9.10E-02	B2	0.00	0.00	NO				YES; inhalation risk
1,2-Dichloroethene (total)	0.218		9.00E-03	24	0.00	NO	--	--	0.00	0.00	NO				
Methylene Chloride	0.026		6E-02	0.43333333	0.00	NO	8E-03	B2	0.00	0.00	NO				
Tetrachloroethene	0.13		1E-02	13	0.00	NO	5.20E-02	--	0.01	0.00	NO				
Toluene	0.088		2.00E-01	0.44	0.00	NO	--	D	0.00	0.00	NO				YES; inhalation risk
Trichloroethene	0.07		6.00E-03	12	0.00	NO	1.10E-02	--	0.00	0.00	NO				
Vinyl Chloride	0.19		--	0.00	0.00	NO	1.90E+00	A	0.36	0.02	YES				
Xylenes (total)	0.0025		2.00E+00	0.00125	0.00	NO	--	D	0.00	0.00	NO				
Acenaphthene	0.019		6E-02	0.32	0.00	NO	--	ND	0.00	0.00	NO				
Fluorene	0.0047		4.00E-02	0.12	0.00	NO	--	D	0.00	0.00	NO				
bis(2-chloroethyl)ether	0.0037		--	0.00	0.00	NO	1.10E+00	B2	0.00	0.00	NO				
bis(2-ethylhexyl)phthalate	0.0028		2.00E-02	0.14	0.00	NO	1.40E-02	B2	0.00	0.00	NO				
Carbazole	0.0018		--	0.00	0.00	NO	2.00E-02	B2	0.00	0.00	NO				
2-Chlorophenol	0.0021		5.00E-03	0.42	0.00	NO	--	--	0.00	0.00	NO				
Dibenzofuran	0.0062		4.00E-03	1.55	0.00	NO	--	D	0.00	0.00	NO				
1,2-Dichlorobenzene	0.019		3.00E-01	0.06	0.00	NO	--	D	0.00	0.00	NO				
1,3-Dichlorobenzene	0.01		3.00E-02	0.33	0.00	NO	--	D	0.00	0.00	NO				
1,4-Dichlorobenzene	0.037		3E-02	1.23	0.00	NO	2.40E-02	C	0.00	0.00	NO				
Diethylphthalate	0.0012		8E-01	0.00	0.00	NO	--	D	0.00	0.00	NO				
2-Methylnaphthalene	0.0017		4.00E-02	0.04	0.00	NO	--	D	0.00	0.00	NO				
4-Methylphenol	0.0022		--	0.00	0.00	NO	--	C	0.00	0.00	NO				YES; no toxcrit
Naphthalene	0.0055		2.00E-02	0.28	0.00	NO	--	ND	0.00	0.00	NO				
Phenol	0.0021		6.00E-01	0.00	0.00	NO	--	D	0.00	0.00	NO				
1,2,4-Trichlorobenzene	0.031		1.00E-02	3.10	0.00	NO	--	D	0.00	0.00	NO				
Endosulfan sulfate	0.00017		--	0.00	0.00	NO	--	--	0.00	0.00	NO				YES; no toxcrit
Aluminum	121	30	1.00E+00	121.00	0.00	NO	--	--	0.00	0.00	NO	30.1	60.1		
Antimony	0.0566	0.04	4.00E-04	141.50	0.00	NO	--	--	0.00	0.00	NO	ND	ND		
Arsenic	11.4	1.91	3.00E-04	38000.00	0.95	YES	1.50E+00	A	17.10	0.98	YES	0.05	0.11		
Barium	0.448	0.29	7E-02	6.40	0.00	NO	--	--	0.00	0.00	NO	0.88	1.8		
Beryllium	0.0066	0.0021	2.00E-03	3.30	0.00	NO	--	B1	0.00	0.00	NO	0.001	0.002		
Cadmium	0.0043	0.00	5.00E-04	8.60	0.00	NO	--	B1	0.00	0.00	NO	0.008	0.016		
Calcium	203	126	--	0.00	0.00	NO	--	--	0.00	0.00	NO	63.8	127.6	400	NO; < nsc
Chromium	0.229	0.05	2E+00	0.15	0.00	NO	--	D	0.00	0.00	NO	0.10	0.204		
Cobalt	0.185	0.04	6.00E-02	3.08	0.00	NO	--	ND	0.00	0.00	NO	0.05	0.100		
Copper	0.77	0.19	3.7E-02	20.81	0.00	NO	--	D	0.00	0.00	NO	0.12	0.245		
Iron	248	106	3.00E-01	826.67	0.02	YES	--	--	0.00	0.00	NO	106	212.2	5	NO; < 2X
Lead	0.544	0.2	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	0.05	0.103		YES; no toxcrit
Magnesium	76.5	41	--	0.00	0.00	NO	--	--	0.00	0.00	NO	16.8	33.7	40	YES; no toxcrit, > nsc, > 2X
Manganese	9.05	3	2.3E-02	393.48	0.01	YES	--	D	0.00	0.00	NO	20.4	40.7		NO; < 2X
Mercury	0.013	0.0018	3.00E-04	43.33	0.00	NO	--	DorC	0.00	0.00	NO	0.001	0.001		
Nickel	0.224	0.05	2E-02	11.20	0.00	NO	--	--	0.00	0.00	NO	0.32	0.648		
Potassium	93.1	33	--	0.00	0.00	NO	--	--	0.00	0.00	NO	14.7	29.5	500	NO; < nsc
Selenium	0.142	0.04	5.00E-03	28.40	0.00	NO	--	D	0.00	0.00	NO	0.008	0.017		
Silver	0.0146	0.01	5E-03	2.92	0.00	NO	--	D	0.00	0.00	NO	0.004	0.008		
Sodium	1120	330	--	0.00	0.00	NO	--	--	0.00	0.00	NO	72.6	145.2	500	NO; < nsc
Thallium	0.0177	0.01	8.00E-05	221.25	0.01	YES	--	ND	0.00	0.00	NO	0.08	0.17		NO; < 2X
Vanadium	0.396	0.10	7.00E-03	56.57	0.00	NO	--	ND	0.00	0.00	NO	0.09	0.174		
Zinc	2.59	0.49	3.00E-01	8.63	0.00	NO	--	D	0.00	0.00	NO	0.59	1.172		
		Total Relative Risk:		40041			Total Relative Risk		17.48						

400956

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
GROUNDWATER

CHEMICAL	Maximum Concentration mg/L	Average mg/L	Oral Reference Dose mg/kg-day	Risk Factor	Relative Screen Risk	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence lassification	Risk Factor	Relative Screen Risk	Background Screen Average Concentration mg/L	Background Screen 2X Average mg/L	Nutrient Screen mg/L	Reason for Selection or Elimination

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.
inhalation risk = Chemical does not pass a similar inhalation concentration/toxicity screen.

400957

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
GROUNDWATER

CHEMICAL	Maximum Concentration mg/L	Average mg/L	Inhalation Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Inhalation Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence lassification	Risk Factor	Relative Risk	Screen	Background Screen Average Concentration mg/L	Background Screen 2X Average mg/L	Nutrient Screen mg/L	Reason for Selection or Elimination
Benzene	0.013		--	0	0.00	NO	2.7E-02	A	0.00	0.00	NO				YES; A carcinogen
Chlorobenzene	0.5		6E-03	83.33	0.94	YES	--	D	0.00	0.00	NO				
Chloroform	0.61		--	0	0.00	NO	8.1E-02	B2	0.05	0.46	YES				
1,2-Dichloroethane	0.0042		1.00E-03	4	0.05	YES	9.10E-02	B2	0.00	0.00	NO				
1,2-Dichloroethene (total)	0.218		--	0	0.00	NO	--	--	0.00	0.00	NO				
Methylene Chloride	0.026		9E-01	0.0289	0.00	NO	2E-03	B2	0.00	0.00	NO				
Tetrachloroethene	0.13		--	0	0.00	NO	2.00E-03	--	0.00	0.00	NO				
Toluene	0.088		1.00E-01	0.88	0.01	YES	--	D	0.00	0.00	NO				
Trichloroethene	0.07		--	0	0.00	NO	6.00E-03	--	0.00	0.00	NO				
Vinyl Chloride	0.19		--	0.00	0.00	NO	3.00E-01	A	0.06	0.53	YES				
Xylenes (total)	0.0025		--	0	0.00	NO	--	D	0.00	0.00	NO				
		Total Relative Risk:		88			Total Relative Risk:		0.11						

no toxcrit = Oral toxicity information is not available.
2X = Two times average background.
nsc = Nutrient screening concentration.

400958

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Conc-tox.xls

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
SURFACE WATER

CHEMICAL	Maximum Concentration mg/L	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Clasification	Risk Factor	Relative Risk	Screen	Nutrient Screen mg/L	Other Reason for Selection or Elimination
Aluminum	17	1.00E+00	17	0.03	YES	--	--	0.00	0.00	NO		
Antimony	0.03	4.00E-04	63	0.11	YES	--	--	0.00	0.00	NO		
Arsenic	0.04	3.00E-04	133	0.22	YES	1.50E+00	A	0.06	1.00	YES		
Barium	0.444	7E-02	6.34	0.01	YES	--	--	0.00	0.00	NO		
Beryllium	0.001	2E-03	0.55	0.00	NO	--	B1	0.00	0.00	NO		
Cadmium	0.009	5.00E-04	17	0.03	YES	--	B1	0.00	0.00	NO		
Calcium	74	--	0.00	0.00	NO	--	--	0.00	0.00	NO	400	NO; <nsc
Chromium	0.043	2E+00	0.03	0.00	NO	--	D	0.00	0.00	NO		
Cobalt	0.0487	6.00E-02	1	0.00	NO	--	ND	0.00	0.00	NO		
Copper	0.3	3.7E-02	9	0.02	YES	--	D	0.00	0.00	NO		
Iron	62	3.00E-01	207	0.35	YES	--	--	0.00	0.00	NO	5	
Lead	0.44	--	0.00	0.00	NO	--	B2	0.00	0.00	NO		YES; no toxcrit
Magnesium	15.2	--	0.00	0.00	NO	--	--	0.00	0.00	NO	40	NO; <nsc
Manganese	2.77	2.30E-02	120	0.20	YES	--	D	0.00	0.00	NO		
Mercury	0.0006	3.00E-04	1.83	0.00	NO	--	D	0.00	0.00	NO		
Nickel	0.1	2E-02	3	0.01	YES	--	--	0.00	0.00	NO		
Potassium	10.0	--	0.00	0.00	NO	--	--	0.00	0.00	NO	500	NO; <nsc
Selenium	0.0083	5.00E-03	2	0.00	NO	--	D	0.00	0.00	NO		
Silver	0.011	5E-03	2	0.00	NO	--	D	0.00	0.00	NO		
Sodium	25	--	0.00	0.00	NO	--	--	0.00	0.00	NO	500	NO; <nsc
Vanadium	0.06	7.00E-03	9	0.01	YES	--	ND	0.00	0.00	NO		
Zinc	0.8	3.00E-01	3	0.00	NO	--	D	0.00	0.00	NO		
	Total Relative Risk:		594			Total Relative Risk:		0				

no toxcrit = Oral toxicity information is not available.
nsc = Nutrient screening concentration.

400959

CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
SEDIMENT

CHEMICAL	Maximum Concentration mg/kg	Average mg/kg	Oral Reference Dose mg/kg-day	Risk Factor	Relative Risk	Screen	Oral Slope Factor (mg/kg-day)$^{-1}$	Weight of Evidence Clasification	Risk Factor	Relative Risk	Screen	Background Screen: Average Concentration mg/kg	Background Screen: 2X Average mg/kg	Nutrient Screen mg/kg	Other Reason for Selection or Elimination
Acetone	0.52		1.00E-01	5.20	0.00	NO	--	D	0.00	0.00	NO				
2-Butanone	0.11		6.00E-01	0.18	0.00	NO	--	D	0.00	0.00	NO				
Anthracene	0.18		3.00E-01	0.60	0.00	NO	--	D	0.00	0.00	NO				
Benzo(a)anthracene	0.35		--	0.00	0.00	NO	7.30E-01	B2	0.26	0.00	NO				
Benzo(a)pyrene	0.3		--	0.00	0.00	NO	7.30E+00	B2	2.19	0.00	NO				
Benzo(g,h,I)perylene	0.18		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Chrysene	0.28		--	0.00	0.00	NO	7.30E-03	B2	0.00	0.00	NO				
Fluoranthene	0.31		4E-02	7.75	0.00	NO	--	D	0.00	0.00	NO				
Indeno(1,2,3-cd)pyrene	0.18		--	0.00	0.00	NO	7.30E-01	B2	0.13	0.00	NO				
Phenanthrene	0.53		--	0.00	0.00	NO	--	D	0.00	0.00	NO				YES; no toxcrit
Pyrene	0.45		3E-02	15.00	0.00	NO	--	D	0.00	0.00	NO				
Benzo(b)fluoranthene	0.36		--	0.00	0.00	NO	7.30E-01	B2	0.26	0.00	NO				
2,4-Dimethylphenol	0.26		2.00E-02	13.00	0.00	NO	--	C	0.00	0.00	NO				
2-Methylphenol	0.74		5.00E-02	14.80	0.00	NO	--	C	0.00	0.00	NO				
4-Methylphenol	0.52		--	0.00	0.00	NO	--	C	0.00	0.00	NO				YES; no toxcrit
Chlordane (total)	0.032		6.00E-05	533.33	0.00	NO	1.30E+00	B2	0.04	0.00	NO				
4,4'-DDD	0.0072		--	0.00	0.00	NO	2.40E-01	B2	0.00	0.00	NO				
4,4'-DDT	0.0055		--	0.00	0.00	NO	3.4E-01	B2	0.00	0.00	NO				
Heptachlor epoxide	0.0028		1.30E-05	215.38	0.00	NO	9.1E+00	B2	0.03	0.00	NO				
Aluminum	11800	6675	1.00E+00	11800.00	0.05	YES	--	--	0.00	0.00	NO	9790	19580		NO; < 2X
Antimony	12.2	6.75	4.00E-04	30500.00	0.13	YES	--	--	0.00	0.00	NO	1.6	3.2		
Arsenic	17.8	9.38	3.00E-04	59333.33	0.25	YES	1.50E+00	A	26.70	0.00	NO	6.3	13		A carcinogen
Barium	126	65.9	7E-02	1800.00	0.01	YES	--	--	0.00	0.00	NO	49	98		NO; < 2X
Beryllium	0.81	0.495	2E-03	405.00	0.00	NO	--	B1	0.00	0.00	NO	1	2		
Cadmium	2.8	1.53	1E-03	2800.00	0.01	YES	--	B1	0.00	0.00	NO	ND	ND		
Calcium	3760	2090.5	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1070	2141	>1E+06	NO; < nsc
Chromium	36.4	19.25	2E+00	24.27	0.00	NO	--	D	0.00	0.00	NO	18	37		
Cobalt	19.5	10.4	6.00E-02	325.00	0.00	NO	--	ND	0.00	0.00	NO	7.27	15		
Copper	180	91.7	3.7E-02	4864.86	0.02	YES	--	D	0.00	0.00	NO	16	32		
Iron	29200	16200	3.00E-01	97333.33	0.41	YES	--	--	0.00	0.00	NO	20591	41183	100,000	NO; < 2X
Lead	271	137.45	--	0.00	0.00	NO	--	B2	0.00	0.00	NO	24.31	49		YES; no toxcrit; >2X
Magnesium	2780	1556	--	0.00	0.00	NO	--	--	0.00	0.00	NO	2147	4294	>1E+06	NO; < nsc
Manganese	386	219.25	2.30E-02	16782.61	0.07	YES	--	D	0.00	0.00	NO	677	1353		NO; < 2X
Mercury	0.35	0.35	3.00E-04	1166.67	0.00	NO	--	D	0.00	0.00	NO	0.09	0.17		
Nickel	41.2	21.75	2E-02	2060.00	0.01	YES	--	--	0.00	0.00	NO	13	25		NO; < 2X
Potassium	1420	785	--	0.00	0.00	NO	--	--	0.00	0.00	NO	1427	2855	>1E+06	NO; < nsc
Selenium	3.1	3.1	5.00E-03	620.00	0.00	NO	--	D	0.00	0.00	NO	2	4		
Silver	7.2	7.2	5E-03	1440.00	0.01	YES	--	D	0.00	0.00	NO	0.47	0.94		
Sodium	121	121	--	0.00	0.00	NO	--	--	0.00	0.00	NO	75	150	>1E+06	NO; < nsc
Vanadium	43.9	23.75	7.00E-03	6271.43	0.03	YES	--	ND	0.00	0.00	NO	25.2	50.4		NO; < 2X
Zinc	364	364	3.00E-01	1213.33	0.01	YES	--	D	0.00	0.00	NO	44	88		
		Total Relative Risk:		239545			Total Relative Risk:		29.61						

no toxcrit = Oral toxicity information is not available.
nsc = Nutrient screening concentration.
2x = Two times average background.

400960

ESSENTIAL NUTRIENT SCREEN

Nutrient screening concentrations to evaluate the concentrations of essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) in soil and groundwater were derived from Recommended Daily Allowances (RDAs) and exposure parameters in the models used by the USEPA, Region III in their derivation of risk-based concentrations (USEPA, 1995). Based on the exposure scenarios considered in the human health evaluation, nutrient screening concentrations for soil were derived for ingestion by a child and reference concentrations for groundwater were derived for residential tap water use by a child (ESHA Research, 1990).

Nutrient Screening Concentrations for Soil

$$RC_s = RDA_a / IR_s * FI * CF$$

where

RC_s = nutrient screening concentration for soil (mg/Kg)
RDA_a = recommended daily allowance for a child (mg/day)
IR_s = soil ingestion rate (200 mg/day)
RI = fraction ingested (0.5)
CF = conversion factor (10^{-6} Kg/mg)

Nutrient Screening Concentration for Groundwater

$$RC_w = RDA_c / IR_w$$

where

RC_w = nutrient screening concentration for water (mg/L)
RDA_c = recommended daily allowance for a child (mg/day)
IR_w = water ingestion rate (2 L/day)

Essential Nutrient	Recommended Daily Allowance (mg/day; male child)	Nutrient Screening Concentration for Soil (mg/Kg)	Nutrient Screening Concentration for Groundwater (mg/L)
Calcium	800	> 1E+06	400
Iron	10	100,000	5
Magnesium	80	8E+05	40
Potassium	1000	> 1E+06	500
Sodium	975	> 1E+06	500

References

U.S. Environmental Protection Agency. 1995. Risk-Based Concentration Table, July-December 1995. Philadelphia, PA: USEPA Region III, Technical Support Section.

ESHA Research. 1990. The Food Processor II. Nutrient Analysis System.

INDOOR SHOWER MODEL

The concentrations of volatile chemicals of potential concern in bathroom air during and after showering are estimated using an approach recommended by the USEPA (Schaum, 1992). The Schaum model is a realistic yet simple model which treats the bathroom as one compartment and yields air concentrations averaged over the time of the actual shower and the time spent in the bathroom subsequent to the shower. It is assumed that the chemicals volatilize at a constant rate, instantly mix uniformly with the bathroom air, and that ventilation with clean air does not occur. This implies that the chemical concentrations in the air increase linearly from zero to a maximum at the end of the shower and then remain constant during the time an individual spends in the bathroom immediately after the shower.

The average concentration of a volatile chemical in the shower air over a period of t_s minutes (for $t_s > 0$) is estimated from the following equation:

$$C_a = ((C_{amax} / 2)\, t_1 + C_{amax}\, t_2) / (t_1 + t_2)$$

where:

C_a = the concentration of a volatile chemical in the bathroom air over a duration of t_s minutes (mg/m^3)

C_{amax} = the maximum concentration of a volatile chemical in the bathroom air (mg/m^3)

t_1 = the time of shower (0.2 hr)

t_2 = the time after shower (0.2 hr)

t_s = the time in the bathroom during (t_1) and after (t_2) the shower (0.4 hr)

and where:

$$C_{amax} = C_w\, f\, F_w\, t_1 / V_a$$

where:

C_{amax} = the maximum volatile chemical concentration in the bathroom air (mg/m^3)

C_w = the water concentration (mg/L)

f = the fraction volatilized (unitless)

F_w = the water flow rate (500 L/hr)

V_a = the bathroom volume (16 m^3)

The fraction volatilized value is the mass fraction of the chemical in water that volatilizes over the course of the shower. It is a chemical-specific value which is not easily predicted. The volatilization rates depend on properties such as Henry's Law constant and molecular weight. McKone (1989) has suggested an approach where the volatilization fraction for an untested chemical can be predicted from a tested chemical (trichloroethene is used here) using a ratio of their overall mass transfer coefficients:

$$f_i = f_j\,((2.5/D_w^{0.67}) + ((RT/D_a^{0.67})*H))_j\,/((2.5/D_w^{0.67}) + ((RT/D_a^{0.67})*H))_i$$

where:

f_i = the volatilization fraction for chemical I

f_j = the volatilization fraction for chemical j

D_a = the diffusion coefficient in air (m^2/sec)

D_w = the diffusion coefficient in water (m^2/sec)

R = the gas constant (atm-m^3/mol-K) = $8.21*10^{-5}$

H = Henry's law constant (atm-m^3/mol-K)

T = temperature (K)

The various input parameters and the estimates of C_a are presented in the following table.

References

Schaum, J., K. Hoang, R. Kinerson, and J. Moya. 1992. Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water. California Environmental Protection Agency. Sacramento, CA.

McKone, T.E. 1989. Household exposure models. Toxicology Letters, 49: 321-339.

INDOOR SHOWER MODEL SCENARIO
CAPTAIN'S COVE SITE

Chemical	Concentration in Air Ca (mg/m3)	Concentration in Water Cw (mg/L)	Henry's Law Constant H (unitless)	H (atm-m3/mol)	Diffusion Coefficient in Water Dw (m^2/sec)	Diffusion Coefficient in Air Da (m^2/sec)	Fraction Volatilized f (unitless)	Flow Rate of Shower Fw (L/hr)	Time of Shower t1 (hours)	Time after Shower t2 (hours)	Bathroom Volume Va (m^3)	Max Chemical Concentration in Bathroom Air Camax (mg/m3)
Benzene	2.25E-02	7.61E-03	2.28E-01	5.55E-03	9.80E-10	8.80E-06	6.29E-01	500	0.2	0.2	16	3.00E-02
Chlorobenzene	5.14E-01	1.89E-01	1.52E-01	3.70E-03	8.70E-10	7.30E-06	5.80E-01	500	0.2	0.2	16	6.85E-01
Chloroform	6.60E-01	2.21E-01	1.50E-01	3.67E-03	1.00E-09	1.04E-05	6.37E-01	500	0.2	0.2	16	8.80E-01
1,2-Dichloroethane	1.44E-02	4.20E-03	4.01E-02	9.79E-04	9.90E-10	1.04E-05	6.24E-01	500	0.2	0.2	16	1.92E-02
1,2 Dichloroethene (total)	2.16E-01	6.68E-02	1.67E-01	4.08E-03	1.13E-09	7.36E-06	6.91E-01	500	0.2	0.2	16	2.88E-01
Methylene Chloride	3.30E-02	9.99E-03	8.98E-02	2.19E-03	1.17E-09	1.01E-05	7.04E-01	500	0.2	0.2	16	4.40E-02
Tetrachloroethene	9.17E-02	3.49E-02	7.54E-01	1.84E-02	8.20E-10	7.20E-06	5.60E-01	500	0.2	0.2	16	1.22E-01
Toluene	6.58E-02	2.43E-02	2.72E-01	6.60E-03	8.60E-10	8.70E-06	5.77E-01	500	0.2	0.2	16	8.77E-02
Trichloroethene	5.60E-02	1.99E-02	4.22E-01	1.03E-02	9.10E-10	7.90E-06	6.00E-01	500	0.2	0.2	16	7.47E-02
Vinyl Chloride	4.07E-02	5.52E-02	1.11E+00	2.70E-02	1.23E-10	1.06E-05	1.57E-01	500	0.2	0.2	16	5.43E-02

Henry's Law constant for 1,2-Dichloroethene is for cis-1,2-Dichloroethene

400965

PERMEABILITY COEFFICIENTS

CHEMICAL	PERMEABILITY COEFFICIENTS (cm/hour)
Benzene	2.1E-02
Chlorobenzene	4.1E-02
Chloroform	8.9E-03
1,2-Dichloroethane	5.3E-03
1,2-Dichloroethene	1E-02
Methylene chloride	4.5E-03
Tetrachloroethane	4.8E-02
Toluene	4.5E-02
Trichloroethene	1.6E-02
Vinyl chloride	7.3E-03
bis(2-chloroethyl)ether	2.1E-03
1,4-Dichlorobenzene	6.2E-02
Endosulfan sulfate	Not Available
Aluminum	1E-03
Antimony	1E-03
Arsenic	1E-03
Barium	1E-03
Cadmium	1E-03
Copper	1E-03
Iron	1E-03
Lead	1E-03
Magnesium	1E-03
Manganese	1E-03
Nickel	1E-03
Vanadium	1E-03

Schaum, J., K. Hoang, R. Kinerson, and J. Moya. 1992. Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water. Sacramento, CA: California Environmental Protection Agency.

DATA USEABILITY WORKSHEETS

DATA USEABILITY WORKSHEET
Site: Captain's Cove
Medium: Soil - Radiological

Requirement	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	None.
Are samples representative of receptor exposure for this medium (e.g., sample depth, grab vs. composite, filtered vs. unfiltered, low flow, etc.)?	Yes.
Assess the effect of field QC results on data useability.	In general, the field QC results did not affect data useability.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	NA
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes.
Were detection limits adequate?	In general, the detection limits were adequate. In a few instances, the MDCs were elevated (i.e., > 0.3 pCi/g).
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	NA

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Soil - Radiological

Requirement	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	Two types of duplicates were collected; field blind duplicates and matrix spike/matrix spike duplicates (MS/MSDs). Both the field blind duplicate and MS/MSD samples were collected at a rate of one per 20 environmental samples.
Accuracy - How were split samples handled?	Split samples were not collected.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.).	In general, there were no recurring problems with data representativeness.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	In general, there were no problems with data completeness.
Comparability - Indicate any problems associated with data comparability.	NA
Were the DQOs specified in the QAPP satisfied?	Yes.
Summarize the effect of DQO issues on the risk assessment, if applicable.	NA

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Soil - Radiological

Requirement	Comment
Data Validation and Interpretation	
What are the data validation requirements for this region?	There are no radiological validation requirements for this region. The radiological data for this project were validated using the following QC: alpha spectroscopy- 1) initial calibration (yearly) 2) calibration verification (weekly) 3) detector background check (monthly) 4) tracer analysis 5) method blank and rinsate blank 6) laboratory control sample (LCS) 7) laboratory duplicate analysis 8) field duplicate analysis 9) matrix spike/matrix spike duplicate analysis gamma spectroscopy- 1) initial calibration (yearly) 2) calibration verification (weekly) 3) detector background check (monthly) 4) method blank and rinsate blank 5) laboratory duplicate analysis 6) field duplicate analysis 7) percent dead time 8) photopeaks/reference library
What method or guidance was used to validate the data?	There are no regional data validation guidelines. Therefore, the validation requirements were specified in the site-specific Quality Assurance Project Plan (QAPP).
Was the data validation method consistent with regional guidance? Discuss any discrepancies.	NA
Were all data qualifiers defined? Discuss those which were not.	Yes.

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Soil - Radiological

Requirement	Comment
Which qualifiers represent usable data?	All data except rejected "R" data are useable.
Which qualifiers represent unusable data?	"R".
How are tentatively identified compounds handled?	NA
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Any data that is qualified as rejected "R" is not used in the risk assessment.
Additional notes:	

DATA USEABILITY WORKSHEET
Site: Captain's Cove
Medium: Water - Radiological

Requirement	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	None.
Are samples representative of receptor exposure for this medium (e.g., sample depth, grab vs. composite, filtered vs. unfiltered, low flow, etc.)?	Yes.
Assess the effect of field QC results on data useability.	In general, the field QC results did not affect data useability.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	NA
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes.
Were detection limits adequate?	In general, the detection limits were adequate. In a few instances, the MDCs were elevated (i.e., > 0.1 pCi/L).
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	NA

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Water - Radiological

Requirement	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	Two types of duplicates were collected; field blind duplicates and matrix spike/matrix spike duplicates (MS/MSDs). Both the field blind duplicate and MS/MSD samples were collected at a rate of one per 20 environmental samples.
Accuracy - How were split samples handled?	Split samples were not collected.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.).	In general, there were no recurring problems with data representativeness.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	In general, there were no problems with data completeness.
Comparability - Indicate any problems associated with data comparability.	NA
Were the DQOs specified in the QAPP satisfied?	Yes.
Summarize the effect of DQO issues on the risk assessment, if applicable.	NA

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Water - Radiological

Requirement	Comment
Data Validation and Interpretation	
What are the data validation requirements for this region?	There are no radiological validation requirements for this region. The radiological data for this project were validated using the following QC: alpha spectroscopy- 1) initial calibration (yearly) 2) calibration verification (weekly) 3) detector background check (monthly) 4) tracer analysis 5) method blank and rinsate blank 6) laboratory control sample (LCS) 7) laboratory duplicate analysis 8) field duplicate analysis 9) matrix spike/matrix spike duplicate analysis gamma spectroscopy- 1) initial calibration (yearly) 2) calibration verification (weekly) 3) detector background check (monthly) 4) method blank and rinsate blank 5) laboratory duplicate analysis 6) field duplicate analysis 7) percent dead time 8) photopeaks/reference library
What method or guidance was used to validate the data?	There are no regional data validation guidelines. Therefore, the validation requirements were specified in the site-specific Quality Assurance Project Plan (QAPP).
Was the data validation method consistent with regional guidance? Discuss any discrepancies.	NA
Were all data qualifiers defined? Discuss those which were not.	Yes.

DATA USEABILITY WORKSHEET (continued)
Site: Captain's Cove
Medium: Water - Radiological

Requirement	Comment
Which qualifiers represent usable data?	All data except rejected "R" data are useable.
Which qualifiers represent unusable data?	"R".
How are tentatively identified compounds handled?	NA
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Any data that is qualified as rejected "R" is not used in the risk assessment.
Additional notes:	

DATA USEABILITY WORKSHEET
Site: Captains Cove, Long Island, NY
Medium: Water and Soil (organic and Inorganic)

Requirement	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	None
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs composite, filtered vs unfiltered, low flow, etc.)?	Yes
Assess the effect of field QC results on data useability.	In general field QC results did not affect data useability. In some instances, there was field blank contamination, however the contaminants were common lab contaminants (e.g., methylene chloride, acetone, bis(2-ethylhexyl)phthalate). Rinsate blanks had only a minor affect on the data.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	N/A
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes
Were detection limits adequate?	Yes
Summarize the effect of analytical technique issues on	N/A

DATA USEABILITY WORKSHEET
Site: Captains Cove, Long Island, NY
Medium: Water and Soil (organic and Inorganic)

Requirement	Comment
the risk assessment, if applicable.	
Data Quality Objectives	
Precision - How were duplicates handled?	Two types of duplicates were collected, field and MS/MSD for organics and field and MS/MD for inorganics. Both types were collected at a rate of 1 per 20 samples.
Accuracy - How were split samples handled?	Split samples were not collected.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.).	In general there were no recurring problems with representativeness. In some instances there was contamination detection in blanks, however, this did not seriously affect the data.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	In general there were no problems with data completeness.
Comparability - Indicate any problems associated with data comparability.	N/A
Were the DQOs specified in the QAPP satisfied?	Yes.
	N/A

DATA USEABILITY WORKSHEET
Site: Captains Cove, Long Island, NY
Medium: Water and Soil (organic and Inorganic)

Requirement	Comment
Summarize the effect of DQO issues on the risk assessment, if applicable.	
Data Validation and Interpretation	
What are the data validation requirements for this region?	Organic: Analyzed following USEPA CLP SOW OLMO3.2. Validated following USEPA CLP National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (OLMO1.0) or most recent and USEPA Region II SOP and Checklists for Organic Analyses (HW-6, Rev. 11, 6/96). Inorganic: Analyzed following USEPA CLP SOW ILMO4.0. Validated following Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis, October 1989 or most recent and USEPA Region II SOP and Checklists for Inrganic Analyses (SOP HW-2, Rev. 11, 1/93).
What method or guidance was used to validate the data?	The validation requirements described above were used to validate the data.
Was the data validation method consistent with regional guidance? Discuss any discrepancies.	Yes.
Were all data qualifiers defined? Discuss those which were not.	Yes, they are defined in the CLP SOW's described above.
Which qualifiers represent usable data?	All data except rejected data are to be considered useable.

DATA USEABILITY WORKSHEET
Site: Captains Cove, Long Island, NY
Medium: Water and Soil (organic and Inorganic)

Requirement	Comment
Which qualifiers represent unusable data?	"R" or red lined
How are tentatively identified compounds handled?	Any TICs detected in the blanks or are instrument artifacts are rejected "R". For remaining TIC's, all calculations and spectra are reviewed. Non-identified TIC's are qualified both estimated "J" and tentatively identified "N".
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Any data that is qualified rejected "R" is not to be used in the risk assessment.
Additional notes:	

Note: The purpose of this Worksheet is to succinctly summarize the data useability analysis and conclusions. Reference specific pages in the Risk Assessment text to further expand on the information presented here.

TOXICOLOGICAL PROFILES

ToxFAQs

Antimony

September 1995

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about antimony. For more information, you may call 404-639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to antimony occurs in the workplace or from skin contact with soil at hazardous waste sites. Breathing high levels of antimony for a long time can irritate the eyes and lungs, and can cause problems with the lungs, heart, and stomach. This chemical has been found in at least 403 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is antimony?
(Pronounced an'ti-mo-nee)

Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals.

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

What happens to antimony when it enters the environment?

- Antimony is released to the environment from natural sources and from industry.
- In the air, antimony is attached to very small particles that may stay in the air for many days.
- Most antimony ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum.
- Antimony is found at low levels in some rivers, lakes, and streams.

How might I be exposed to antimony?

- Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.
- It may be found in air near industries that process or release it, such as smelters, coal-fired plants,

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and refuse incinerators.
- In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.
- Workers in industries that process it or use antimony ore may be exposed to higher levels.

How can antimony affect my health?

Exposure to antimony at high levels can result in a variety of adverse health effects.

Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.

In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. We don't know what other effects may be caused by ingesting it. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.

Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

How likely is antimony to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified antimony as to its human carcinogenicity.

Lung cancer has been observed in some studies of rats that breathed high levels of antimony. No human studies are available. We don't know whether antimony will cause cancer in people.

Is there a medical test to show whether I've been exposed to antimony?

Tests are available to measure antimony levels in the body. Antimony can be measured in the urine, feces, and blood for several days after exposure. However, these tests cannot tell you how much antimony you have been exposed to or whether you will experience any health effects. Some tests are not usually performed in most doctors' offices and may require special equipment to conduct them.

Has the federal government made recommendations to protect human health?

The EPA allows 0.006 parts of antimony per million parts of drinking water (0.006 ppm). The EPA requires that discharges or spills into the environment of 5,000 pounds or more of antimony be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 0.5 milligrams of antimony per cubic meter of air (0.5 mg/m^3) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) currently recommend the same guidelines for the workplace as OSHA.

Glossary

Carcinogenicity:
Ability to cause cancer.

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Ingestion:
Taking food or drink into your body.
Long-term:
Lasting one year or more.
Milligram (mg):
One thousandth of a gram.
Parasite:
An organism living in or on another organism.
PPM:
Parts per million.
Short-term:
Lasting 14 days or less.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for antimony. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 404-639-6000
FAX: 404-639-6315

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry

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Last Update: September 1, 1995
Charlie Xintaras / chx1@cdc.gov

ToxFAQs

Arsenic

April 1993

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about arsenic. For more information, you may call 404-639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to higher than average levels of arsenic happens mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. Arsenic is a powerful poison. At high levels, it can cause death or illness. This chemical has been found in at least 781 of 1,300 National Priorities List sites identified by the Environmental Protection Agency.

What is arsenic?
(Pronounced ar' se-nik)

Arsenic is found in nature at low levels. It's mostly in compounds with oxygen, chlorine, and sulfur. These are called inorganic arsenic compounds. Arsenic in plants and animals combines with carbon and hydrogen. This is called organic arsenic. Organic arsenic is usually less harmful than inorganic arsenic.

Most arsenic compounds have no smell or special taste.

Inorganic arsenic compounds are mainly used to preserve wood. They are also used to make insecticides and weed killers. You can check the labels of treated wood and insecticides to see if they contain arsenic.

Copper and lead ores contain small amounts of arsenic.

What happens to arsenic when it enters the environment?

- It doesn't evaporate.
- Most arsenic compounds can dissolve in water.
- It gets into air when contaminated materials are burned.
- It settles from the air to the ground.
- It doesn't break down, but can change from one form to another.
- Fish and shellfish build up organic arsenic in their tissues, but most of the arsenic in fish isn't toxic.

How might I be exposed to arsenic?

- Breathing sawdust or burning smoke from wood containing arsenic
- Breathing workplace air
- Ingesting contaminated water, soil, or air at waste sites
- Ingesting contaminated water, soil, or air near areas naturally high in arsenic

How can arsenic affect my health?

Inorganic arsenic is a human poison. Organic arsenic is less harmful.

High levels of inorganic arsenic in food or water can be fatal. A high level is 60 parts of arsenic per million parts of food or water (60 ppm). Arsenic damages many tissues including nerves, stomach and intestines, and skin. Breathing high levels can give you a sore throat and irritated lungs.

Lower levels of exposure to inorganic arsenic may cause:

- Nausea, vomiting, and diarrhea
- Decreased production of red and white blood cells
- Abnormal heart rhythm
- Blood vessel damage
- A "pins and needles" sensation in hands and feet

Long term exposure to inorganic arsenic may lead to a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Direct skin contact may cause redness and swelling.

How likely is arsenic to cause cancer?

The Department of Health and Human Services (DHHS) has determined that arsenic is a known carcinogen. Breathing inorganic arsenic increases the risk of lung cancer. Ingesting inorganic arsenic increases the risk of skin cancer and tumors of the bladder, kidney, liver, and lung.

Is there a medical test to show whether I've been exposed to arsenic?

Tests can measure your exposure to high levels of arsenic. These tests are not routinely performed in a doctor's office.

Arsenic can be measured in your urine. This is the most reliable test for arsenic exposure. Since arsenic stays in the body only short time, you must have the test soon after exposure.

Tests on hair or fingernails can measure your exposure to highlevels of arsenic over the past 6-12 months. These tests are not very useful for low level exposures.

These tests do not predict whether you will have any harmful health effects.

Has the federal government made recommendations to protect human health?

The Environmental Protection Agency (EPA) sets limits on the amount of arsenic that industrial sources can release. It restricted or canceled many uses of arsenic in pesticides and may restrict more EPA set a limit of 0.05 parts per million (ppm) for arsenic in drinking water. EPA may lower this further

The Occupational Safety and Health Administration (OSHA) established a maximum permissible exposure limit for workplace airborne arsenic of 10 micrograms per cubic meter ($\mu g/m^3$).

Glossary

Carcinogen:
Substance that can cause cancer.
Ingesting:
Taking food or drink into your body.
PPM:
Parts per million.
Microgram (μg):
One millionth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological profile for arsenic. Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Case studies in environmental medicine: Arsenic toxicity. Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns. For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 404-639-6000

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry

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ToxFAQs

Cadmium

April 1993

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about cadmium For more information, you may call 404- 639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the lungs, can cause kidney disease, and may irritate the digestive tract. Cadmium has been found in at least 388 of 1,300 National Priorities List sites identified by the Environmental Protection Agency.

What is cadmium?
Pronounced (cad' me-um)

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). It doesn't have a definite taste or odor.

All soils and rocks, including coal and mineral fertilizers, have some cadmium in them The cadmium that industry uses is extracted during the production of other metals like zinc, lead, and copper.

Cadmium does not corrode easily and has many uses. In industry and consumer products, it is used for batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- Cadmium enters air from mining, industry, and burning coal and household wastes.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- It binds strongly to soil particles.
- Some cadmium dissolves in water.
- It doesn't break down in the environment, but can change forms.
- Fish, plants, and animals take up cadmium from the environment.

- Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

How might I be exposed to cadmium?

- Breathing contaminated workplace air (battery manufacturing, metal soldering or welding)
- Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats)
- Breathing cadmium in cigarette smoke (doubles the average daily intake)
- Drinking contaminated water
- Breathing contaminated air near the burning of fossil fuels or municipal waste

How can cadmium affect my health?

Breathing **high levels** of cadmium severely damages the lungs and can cause death. Eating food or drinking water with **very high levels** severely irritates the stomach, leading to vomiting and diarrhea.

Long term exposure to lower levels of cadmium in air, food, or water leads to a build up of cadmium in the kidneys and possible kidney disease. Other potential long term effects are lung damage and fragile bones.

Animals given cadmium in food or water show high blood pressure, iron-poor blood, liver disease, and nerve or brain damage. We don't know if humans get any of these diseases from eating or drinking cadmium.

Skin contact with cadmium is not known to cause health effects in humans or animals.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

This is based on weak evidence of increased lung cancer in humans from breathing cadmium and on strong evidence from animal studies. We do not know if cadmium causes cancer from skin contact or from eating or drinking contaminated food and water.

Is there a medical test to show whether I've been exposed to cadmium?

Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails.

Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. Urine tests can indicate kidney damage. The reliability of tests for cadmium levels in hair or nails is unknown.

Tests are available to measure cadmium in your liver and kidney. The tests are expensive, but can help a doctor evaluate your risk of kidney disease.

Has the federal government made recommendations to protect human health?

The Environmental Protection Agency (EPA) allows 5 parts of cadmium per billion parts of drinking water (5 ppb). The EPA also limits how much cadmium can enter lakes, rivers, waste sites, and cropland.

The EPA does not allow cadmium in pesticides.

The Food and Drug Administration (FDA) limits the amount of cadmium in food colors to 15 parts of cadmium per million parts of food color (15 ppm).

The Occupational Safety and Health Administration (OSHA) now limits workplace air to 100 micrograms (µg) cadmium per cubic meter as cadmium fumes and 200 µg cadmium/cubic meter as cadmium dust. OSHA is planning to limit all cadmium compounds to either 1 or 5 µg/cubic meter.

The National Institute for Occupational Safety and Health (NIOSH) currently recommends that workers breathe as little cadmium as possible.

Glossary

Carcinogen:
Substance that can cause cancer.

PPM:
Parts per million.

PPB:
Parts per billion.

Microgram (µg):
One millionth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological profile for cadmium Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Case studies in environmental medicine: Cadmium toxicity. Atlanta: U.S. Department of Health and Human Services, Public Health Service

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns. For more information, contact:

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Phone: 404-639-6000

U.S. Department of Health and Human Services
Public Health Service

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ToxFAQs

Cobalt

September 1995

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about cobalt. For more information, you may call 404-639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Everyone is exposed to low levels of cobalt in air, water, and food. Exposure to higher levels of cobalt occurs in the workplace. Cobalt has both beneficial and harmful effects on health. At low levels, it is part of Vitamin B12, which is essential for good health; at high levels, it may harm the lungs. This chemical has been found in at least 336 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is cobalt?
(Pronounced ko'balt)

Cobalt is a compound that occurs in nature. It occurs in many different chemical forms. Pure cobalt is a steel-gray, shiny, hard metal. Cobalt is not currently mined in the United States.

All cobalt used in industry is imported or obtained by recycling scrap metal that contains cobalt. It is used in industry to make alloys (mixtures of metals), colored pigments, and as a drier for paint and porcelain enamel used on steel bathroom fixtures, large appliances, and kitchen wares.

Small amounts of cobalt naturally occur in food. In addition, vitamin B12 is a cobalt-containing compound that is essential for good health.

Some important natural sources of cobalt in the environment are soil, dust, and seawater. Cobalt is also released to the environment from burning coal and oil, and from exhaust from cars and trucks.

What happens to cobalt when it enters the environment?

- Cobalt enters the environment from natural sources and from the burning of coal and oil.
- Cobalt stays in the air for a few days.
- Pure cobalt does not dissolve in water, but some of its compounds do.

- Cobalt can stay for years in water and soil.
- It can move from the soil to underground water.
- Cobalt is taken up by plants from the soil.

How might I be exposed to cobalt?

- Everyone is exposed to cobalt at low levels in air, water, and food.
- People who live near hazardous waste sites containing cobalt may be exposed to higher levels of this chemical.
- Food is another source of exposure to cobalt.
- Workers may be exposed to cobalt in industries that process it or make products containing cobalt

How can cobalt affect my health?

Cobalt has both beneficial and harmful effects on human health. Cobalt is beneficial because it is part of Vitamin B12. Cobalt has also been used as a treatment for anemia, because it causes red blood cells to be produced.

Exposure to high levels of cobalt can harm your health. Effects on the lungs, including asthma, pneumonia, and wheezing, have been found in workers who breathed high levels of cobalt in the air.

In the 1960s, some breweries added cobalt to beer to stabilize the foam. Some people who drank large quantities of the beer experienced nausea, vomiting, and serious effects on the heart. However, effects on the heart were not seen in people with anemia or pregnant women treated with cobalt.

Animal studies have found problems with the development of the fetus in animals exposed to high concentrations of cobalt during pregnancy. However, cobalt is also essential for the growth and development of certain animals.

How likely is cobalt to cause cancer?

The International Agency for Research on Cancer has determined that cobalt is a possible carcinogen to humans.

Studies in animals have shown that cobalt causes cancer when placed directly into the muscle or under the skin Cobalt did not cause cancer in animals that were exposed to it in the air, in food, or in drinking water Studies on people are inconclusive regarding cobalt and cancer.

Is there a medical test to show whether I've been exposed to cobalt?

Tests are available to measure cobalt levels in the urine and blood. These tests are only accurate for up to a few days after exposure because cobalt leaves the body fairly quickly.

These tests are not usually performed in most doctors' offices because special equipment is needed to conduct them. These tests cannot determine if adverse health effects will occur from exposure to cobalt.

Has the federal government made recommendations to protect human health?

The Environmental Protection Agency (EPA) requires that discharges or accidental spills into the environment of 1,000 pounds or more of cobalt be reported.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.1 milligrams per cubic meter (0.1 mg/m³) for cobalt in workplace air for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental and Industrial Hygienists (ACGIH) has recommended an occupational exposure limit of 0.02 mg/m³ for cobalt for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) has recommended an occupational exposure limit of 0.05 mg/m³ for cobalt for a 10-hour workday, 40-hour workweek.

Glossary

Alloy:
A mixture of metals.
Anemia:
A decreased ability of the blood to transport oxygen.
Carcinogen:
A substance that can cause cancer.
Milligram (mg):
One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for cobalt. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 404-639-6000
FAX: 404-639-6315

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry

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Last Update: September 1, 1995
Charlie Xintaras / chx1@atsoaa1.em.cdc.gov

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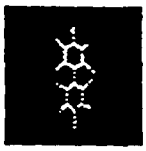
ToxFAQs

Polychlorinated Biphenyls (PCBs)

April 1993



2,2',3,3',4,4',6,6'-octachlorobiphenyl

- GIF Image
- 3D Viewer File

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about PCBs. For more information, you may call 404-639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polychlorinated biphenyls (PCBs) happens mostly from eating contaminated foods or breathing contaminated workplace air. High exposures to PCBs can damage the skin, eyes, and lungs. PCBs have been found in at least 349 of 1,300 National Priorities List sites identified by the Environmental Protection Agency.

What are polychlorinated biphenyls (PCBs)? (Pronounced pol'e-klo'ri-nat-ed-bi-fe'nils)

PCBs are a group of industrial chemicals that share a common structure. They are oily liquids or solids, clear to light yellow in color, and with no smell or taste. They don't occur naturally in the environment. Aroclor is a popular trade name of a commercial PCB mixture.

PCBs don't burn easily. In the past, they were widely used as coolants, insulating materials, and lubricants in electrical equipment like transformers and capacitors. The U.S. stopped making them in 1977 because of the health effects associated with exposure. As levels in the environment increased, the potential for harmful effects increased.

Pre-1977 products may still contain PCBs. These include old fluorescent lighting fixtures, electrical devices or appliances with PCB capacitors, old microscope oil, and hydraulic fluids.

What happens to PCBs when they enter the environment?

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- They enter air as solid or liquid aerosols or vapor and can stay in air more than 10 days.
- When in air, they can travel long distances in the wind.
- They move from air to soil and water when it snows or rains.
- Most stick tightly to soil particles; a small amount dissolves in water.
- They take several years to break down in soil.
- They are stored in the bodies of fish and seafood.
- Levels in fish can be many thousands of times higher than the levels in water.

How might I be exposed to PCBs?

- Breathing workplace air (indoor air around electrical parts or outdoor air at waste sites)
- Drinking water, skin contact with soil, or breathing air that is contaminated from nearby waste sites
- Eating fatty foods such as fish, seafood, dairy, or fatty meats contaminated with PCBs
- Breast milk from mothers exposed to PCBs.

How can PCBs affect my health?

Most of what we know about the human health effects of PCBs comes from studies on workers. Levels in the workplace are usually much higher than at other places. Workers are exposed to PCBs from breathing air and contact with their skin.

Exposures to PCBs at levels found in the workplace and over a long time may cause harmful effects to the skin (acne, rashes, and coloring of the nails and skin) and eyes (redness, burning, irritation, and discharge). PCBs in the diet of animals produced similar effects. PCBs may also irritate the nose and lungs.

Repeated skin contact to PCBs in rabbits caused liver, kidney, and skin damage. A single, large exposure to skin caused death in rabbits. Rats and other animals that breathed very high levels of PCBs over several months had liver and kidney damage. It is not clear if these effects would happen in people at similar levels of exposure.

Rats that ate large amounts of PCBs for a short period had mild liver damage; some died. Smaller amounts over several weeks or months caused liver, stomach, and thyroid gland injuries, anemia, acne, and reduced the ability to have offspring. Similar effects occurred in different laboratory animals.

How likely are PCBs to cause cancer?

The Department of Health and Human Services (1991) has determined that PCBs may reasonably be anticipated to be carcinogens. This is based on animal studies. Studies in workers do not provide enough information to know with any certainty if PCBs cause cancer in humans.

Is there a medical test to show whether I've been exposed to PCBs?

Tests are available for PCBs in blood, body fat, and breast milk. Blood tests are the best method for detecting recent exposures to large amounts. These tests are not routinely performed at your doctor's office.

High levels in your body fluids indicate exposure to high levels of PCBs. These tests can't determine the exact amount or type of PCBs, how long you were exposed, or if you will develop harmful health effects. Most people have small but measurable amounts of PCBs in their blood, fat, and breast milk.

Has the federal government made recommendations to protect human health?

The U.S. Environmental Protection Agency (EPA) recommends PCBs levels in lakes and streams be no higher than 0.001 parts of PCB per billion parts of water (0.001 ppb) to prevent cancer. PCBs in drinking water should be no higher than 4 milligrams per liter of water (4 mg/L) for adults, and 1 mg/L for children to prevent noncancer harmful effects. EPA regulates the transport, storage, or disposal of PCBs. EPA limits the amount of PCBs in publicly owned waste water treatment plants, and requires industry to report release of 1 pound or more.

The Food and Drug Administration (FDA) requires milk, eggs, other dairy products, poultry fat, fish, shellfish, and infant foods to contain no more than 0.2-3 parts of PCBs per million parts of food (0.2-3 ppm) to prevent noncancer harmful effects.

The National Institute for Occupational Safety and Health (NIOSH) recommends workers not breathe air with more than 0.001 milligrams of PCBs per cubic meter of air (0.001 mg/m^3) for a 10- hour workday, 40-hour workweek.

The Occupational Safety and Health Administration (OSHA) requires workplace exposure limits of 0.5 mg/m^3 (54 percent chlorine) or 1 mg/m^3 (42 percent chlorine) for an 8-hour workday to protect workers from noncancer harmful health effects.

Glossary

Carcinogen:
Substance that can cause cancer.

PPM
Parts per million.

Milligram (mg):
One thousandth of a gram.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological profile for selected polychlorinated biphenyls (PCBs). Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Case studies in environmental medicine PCBs toxicity. Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

Agency for Toxic Substances and Disease Registry

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Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
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Phone: 404-639-6000

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry

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Agency for Toxic Substances and Disease Registry

Public Health Statement

Copper

ATSDR Public Health Statement, December 1990

This Statement was prepared to give you information about copper and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Copper has been found at 210 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for copper. As EPA evaluates more sites, the number of sites at which copper is found may change. The information is important for you because copper may cause harmful health effects and because these sites are potential or actual sources of human exposure to copper.

When a chemical is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous substance such as copper, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health

What is copper?

Copper is a reddish metal that occurs naturally in rock, soil, water, sediment, and air. Its average concentration in the earth's crust is about 50 parts copper per million parts soil (ppm). Copper also occurs naturally in plants and animals. It is an essential element for all known living organisms including humans and other animals.

Copper can be easily molded or shaped. Its reddish color is most commonly seen in the U.S. penny, electrical wiring, and some water pipes. It is also found in many mixtures of metals, called alloys, such as brass and bronze. Many compounds (substances formed by joining two or more chemicals) of copper exist. These include naturally occurring minerals as well as man-made chemicals. The most commonly used compound of copper is copper sulfate. Many copper compounds can be recognized by their

blue-green color. When we speak of copper, we will not only be referring to copper metal, but also to compounds of copper that may be in the environment.

Copper is extensively mined and processed in the United States and is primarily used as the metal or alloy in the manufacture of wire, sheet metal, pipe, and other metal products. Copper compounds are most commonly used in agriculture to treat plant diseases, like mildew, or for water treatment and as preservatives for wood, leather, and fabrics.

How might I be exposed to copper?

Copper is common in the environment. You may be exposed to copper by breathing air, drinking water, eating food, and by skin contact with soil, water, and other copper-containing substances. Most copper compounds found in air, water, sediment, soil, and rock are so strongly attached to dust and dirt or imbedded in minerals that they cannot easily affect your health. Copper found in hazardous waste sites is likely to be of this form. Some copper in the environment is less tightly bound to particles and may be taken up by plants and animals. Soluble copper compounds (those that dissolve in water), that are most commonly used in agriculture, are more likely to threaten your health. However, when soluble copper compounds are released into lakes and rivers, they generally become attached to particles in the water within approximately a day, and are then less of a threat to your health.

The concentration of copper in air ranges from a few nanograms (1 nanogram equals 1/1,000,000,000 of a gram) in a cubic meter of air (ng/m3) to about 200 ng/m3. Near smelters that process copper ore into metal, concentrations may reach 5000 ng/m3. You may breathe high levels of copper-containing dust if you live or work near copper mines or processing facilities.

You may be exposed to high levels of soluble copper in your drinking water. The average concentration of copper in tap water ranges from 20 to 75 parts copper per billion parts water (ppb). However, many households have copper concentrations of more than 1000 ppb. That is more than 1 milligram per liter of water. This is because copper is picked up from copper pipes and brass faucets when the water sits in the pipes overnight. After the water is allowed to run for a while, the concentration of copper in the water decreases

The average concentration of copper in lakes and rivers is 4 ppb. The average copper concentration in groundwater is similar to that in lakes and rivers; however, monitoring data indicate that some groundwater contains higher levels of copper. This copper is generally strongly attached to particles in the water. Lakes and reservoirs recently treated with copper compounds to control algae or receive cooling water from a power plant may have high concentrations of dissolved copper Once in natural water, much of this copper soon attaches to particles or converts to forms that cannot easily enter the body

Garden products containing copper that are used to control certain plant diseases are also a potential source of exposure.

Soil generally contains between 2 and 250 ppm copper, although concentrations close to 7000 ppm have been found near copper production facilities. High concentrations of copper may be found in soil because dust from these industries settles out of the air, or waste from mining and other copper industries are disposed of on the soil. Another common source of copper in soil results from spreading sludge from sewage treatment plants. This copper generally stays strongly attached to the surface layer of soil. You may be exposed to this copper by skin contact. Children may also be exposed to this copper by eating the

dirt.

Food naturally contains copper. You eat and drink about 1 milligram (1/1000 of a gram) of copper every day. Copper is necessary in your diet for good health.

While some hazardous waste sites on the National Priorities List (NPL) contain high levels of copper, we do not always know how high it is above natural levels. We also do not know what form it is in at most of these sites. However, evidence suggests that most copper at these sites is strongly attached to soil.

You may be exposed to copper in the workplace. If you work in mining copper or processing the ore, you may be exposed to copper by breathing copper-containing dust or by skin contact. If you grind or weld copper metal you may breathe high levels of copper dust and fumes. Occupational exposure to forms of copper that are soluble or not strongly attached to dust or dirt would most commonly occur in agriculture, water treatment, and industries such as electroplating, where soluble copper compounds are employed.

How can copper enter and leave my body?

Copper can enter your body when you drink water or eat food, soil, or other substances that contain copper. Copper can also enter your body if you breathe air or dust containing copper. Copper may enter the lungs of workers exposed to copper dust or fumes.

Copper rapidly enters the bloodstream and is distributed throughout the body after you eat or drink it. Other foods eaten with copper can affect the amount of copper that enters the bloodstream. Your body is very good at blocking high levels of copper from entering the bloodstream. After you eat or drink high levels of copper, you may vomit or have diarrhea; this will also prevent copper from entering the blood. We do not know how much copper enters the body through the lungs or skin. Copper leaves your body in feces and urine, mostly in feces. It takes several days for copper to leave your body.

How can copper affect my health?

Copper is necessary for good health. However, very large single or daily intakes of copper can harm your health. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea. If you drink water that contains higher than normal levels of copper, you may experience vomiting, diarrhea, stomach cramps, and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even death. Very young children are sensitive to copper, and long-term exposure to high levels of copper in food or water may cause liver damage and death. Copper is not known to cause cancer. We do not know if copper can cause birth defects in humans. The seriousness of the effects of copper can be expected to increase with both level and length of exposure.

What levels of exposure have resulted in harmful health effects?

Tables 1-1, 1-2, 1-3, and 1-4 show the relationship between exposure to copper and known health effects in humans and animals. The levels of copper in air that can result in harmful health effects in humans are not known. Exposure to low levels of copper in air affects the lungs of animals.

You can usually taste copper in your drinking water before experiencing adverse effects. If you drink too much copper at one time, you may vomit, have diarrhea, and experience stomach cramps. Infants drinking

water that has high levels of copper may have harmful health effects at lower levels than adults. High levels of copper in drinking water or food have been shown to damage animal livers and kidneys.

Is there a medical test to determine whether I have been exposed to copper?

There are reliable and accurate ways of measuring copper in the body. It can be measured in the urine and blood. High levels of copper in these fluids can show that you have been exposed to high levels of copper. Samples of your blood plasma or urine can be properly collected in a doctor's office and sent to a laboratory that has special equipment to measure copper levels. However, we do not know if such a measurement can predict the extent of exposure or potential health effects.

What recommendations has the federal government made to protect human health?

The Environmental Protection Agency (EPA) has determined that the level of copper in water (lakes, streams) should be limited to 1 ppm to protect human health from the toxic properties of copper ingested through water and contaminated aquatic organisms. EPA has also determined that drinking water should not contain more than 1.3 ppm of copper. EPA has developed regulations on the amount of copper released by industry.

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams/cubic meter (mg/m3) of copper fume (vapor generated from heating copper) and 1.0 mg/m3 copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) of workroom air to protect workers during an 8-hour work shift (40-hour workweek). The National Institute for Occupational Safety and Health (NIOSH) recommends that the concentration in workroom air be limited to 0.1 mg/m3 for copper fumes and 1 mg/m3 for copper mist, averaged over an 8-hour work shift.

The National Academy of Sciences (NAS) has recommended that 2-3 milligrams copper is a safe and adequate daily intake. This provides enough copper for adult nutrition.

Where can I get more information?

If you have any more questions or concerns not covered here, please contact your state health or environmental department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road, E-29
Atlanta, Georgia 30333

This agency can also give you information on the location of the nearest occupational and environmental health clinics. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

ToxFAQs

Chloroform

April 1993

chloroform

- GIF Image
- 3D Viewer File

Agency for Toxic Substances and Disease Registry

This fact sheet answers the most frequently asked health questions about chloroform. For more information, you may call 404-639-6000. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to chloroform happens mostly from breathing contaminated air around waste sites or in the workplace or drinking or contacting contaminated water. Very high amounts of chloroform can damage your central nervous system, liver, and kidneys. Chloroform has been found in at least 646 of 1,300 National Priorities List sites identified by the Environmental Protection Agency.

What is chloroform?
(Pronounced klo' ro-form)

Chloroform is a colorless liquid with a pleasant odor and a slight, sweet taste. It is a naturally occurring compound, but most of the chloroform that gets into our environment is manufactured. It is also called trichloromethane.

Chloroform is used to make other compounds. Small amounts are also formed when chlorine is added to water. Chlorine is used as a disinfectant for sewage treatment plants, drinking water treatment, and in swimming pools and spas. It is also used as a bleach in paper mills.

There are many ways for chloroform to enter the environment, so small amounts are likely to be found almost everywhere.

What happens to chloroform when it enters the environment?

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- Chloroform enters the air and water from factories, leaky storage containers, and waste disposal
- It evaporates very quickly, so it's mostly in air.
- It's a small molecule that dissolves easily in water.
- It can travel through soil to groundwater.
- It breaks down slowly in air (over many months) and very slowly in water (over many years).
- It can remain in groundwater a long time.
- It doesn't build up in plants and animals.

How might I be exposed to chloroform?

- Very low levels in most air and water
- Higher levels from breathing contaminated air or drinking contaminated water around landfills or hazardous waste sites
- Breathing indoor air around heated water
- Breathing contaminated workplace air (industrial or water treatment sites, drinking water treatment plants, waste burning sites, paper and pulp mills)
- From skin contact with contaminated water when swimming or bathing

How can chloroform affect my health?

The health effects of chloroform are similar whether it is breathed or ingested.

The effects of chloroform depend on how much gets in your body.

In large amounts, chloroform may damage your central nervous system, liver, and kidneys.

Exposure to **very high levels** (8,000-10,000 parts of chloroform per million parts of air; 8,000-10,000 ppm) will likely result in unconsciousness and death. Breathing high levels in the air (900 ppm) for a short time may cause tiredness, dizziness, or headaches. These levels are several hundred thousand times higher than the background levels in air. Background levels are from 0.02 to 0.05 parts of chloroform per billion parts of air (0.02-0.05 ppb). Background levels in water are from 2-44 ppb.

If you continually breathe air, eat food, or drink water that contains sufficient chloroform, you may damage your liver and kidneys.

When chloroform comes in direct contact with your skin, it can cause sores.

We don't know whether chloroform affects reproduction or causes birth defects in humans.

In animal studies, **moderate amounts** (300 ppm) of chloroform affected reproduction. Male mice had abnormal sperm. Female rats and mice, when exposed to chloroform during pregnancy, aborted their fetuses or had higher numbers of offspring with birth defects.

How likely is chloroform to cause cancer?

The Department of Health and Human Services has determined that chloroform may reasonably be anticipated to be a carcinogen. Human data is lacking, but animal studies showed an increase in liver and kidney cancer from daily eating or drinking over a long time of food and water containing chloroform in the 60-200 ppm range.

Is there a medical test to show whether I've been exposed to chloroform?

Tests are available to measure the amount of chloroform in breath, blood, urine, and body tissues. The tests can't determine how much chloroform you were exposed to or whether you will have any health effects.

These tests must be performed soon after the exposure, because chloroform leaves the body quickly. Since chloroform is a breakdown product of other chemicals, the presence of chloroform in your body might also indicate that you have come into contact with other chemicals.

Has the federal government made recommendations to protect human health?

The Environmental Protection Agency (EPA) limits exposure to total trihalomethanes, which include chloroform, in drinking water to 100 micrograms per liter (µg/L). EPA requires that spills of 10 pounds or more of chloroform be reported to the federal government.

The Occupational Safety and Health Administration (OSHA) sets an occupational exposure limit of 2 ppm for an 8- hour workday for persons who work with chloroform.

Glossary

Carcinogen:
Substance that can cause cancer.

Ingestion:
Taking food or drink into your body.

Microgram (µg):
One millionth of a gram.

PPM:
Parts per million.

PPB:
Parts per billion.

Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns. For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 404-639-6000

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Public Health Service

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Agency for Toxic Substances and Disease Registry

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PB93-110781

TOXICOLOGICAL PROFILE FOR MANGANESE AND COMPOUNDS

Prepared by:

Life Systems, Inc.
Under Subcontract to:

Clement International Corporation
Under Contract No. 205-88-0608

Prepared for:

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

July 1992

401008

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about manganese and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Manganese has been found in at least 148 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for manganese. As EPA evaluates more sites, the number of sites at which manganese is found may change. This information is important for you to know because manganese may cause harmful health effects and because these sites are potential or actual sources of human exposure to manganese.

When a chemical is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous chemical such as manganese, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health.

1.1 WHAT IS MANGANESE?

Manganese is a naturally occurring substance found in many types of rock. Pure manganese is a silver-colored metal, somewhat like iron in its physical and chemical properties. Manganese does not occur in the environment as the pure metal. Rather, it occurs combined with other chemicals such as oxygen, sulfur, and chlorine. These forms (called compounds) are solids that do not evaporate. However, small dust particles of the solid material can become suspended in air. Some manganese compounds can dissolve in water, and low levels of these compounds are normally present in lakes, streams, and the ocean. Manganese can change from one compound to another (either by natural processes or by man's activities), but it does not break down or disappear in the environment.

Rocks containing high levels of manganese compounds are mined and used to produce manganese metal. This manganese metal is mixed with iron to make various types of steel. Some manganese compounds are used in the production of batteries, as an ingredient in some ceramics, pesticides, and fertilizers, and in dietary supplements.

More information on the properties and uses of manganese and how it behaves in the environment may be found in Chapters 3, 4, and 5.

1. PUBLIC HEALTH STATEMENT

1.2 HOW MIGHT I BE EXPOSED TO MANGANESE?

Because manganese is a natural component in the environment, you are always exposed to low levels of it in water, air, soil, and food. In drinking water, levels are usually about 0.004 parts manganese per million parts of water (ppm). In air, levels are usually about 0.02 micrograms manganese per cubic meter of air ($\mu g/m^3$). Levels in soil usually range from 40 to 900 ppm. Manganese is also a normal component of living things, including both plants and animals, so manganese is present in foods. For nearly all people, food is the main source of manganese, and usual daily intakes range from about 2,000 to 9,000 μg/day. The exact amount you take in depends on your diet.

You are most likely to be exposed to higher-than-normal levels of manganese if you work in a factory where manganese metal is produced from manganese ores, or where manganese compounds are used to make steel or other products. In these factories, you would be exposed to manganese mainly by breathing in manganese dust. If you live near such a factory, you could also be exposed to higher-than-average levels of manganese dust in the outside air, although the amounts would be much lower than in the factory. You might be exposed to higher-than-average levels if you live near a coal or oil-burning factory, or close to a major highway, because manganese is released into air when fossil fuels are burned. If manganese compounds from a factory or a waste site get into water, you could be exposed to higher-than-average levels by drinking the water.

More information on how you might be exposed to manganese or its compounds is given in Chapter 5.

1.3 HOW CAN MANGANESE ENTER AND LEAVE MY BODY?

If you live near a hazardous waste site, you could be exposed to manganese in soil or water, or to manganese-containing dust particles in air. If you get manganese-contaminated soil or water on your skin, very little will enter your body, so this is not of concern. If you swallow manganese in water or in soil, most of the manganese is excreted in the feces. However, about 3%-5% is usually taken up and kept in the body. If you breathe air containing manganese dust, many of the dust particles will be trapped in your lungs. Some of the manganese in these particles may then dissolve in the lungs and enter the blood. The exact amount that does this is not known. Particles that do not dissolve will be carried in a sticky layer of mucus out of the lungs to the throat, where they will be swallowed into the stomach.

Because manganese is a regular part of the human body, the body normally controls the amount that is taken up and kept. For example, if large amounts are eaten in the diet, the amount that is taken up in the body becomes smaller. If too much does enter the body, the excess is usually removed in the feces. Therefore, the total amount of manganese in the body usually tends to stay about the same, even when exposure rates are higher or lower than usual. However, if too much manganese is taken in, the body may not be able to adjust for the added amount.

More information on how manganese enters and leaves the body is given in Chapter 2.

1.4 HOW CAN MANGANESE AFFECT MY HEALTH?

Eating a small amount of manganese each day is important in maintaining your health. The amount of manganese in a normal diet (about 2,000–9,000 μg/day) seems to be enough to meet your daily need, and no cases of illness from eating too little manganese have been reported in humans. In animals, eating too little manganese can interfere with normal growth, bone formation, and reproduction.

Too much manganese, however, can cause serious illness. Although there are some differences between different kinds of manganese, most manganese compounds seem to cause the same effects. Manganese miners or steel workers exposed to high levels of manganese dust in air may have mental and emotional disturbances, and their body movements may become slow and clumsy. This combination of symptoms is a disease called manganism. Workers usually do not develop symptoms of manganism unless they have been exposed for many months or years. Manganism occurs because too much manganese injures a part of the brain that helps control body movements. Some of the symptoms of manganism can be reduced by medical treatment, but the brain injury is permanent.

It is not certain whether eating or drinking too much manganese can cause manganism or not. In one report, humans who drank water containing high levels of manganese developed symptoms similar to those seen in manganese miners or steel workers, but it is not certain if the effects were caused by manganese alone. In another report, people who drank water with above average levels of manganese seemed to have a slightly higher frequency of symptoms such as weakness, stiff muscles, and trembling of the hands. However, these symptoms are not specific for manganese, and might have been caused by other factors. Studies in animals have shown that very high levels of manganese in food or water can cause changes in the brain. This information suggests that high levels of manganese in food or water might cause brain injury, but it does not appear that this is of concern to people exposed to the normal amounts of manganese in food, water, or air. The chances of harm from exposure near a waste site can only be evaluated on a site-by-site basis.

Breathing too much manganese dust can also cause irritation of the lungs. Sometimes this makes breathing difficult and it can also increase the chances of getting a lung infection, such as pneumonia. However, this can happen from breathing in many different kinds of dust particles, not just those that contain manganese.

A common effect in men who are exposed to high levels of manganese dust in air is impotence. As a result, men exposed to high levels may not be able to father children. Studies in animals show that too much manganese may also injure the testes. Much less is known about the effects of too much manganese in women. Studies in animals suggest that females may not be as sensitive to manganese as males, but this is not certain.

There is not much information on whether manganese can cause birth defects. One study in humans suggests that high exposures to manganese in the environment might increase the chances of birth defects, but other factors besides manganese might have been responsible. One study in animals shows that exposure of pregnant females to high levels of manganese in air can lead to changes in behavior of the offspring. Since there are so few studies on this, more research is needed to determine the importance of these observations.

No studies have been done to determine if breathing manganese dust causes cancer. Some studies in animals suggest that eating high amounts of manganese might increase the chances of getting cancer. However, only a few animals in these studies got cancer, and it was difficult to tell if the tumors were really caused by the excess manganese. Thus, there is little evidence to suggest that cancer is a major concern for people exposed to manganese in the environment or near waste sites. The EPA has determined that manganese is not classifiable as to human carcinogenicity.

There is no information on any human or animal health effects from skin contact with manganese.

More information on health effects of manganese in humans and animals can be found in Chapter 2.

1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO MANGANESE?

Several tests are available for measuring manganese in blood, urine, hair, or feces. Because manganese is a normal part of the body, some manganese is always found in these materials. Concentrations of manganese in blood, urine, hair, or feces are often found to be higher-than-average in groups of people exposed to above-average levels of manganese. However, because the levels in different people can vary widely, these methods are not very reliable for determining if any one individual has been exposed to higher-than-average levels of manganese. Also, because excess manganese is usually removed from the body within a few days, past exposures to manganese are difficult to measure. For these reasons, it is often not possible to tell whether excess exposure to manganese has occurred, or whether there is reason for health concern.

More information of how manganese can be measured in exposed humans can be found in Chapters 2 and 6.

1.6 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

In order to avoid staining of clothing or fixtures, the EPA recommends that the concentration of manganese in drinking water not be more than 0.05 ppm. The Food and Drug Administration (FDA) has set the same level for bottled water. This concentration is believed to be more than adequate to

protect human health. The EPA has also established rules that set limits on the amount of manganese that factories can dump into water, and requires factories that use or produce manganese to report how much they dump in the environment to the EPA. The Occupational Safety and Health Administration (OSHA) has set a limit of 1,000 $\mu g/m^3$ for the average amount of manganese in workplace air over an 8-hour workday.

More information on governmental rules regarding manganese can be found in Chapter 7.

1.7 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your state health or environmental department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road, E-29
Atlanta, Georgia 30333

This agency can also provide you with information on the location of the nearest occupational and environmental health clinic. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

CHLOROBENZENE

DISCLAIMER

The use of company or product name(s) is for identification only and does not imply endorsement by the Agency for Toxic Substances and Disease Registry.

FOREWORD

The Superfund Amendments and Reauthorization Act (SARA) of 1986 (Public Law 99-499) extended and amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund). This public law directed the Agency for Toxic Substances and Disease Registry (ATSDR) to prepare toxicological profiles for hazardous substances which are most commonly found at facilities on the CERCLA National Priorities List and which pose the most significant potential threat to human health, as determined by ATSDR and the Environmental Protection Agency (EPA). The lists of the 250 most significant hazardous substances were published in the Federal Register on April 17, 1987 on October 20, 1988, on October 26, 1989, and on October 17, 1990.

Section 104(i)(3) of CERCLA, as amended, directs the Administrator of ATSDR to prepare a toxicological profile for each substance on the list. Each profile must include the following content:

(A) The examination, summary, and interpretation of available toxicological information and epidemiological evaluations on a hazardous substance in order to ascertain the levels of significant human exposure for the substance and the associated acute, subacute, and chronic health effects.

(B) A determination of whether adequate information on the health effects of each substance is available or in the process of development to determine levels of exposure that present a significant risk to human health of acute, subacute, and chronic health effects.

(C) Where appropriate, identification of toxicological testing needed to identify the types or levels of exposure that may present significant risk of adverse health effects in humans.

This toxicological profile is prepared in accordance with guidelines developed by ATSDR and EPA. The original guidelines were published in the Federal Register on April 17, 1987.

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Each profile will be revised and republished as necessary, but no less often than every three years, as required by CERCLA, as amended.

The ATSDR toxicological profile is intended to characterize succinctly the toxicological and adverse health effects information for the hazardous substance being described. Each profile identifies and reviews the key literature (that has been peer-reviewed) that describes a hazardous substance's toxicological properties. Other pertinent literature is also presented but described in less detail than the key studies. The profile is not intended to be an exhaustive document; however, more comprehensive sources of specialty information are referenced.

Each toxicological profile begins with a public health statement, which describes in nontechnical language a substance's relevant toxicological properties. Following the public health statement is information concerning significant health effects associated with exposure to the substance. The adequacy of information to determine a substance's health effects is described. Data needs that area of significance to protection of public health will be identified by ATSDR, the National Toxicology Program (NTP) of the Public Health Service, and EPA. The focus of the profiles is on health and toxicological information; therefore, we have included this information in the beginning of the document.

The principal audiences for the toxicological profiles are health professionals at the federal, state, and local levels, interested private sector organizations and groups, and members of the public.

This profile reflects our assessment of all relevant toxicological testing and information that has been peer reviewed. It has been reviewed by scientists from ATSDR, the Centers for Disease Control, the NTP, and other federal agencies. It has also been reviewed by a panel of nongovernment peer reviewers and is being made available for public review. Final responsibility for the contents and views expressed in this toxicological profile resided with ATSDR.

William L. Roper, M.D., M.P.H.
Administrator
Agency for Toxic Substances and
Disease Registry

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about chlorobenzene and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Chlorobenzene has been found at 97 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for chlorobenzene. As EPA evaluates more sites,

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the number of sites at which chlorobenzene is found may change. The information is important for you because chlorobenzene may cause harmful health effects and because these sites are potential or actual sources of human exposure to chlorobenzene.

When a chemical is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous substance such as chlorobenzene, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health.

1.1 WHAT IS CHLOROBENZENE?

Chlorobenzene is a colorless liquid with an almond-like odor. The compound does not occur widely in nature, but is manufactured for use as a solvent (a substance used to dissolve other substances) and is used in the production of other chemicals. Chlorobenzene persists in soil (several months), in air (3.5 days), and water (less than 1 day). Additional information can be found in Chapters 3, 4, and 5.

1.2 HOW MIGHT I BE EXPOSED TO CHLOROBENZENE?

There is potential for humans to be exposed to chlorobenzene by breathing contaminated air, by drinking water or eating food contaminated with chlorobenzene, or by getting chlorobenzene-contaminated soil on the skin. These exposures are most likely to occur in the workplace or in the vicinity of chemical waste sites.

Occupational exposure occurs primarily through breathing the chemical. Personnel engaged in the production and handling of chlorobenzene would be at greatest risk. Levels of chlorobenzene in the air at several industrial sites during normal operations were found to be below allowable federal standards.

Exposure in humans could occur in persons living or working in the vicinity of hazardous waste sites if emissions to water, air, and soil are not adequately controlled. Chlorobenzene has been found at 97 out of 1,177 NPL hazardous waste sites in the United States. Thus, federal and state surveys suggest that chlorobenzene is not a widespread environmental contaminant. The chemical has not been detected in surface water, although a few ground water systems have been found with chlorobenzene levels in the parts per billion (ppb)

range. Background levels of less than 1 ppb were detected in air samples from urban and suburban areas. No information of the occurrence of chlorobenzene in food has been found. Additional information on the potential for human exposure is presented in Chapter 5.

1.3 HOW CAN CHLOROBENZENE ENTER AND LEAVE MY BODY?

Chlorobenzene enters your body when you breathe in air containing it, when you drink water or eat food containing it, or when it comes in contact with your skin. Human exposure to contaminated water could occur near hazardous waste sites where chlorobenzene is present. Significant exposure to chlorobenzene is not expected to occur by getting chlorobenzene contaminated soil on your skin. When chlorobenzene enters your body, most of it is expelled from your lungs in the air we breathe out and in urine. Additional information is presented in Chapter 2.

1.4 HOW CAN CHLOROBENZENE AFFECT MY HEALTH?

Workers exposed to high levels of chlorobenzene complained of headaches, numbness, sleepiness, nausea, and vomiting. However, it is not known if chlorobenzene alone was responsible for these health effects since the workers may have also been exposed to other chemicals at the same time. Mild to severe depression of functions of parts of the nervous system is a common response to exposure to a wide variety of industrial solvents (a substance that dissolves other substances).

In animals, exposure to high concentrations of chlorobenzene affects the brain, liver, and kidneys. Unconsciousness, tremors and restlessness have been observed. The chemical can cause severe injury to the liver and kidneys. Data indicate that chlorobenzene does not affect reproduction or cause birth defects. Studies in animals have shown that chlorobenzene can produce liver nodules, providing some but not clear evidence of cancer risk. Additional information on health effects is presented in Chapter 2.

TABLE 1-1. Human Health Effects from Breathing Chlorobenzene*

Short-term Exposure (less than or equal to 14 days)		
Levels in Air	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of human to air containing specific levels of

chlorobenzene are not known.

Long-term Exposure (greater than 14 days)		
Levels in Air	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of humans to air containing specific levels of chlorobenzene are not know.

*See Section 1.2 for a discussion of exposures encountered in daily life.

TABLE 1-1. Human Health Effects from Breathing Chlorobenzene*

1.5 WHAT LEVELS OF EXPOSURE HAVE RESULTED IN HARMFUL HEALTH EFFECTS?

Harm to human health from breathing, eating or drinking chlorobenzene is not established (Tables 1-1 and 1-3). Tables 1-2 and 1-4 show the relationship between exposure to chlorobenzene and known health effects in animals. A Minimal Risk Level (MRL) is included in Table 1-3. The MRL was derived from animal data for long-term exposure, as described in Chapter 2 and in Table 2-2. The MRL provides a basis for comparison with levels that people might encounter either in the air or in food or drinking water. If a person is exposed to chlorobenzene at an amount below the MRL, it is not expected that harmful (noncancer) health effects will occur. Because this level is based only on information currently available, some uncertainty is always associated with it. Also, because the method for deriving MRLs does not use any information about cancer, a MRL does not imply anything about the presence, absence, or level of risk for cancer. Further information on the levels of chlorobenzene that have been observed to cause health effects in animals is presented in Chapter 2.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO CHLOROBENZENE?

Exposure to chlorobenzene can be determined by measuring the chemical or its metabolite in urine, exhaled air, blood, and body fat. Tests are not routinely available at the doctor's office. Specific tests are available that can determine if exposure is currently occurring or has occurred very recently, but not whether exposure occurred in the past. Further, levels in the various media stated above do not predict adverse health effects. Additional information on how chlorobenzene can be measured in exposed humans is given in Chapters 2 and 6.

TABLE 1-2. Animal Health Effects from Breathing Chlorobenzene

Short-term Exposure (less than or equal to 14 days)		
Levels in Air (ppm)	Length of Exposure	Description of Effects*
537	2 hours	Death in rabbits.

Long-term Exposure (greater than 14 days)		
Levels in Air (ppm)	Length of Exposure	Description of Effects*
75	24 weeks	Liver and Kidney damage in rats and rabbits.

*These effects are listed at the lowest level at which they were first observed. The

TABLE 1-2. Animal Health Effects from Breathing Chlorobenzene

TABLE 1-3. Human Health Effects from Eating or Drinking Chlorobenzene

Short-term Exposure (less than or equal to 14 days)		
Levels in Food	Length of Exposure	Description of Effects
		The health effects resulting from short-term exposure of humans to food containing

		specific levels of chlorobenzene are not known.
Levels in Water		The health effects resulting from short-term exposure of humans to water containing specific levels of chlorobenzene are not know.

Long-term Exposure
(greater than 14 days)

Levels in Food (ppm)	Length of Exposure	Description of Effects
15	91 days	Minimal Risk Level (based on animal studies; see Section 1.5 for discussion.
Levels in Water		The health effects resulting from long-term exposure of animals to water containing specific levels of chlorobenzene are not known.

TABLE 1-3. Human Health Effects from Eating or Drinking Chlorobenzene

TABLE 1-4. Animal Health Effects from Eating or Drinking Chlorobenzene

Short-term Exposure
(less than or equal to 14 days)

Levels in Food (ppm)	Length of Exposure	Description of Effects*
7,692 - 20,000	1-14 days	Death in mice and rats.

Levels in Water	The health effects of short-term exposure of animals to water containing specific levels of chlorobenzene are not known.

Long-term Exposure
(greater than 14 days)

Levels in Food (ppm)	Length of Exposure	Description of Effects*
1,923 - 5,000	91 days	Liver and kidney damage in mice. Liver injury rats.
1,923	13 weeks	Injury to organs of the immune system in mice.
1,923	13 weeks	Death in mice.
Levels in Water		The health effects resulting from long-term exposure of animals to water containing specific levels of chlorobenzene are not known.

*These effects are listed at the lowest level at which they were [illegible] observed. They may also be seen at higher levels.

TABLE 1-4. Animal Health Effects from Eating or Drinking Chlorobenzene

1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The Federal Government has developed regulatory standards and advisories to protect individuals from potential health effects of chlorobenzene in the environment. The Environmental Protection Agency has proposed that the maximum level of chlorobenzene in

drinking water be 0.1 parts per million (ppm). For short-term exposures to drinking water, EPA has recommended that drinking water levels not exceed 2 ppm for up to ten days. The Occupational Safety and Health Administration (OSHA) has established a legally enforceable maximum limit of 75 ppm of chlorobenzene in workplace air for an 8 hour/day, 40-hour work week. Additional information regarding federal and state regulations is presented in Chapter 7.

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your State Health or Environmental Department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, E-29
Atlanta, Georgia 30333

This agency can also give you information on the location of the nearest occupational and environmental health clinics. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

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ATTACHMENT C

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ATTACHMENT G

ATTACHMENT G
RADIOLOGICAL RISK ASSESSMENT TABLES

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

CAPTAIN'S COVE

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On Site Off Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	Area A and Area G	Trespasser	Adolescent	External Radiation	On Site	Quant	Contaminated soil may be encountered by trespassers while on site
						Ingestion	On Site	Quant	Contaminated soil may be encountered by trespassers while on site
				Site Worker	Adult	External Radiation	On Site	None	Site is currently abandoned
						Ingestion	On Site	None	Site is currently abandoned
		Particulates	Area A and Area G	Trespasser	Adolescent	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
				Site Worker	Adult	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
	Sediment	Sediment	Retention Ponds and Wetland area	Trespasser	Adolescent	External Radiation	On Site	Quant	Contaminated sediment may be encountered by trespassers while on site
						Ingestion	On Site	Quant	Contaminated sediment may be encountered by trespassers while on site
	Surface Water	Surface Water	Retention Ponds and low area	Trespasser	Adolescent	--	On Site	None	Not a relevant exposure pathway
Future	Surface Soil	Surface Soil	Area A and Area G	Trespasser	Adolescent	External Radiation	On Site	Quant	Contaminated soil may be encountered by trespassers while on site
						Ingestion	On Site	Quant	Contaminated soil may be encountered by trespassers while on site
				Site Worker	Adult	External Radiation	On Site	Quant	Contaminated soil may be encountered by site workers while on site
						Ingestion	On Site	Quant	Contaminated soil may be encountered by site workers while on site
			Area A	Visitor	Adult	External Radiation	On Site	None	Exposure would be infrequent and direct contact with contaminated media is unlikely
		Particulates	Area A and Area G	Trespasser	Adolescent	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
				Site Worker	Adult	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
	All Soil	All Soil	Area A and Area G	Construction Worker	Adult	External Radiation	On Site	Quant	Contaminated soil may be encountered by construction workers during excavation activities
						Ingestion	On Site	Quant	Contaminated soil may be encountered by construction workers during excavation activities
				Resident	Adult	External Radiation	On Site	Quant	Residential development is possible
						Ingestion	On Site	Quant	Residential development is possible
					Child	External Radiation	On Site	Quant	Residential development is possible
						Ingestion	On Site	Quant	Residential development is possible
		Particulates	Area A and Area G	Construction Worker	Adult	Inhalation	On Site	Quant	Contaminated soil may be encountered by construction workers during excavation activities
				Resident	Adult	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
					Child	Inhalation	On Site	None	Vegetation hinders the resuspension of contaminated particles
		Radon Decay Products	Area A and Area G	Resident	Adult	Inhalation	On Site	Quant	Residential development is possible
					Child	Inhalation	On Site	Quant	Residential development is possible
		Home grown Produce	Area A and Area G	Resident	Adult	Ingestion	On Site	Quant	Residential development is possible
					Child	Ingestion	On Site	Quant	Residential development is possible
	Sediment	Sediment	Retention Ponds and Wetland area	Trespasser	Adolescent	External Radiation	On Site	Quant	Sediment may be encountered by trespassers while on site
						Ingestion	On Site	Quant	Sediment may be encountered by trespassers while on site
	Surface Water	Surface Water	Retention Ponds and low area	Trespasser	Adolescent		On Site	None	Not a relevant exposure pathway
	Groundwater	Groundwater	Upper Glacial Aquifer	Site Worker	Adult	Ingestion	On Site	Quant	Potable use of the groundwater is possible
				Resident	Adult	Ingestion	On Site	Quant	Potable use of the groundwater is possible
					Child	Ingestion	On Site	Quant	Potable use of the groundwater is possible

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TABLE 2-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN SCOTT

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.415	2.53	pCi/g	CC-TP-4-0-1	2.53	1.1	YES	TX, ASL
Uranium 238 + D	0.351	2.89	pCi/g	CC-TP-4-0-1	2.89	1.1	YES	TX, ASL
Radium 226 + D	0.483	4.63	pCi/g	CC-TP-4-0-1	4.63	1.4	YES	TX, ASL
Radium 228 + D	0.314	1.9	pCi/g	CC-TP-4-0-1	1.9	1.7	YES	TX, ASL
Thorium 228 + D	0.435	1.83	pCi/g	CC-TP-4-0-1	1.83	1.7	YES	TX, ASL
Thorium 230	0.48	4.47	pCi/g	CC-TP-4-0-1	4.47	1.6	YES	TX, ASL
Thorium 232	0.41	1.76	pCi/g	CC-TP-4-0-1	1.76	1.5	YES	TX, ASL
Lead 210 + D	0.483	4.63	pCi/g	CC-TP-4-0-1	4.63	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226, between (background samples) Uranium-234 and Uranium-238, and between (background samples) Thorium-228 and Radium-228

(2) Minimum/maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (HIST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

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TABLE 2.2
CHOKEPRESET DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.415	232	pCi/g	CC-TP-3.5-6	232	1.1	YES	TX, ASL
Uranium 238 + D	0.349	162	pCi/g	CC-SB-13.6-7	162	1.1	YES	TX, ASL
Radium 226 + D	0.483	252	pCi/g	CC-TP-3.5-6	252	1.4	YES	TX, ASL
Radium 228 + D	0.291	113	pCi/g	CC-TP-3.5-6	113	1.7	YES	TX, ASL
Thorium 228 + D	0.19	160	pCi/g	CC-TP-3.5-6	160	1.7	YES	TX, ASL
Thorium 230	0.48	494	pCi/g	CC-TP-3.5-6	494	1.6	YES	TX, ASL
Thorium 232	0.08	126	pCi/g	CC-SB-13.6-7	126	1.5	YES	TX, ASL
Lead 210 + D	0.483	252	pCi/g	CC-TP-3.5-6	252	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason:	Infrequent Detection but Associated Historically (HIST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason:	Infrequent Detection (ID)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

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TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.415	232	pCi/g	CC-TP-3-5-6	232	1.1	YES	TX, ASL
Uranium 238 + D	0.339	162	pCi/g	CC-SB-13-6-7	162	1.1	YES	TX, ASL
Radium 226 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	1.4	YES	TX, ASL
Radium 228 + D	0.291	113	pCi/g	CC-TP-3-5-6	113	1.7	YES	TX, ASL
Thorium 228 + D	0.19	160	pCi/g	CC-TP-3-5-6	160	1.7	YES	TX, ASL
Thorium 230	0.48	494	pCi/g	CC-TP-3-5-6	494	1.6	YES	TX, ASL
Thorium 232	0.08	126	pCi/g	CC-SB-13-6-7	126	1.5	YES	TX, ASL
Lead 210 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (ID)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401029

TABLE 2-4
OCCURRENCE, DISTRIBUTION, AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Location: Installation: Future
Medium: All Soil
Exposure Medium: Radon Decay Products
Exposure Point: Area A

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.415	232	pCi/g	CC-TP-3-5-6	232	1.1	YES	TX, ASL
Uranium 238 + D	0.349	162	pCi/g	CC-SB-13-6-7	162	1.1	YES	TX, ASL
Radium 226 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	1.4	YES	TX, ASL
Radium 228 + D	0.291	113	pCi/g	CC-TP-3-5-6	113	1.7	YES	TX, ASL
Thorium 228 + D	0.19	160	pCi/g	CC-TP-3-5-6	160	1.7	YES	TX, ASL
Thorium 230	0.48	494	pCi/g	CC-TP-3-5-6	494	1.6	YES	TX, ASL
Thorium 232	0.08	126	pCi/g	CC-SB-13-6-7	126	1.5	YES	TX, ASL
Lead 210 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (HIST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (ID)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401030

TABLE 2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home grown Produce
Exposure Point: Area A

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.415	232	pCi/g	CC-TP-3-5-6	232	1.1	YES	TX, ASL
Uranium 238 + D	0.349	162	pCi/g	CC-SB-13-6-7	162	1.1	YES	TX, ASL
Radium 226 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	1.4	YES	TX, ASL
Radium 228 + D	0.291	113	pCi/g	CC-TP-3-5-6	113	1.7	YES	TX, ASL
Thorium 228 + D	0.19	160	pCi/g	CC-TP-3-5-6	160	1.7	YES	TX, ASL
Thorium 230	0.48	494	pCi/g	CC-TP-3-5-6	494	1.6	YES	TX, ASL
Thorium 232	0.08	126	pCi/g	CC-SB-13-6-7	126	1.5	YES	TX, ASL
Lead 210 + D	0.483	252	pCi/g	CC-TP-3-5-6	252	3.8	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (HIST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401031

TABLE 2.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area G

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	1.92	2.66	pCi/g	CC-TP-5-0-1	2.66	1.1	YES	TX, ASL
Uranium 238 + D	1.9	2.64	pCi/g	CC-TP-5-0-1	2.64	1.1	YES	TX, ASL
Radium 226 + D	2.45	3.14	pCi/g	CC-TP-5-0-1	3.14	1.4	YES	TX, ASL
Radium 228 + D	1.47	1.5	pCi/g	CC-SB-22-0-2	1.5	1.7	NO	TX, BSL
Thorium 228 + D	1.21	1.42	pCi/g	CC-TP-5-0-1	1.42	1.7	NO	TX, BSL
Thorium 230	1.86	2.18	pCi/g	CC-TP-5-0-1	2.18	1.6	YES	TX, ASL
Thorium 232	1.26	1.34	pCi/g	CC-TP-5-0-1	1.34	1.5	NO	TX, BSL
Lead 210 + D	2.45	3.14	pCi/g	CC-TP-5-0-1	3.14	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum/maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (ID)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401032

TABLE 2.7
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.48	104J	pCi/g	CC-SB-23-6-8	104J	1.1	YES	TX, ASL
Uranium 238 + D	0.46	103J	pCi/g	CC-SB-23-6-8	103J	1.1	YES	TX, ASL
Radium 226 + D	1.01	169	pCi/g	CC-SB-08-6-8	169	1.4	YES	TX, ASL
Radium 228 + D	0.739	48.9	pCi/g	CC-SB-08-6-8	48.9	1.7	YES	TX, ASL
Thorium 228 + D	0.92	47.7	pCi/g	CC-SB-08-6-8	47.7	1.7	YES	TX, ASL
Thorium 230	0.032	150	pCi/g	CC-SB-26-2-4	150	1.6	YES	TX, ASL
Thorium 232	0.88	47.8	pCi/g	CC-SB-08-6-8	47.8	1.5	YES	TX, ASL
Lead 210 + D	1.01	169	pCi/g	CC-SB-08-6-8	169	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum-maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401033

TABLE 2.8
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario: Homegrown Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area G

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.48	1041	pCi/g	CC:SB:23:6 ft	1041	1.1	YES	TX, ASL
Uranium 238 + D	0.46	1031	pCi/g	CC:SB:23:6 ft	1031	1.1	YES	TX, ASL
Radium 226 + D	1.01	169	pCi/g	CC:SB:08:6 ft	169	1.4	YES	TX, ASL
Radium 228 + D	0.739	48.9	pCi/g	CC:SB:08:6 ft	48.9	1.7	YES	TX, ASL
Thorium 228 + D	0.92	47.7	pCi/g	CC:SB:08:6 ft	47.7	1.7	YES	TX, ASL
Thorium 230	0.032	150	pCi/g	CC:SB:26:2.4	150	1.6	YES	TX, ASL
Thorium 232	0.88	47.8	pCi/g	CC:SB:08:6 ft	47.8	1.5	YES	TX, ASL
Lead 210 + D	1.01	169	pCi/g	CC:SB:08:6 ft	169	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

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401035

TABLE 2.9
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAINS COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Radon Decay Products
Exposure Point: Area G

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.48	1041	pCi/g	CC SB 23.6 8	1041	1.1	YES	TX, ASL
Uranium 238 + D	0.46	1033	pCi/g	CC SB 23.6 8	1033	1.1	YES	TX, ASL
Radium 226 + D	1.01	169	pCi/g	CC SB 08.6 8	169	1.4	YES	TX, ASL
Radium 228 + D	0.739	48.9	pCi/g	CC SB 08.6 8	48.9	1.7	YES	TX, ASL
Thorium 228 + D	0.92	47.7	pCi/g	CC SB 08.6 8	47.7	1.7	YES	TX, ASL
Thorium 230	0.032	150	pCi/g	CC SB 26.2 4	150	1.6	YES	TX, ASL
Thorium 232	0.88	47.8	pCi/g	CC SB 08.6 8	47.8	1.5	YES	TX, ASL
Lead 210 + D	1.01	169	pCi/g	CC SB 08.6 8	169	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium-228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (HIST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

TABLE 2.10
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home Grown Produce
Exposure Point: Area G

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.48	1041	pCi/g	CC-SB 23 6 8	1041	1.1	YES	TX, ASL
Uranium 238 + D	0.46	1031	pCi/g	CC SB 23 6 8	1031	1.1	YES	TX, ASL
Radium 226 + D	1.01	169	pCi/g	CC SB 08 6 8	169	1.4	YES	TX, ASL
Radium 228 + D	0.749	48.9	pCi/g	CC SB 08 6 8	48.9	1.7	YES	TX, ASL
Thorium 228 + D	0.92	47.7	pCi/g	CC SB 08 6 8	47.7	1.7	YES	TX, ASL
Thorium 230	0.032	150	pCi/g	CC SB 26 2 4	150	1.6	YES	TX, ASL
Thorium 232	0.88	47.8	pCi/g	CC SB 08 6 8	47.8	1.5	YES	TX, ASL
Lead 210 + D	1.01	169	pCi/g	CC SB 08 6-8	169	1.4	YES	TX, ASL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium-238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

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TABLE 2-11
OCCURRENCE, DISTRIBUTIONS AND SELECTIONS OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Retention Ponds

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.158	0.79	pCi/g	CC-SED-3	0.79	1.1	NO	BSL
Uranium 238 + D	0.123	0.86	pCi/g	CC-SED-3	0.86	1.1	NO	BSL
Radium 226 + D	0.251	1.66	pCi/g	CC-SED-3	1.66	1.4	YES	BSL
Radium 228 + D	0.226	1.31	pCi/g	CC-SED-3	1.31	1.7	NO	BSL
Thorium 228 + D	0.087	0.95	pCi/g	CC-SED-3	0.95	1.7	NO	BSL
Thorium 230	0.031	0.89	pCi/g	CC-SED-3	0.89	1.6	NO	BSL
Thorium 232	0.158	0.9	pCi/g	CC-SED-3	0.9	1.5	NO	BSL
Lead 210 + D	0.251	1.66	pCi/g	CC-SED-3	1.66	1.4	YES	BSL

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum/maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (IIC-1)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

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TABLE 2.12
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Wetland Area

Radionuclide (1)	Minimum Concentration (2)	Maximum Concentration (2)	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	Maximum Background Concentration (3)	ROPC Flag (4)	Rationale for Radionuclide Selection or Deletion (5)
Uranium 234	0.229	0.79	pCi/g	CC-WS-2	0.79	1.1	NO	BSL
Uranium 238 + D	0.167	0.75	pCi/g	CC-WS-2	0.75	1.1	NO	BSL
Radium 226 + D	0.267	0.625	pCi/g	CC-WS-4	0.625	1.4	NO	BSL
Radium 228 + D	0.229	0.477	pCi/g	CC-WS-3	0.477	1.7	NO	BSL
Thorium 228 + D	0.087	0.5	pCi/g	CC-WS-3	0.5	1.7	NO	BSL
Thorium 230	0.025	0.72	pCi/g	CC-WS-2	0.72	1.6	NO	BSL
Thorium 232	0.099	0.48	pCi/g	CC-WS-2	0.48	1.5	NO	BSL
Lead 210 + D	0.267	0.625	pCi/g	CC-WS-4	0.625	1.4	NO	BSL

(1) Risk from decay products (+D) included as appropriate, secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum/maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401039

TABLE 2-13
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
CAPTAIN'S COVE

Exposure Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer

(1) Radionuclide	(2) Minimum Concentration	(2) Maximum Concentration	Units	Location of Maximum Concentration	Concentration Used for Screening to Background	(3) Maximum Background Value	(4) ROPC Flag	(5) Rationale for Radionuclide Selection or Deletion
Uranium 234	0.85	7.2	pCi/L	CC-MW-7	7.2	4.6	YES	TX, BSL
Uranium 238 + D	0.58	4.4	pCi/L	CC-MW-7	4.4	4.6	NO	TX, BSL
Radium 226 + D	0.8	3.03	pCi/L	CC-MW-2	3.03	10	NO	TX, BSL
Radium 228 + D	0.8	7.8	pCi/L	CC-MW-2	7.8	5.2	YES	TX, ASL
Thorium 228 + D	0.091	0.95	pCi/L	CC-MW-2	0.95	5.2	NO	TX, BSL
Thorium 230	0.139	3.68	pCi/L	CC-MW-7	3.68	1.4	YES	TX, BSL
Thorium 232	0.066	0.57	pCi/L	CC-MW-7	0.57	1.7	NO	TX, BSL
Lead 210 + D	0.8	3.03	pCi/L	CC-MW-2	3.03	10	NO	

(1) Risk from decay products (+D) included as appropriate. secular equilibrium assumed between Lead 210 and Radium 226, between (background samples) Uranium 234 and Uranium 238, and between (background samples) Thorium 228 and Radium 228

(2) Minimum/maximum detected concentration

(3) Maximum concentrations from background samples. See text

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason	Infrequent Detection but Associated Historically (IHST)
	Frequent Detection (FD)
	Toxicity Information Available (TX)
	Above Screening Levels (ASL)
Deletion Reason	Infrequent Detection (IFD)
	Background Levels (BKG)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

401040

TABLE 3.1
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	1.09E+00	N/A	2.53E+00	pCi/g	2.53E+00	Max	less than 10 samples	--	--	--
Uranium 238 + D	pCi/g	1.16E+00	N/A	2.89E+00	pCi/g	2.89E+00	Max	less than 10 samples	--	--	--
Radium 226 + D	pCi/g	1.62E+00	N/A	4.63E+00	pCi/g	4.63E+00	Max	less than 10 samples	--	--	--
Radium 228 + D	pCi/g	8.88E-01	N/A	1.90E+00	pCi/g	1.90E+00	Max	less than 10 samples	--	--	--
Thorium 228 + D	pCi/g	9.16E-01	N/A	1.83E+00	pCi/g	1.83E+00	Max	less than 10 samples	--	--	--
Thorium 230	pCi/g	1.65E+00	N/A	4.47E+00	pCi/g	4.47E+00	Max	less than 10 samples	--	--	--
Thorium 232	pCi/g	8.91E-01	N/A	1.76E+00	pCi/g	1.76E+00	Max	less than 10 samples	--	--	--
Lead 210 + D [1]	pCi/g	1.62E+00	N/A	4.63E+00	pCi/g	4.63E+00	Max	less than 10 samples	--	--	--

For non detects, minimum detectable concentration was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation

Statistics: Maximum Detected Value (Max)

N/A = Not Applicable

(1) Lead-210 assumed in equilibrium with Radium 226

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TABLE 3.2
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	3.34E+01	1.56E+02	2.32E+02	pCi/g	1.56E+02	95% UCL-T	W-Test (2)	--	--	--
Uranium 238 + D	pCi/g	2.92E+01	1.54E+02	1.62E+02	pCi/g	1.54E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 226 + D	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 228 + D	pCi/g	1.48E+01	4.75E+01	1.13E+02	pCi/g	4.75E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.88E+01	6.22E+01	1.60E+02	pCi/g	6.22E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	4.64E+01	2.01E+02	4.94E+02	pCi/g	2.01E+02	95% UCL-T	W-Test (2)	--	--	--
Thorium 232	pCi/g	1.45E+01	5.39E+01	1.26E+02	pCi/g	5.39E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D [1]	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk; refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: 95% UCL of log-transformed data (95% UCL-T)

(1) Lead 210 assumed in equilibrium with Radium 226.
(2) Shapiro-Wilk W-Test indicates data do not follow a normal distribution.

401042

TABLE 3.3
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe Future
Medium All Soil
Exposure Medium Particulates
Exposure Point Area A

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	3.34E+01	1.56E+02	2.32E+02	pCi/g	1.56E+02	95% UCL-T	W-Test (2)	--	--	--
Uranium 238 + D	pCi/g	2.92E+01	1.54E+02	1.62E+02	pCi/g	1.54E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 226 + D	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 228 + D	pCi/g	1.48E+01	4.75E+01	1.13E+02	pCi/g	4.75E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.88E+01	6.22E+01	1.60E+02	pCi/g	6.22E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	4.64E+01	2.01E+02	4.94E+02	pCi/g	2.01E+02	95% UCL-T	W-Test (2)	--	--	--
Thorium 232	pCi/g	1.45E+01	5.39E+01	1.26E+02	pCi/g	5.39E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D [1]	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration, for duplicate sample results, the maximum value was used in the calculation

W - Test Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics 95% UCL of log transformed data (95% UCL-T)

(1) Lead-210 assumed in equilibrium with Radium-226
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution

401043

TABLE 3.4
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe Future
Medium All Soil
Exposure Medium Radon Decay Products
Exposure Point Area A

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	3.34E+01	1.56E+02	2.32E+02	pCi/g	1.56E+02	95% UCL-T	W-Test (2)	--	--	--
Uranium 238 + D	pCi/g	2.92E+01	1.54E+02	1.62E+02	pCi/g	1.54E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 226 + D	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 228 + D	pCi/g	1.48E+01	4.75E+01	1.13E+02	pCi/g	4.75E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.88E+01	6.22E+01	1.60E+02	pCi/g	6.22E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	4.64E+01	2.01E+02	4.94E+02	pCi/g	2.01E+02	95% UCL-T	W-Test (2)	--	--	--
Thorium 232	pCi/g	1.45E+01	5.39E+01	1.26E+02	pCi/g	5.39E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D[1]	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--

For non detects, sample quantitation limit was used as a proxy concentration, for duplicate sample results the maximum value was used in the calculation

W - Test Developed by Shapiro and Wilk refer to Supplemental Guidance to RAGS Calculating the Concentration Term OSWER Directive 9285.7-081, May 1992

Statistics 95% UCL of log-transformed data (95% UCL-T)

(1) Lead-210 assumed in equilibrium with Radium 226
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution

TABLE A5
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home Grown Produce
Exposure Point: Area A

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	3.34E+01	1.56E+02	2.32E+02	pCi/g	1.56E+02	95% UCL-T	W-Test (2)	--	--	--
Uranium 238 + D	pCi/g	2.92E+01	1.54E+02	1.62E+02	pCi/g	1.54E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 226 + D	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--
Radium 228 + D	pCi/g	1.48E+01	4.75E+01	1.13E+02	pCi/g	4.75E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.88E+01	6.22E+01	1.60E+02	pCi/g	6.22E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	4.64E+01	2.01E+02	4.94E+02	pCi/g	2.01E+02	95% UCL-T	W-Test (2)	--	--	--
Thorium 232	pCi/g	1.35E+01	5.39E+01	1.26E+02	pCi/g	5.39E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D [1]	pCi/g	3.90E+01	2.12E+02	2.52E+02	pCi/g	2.12E+02	95% UCL-T	W-Test (2)	--	--	--

For non detects, sample quantitation limit was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk; refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: 95% UCL of log transformed data (95% UCL-L)

(1) Lead 210 assumed in equilibrium with Radium 226
(2) Shapiro Wilk W-Test indicates data do not follow a normal distribution

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TABLE 3.6
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe Current / Future
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point Area G

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	2.29E+00	N/A	2.66E+00	pCi/g	2.66E+00	Max	less than 10 samples	--	--	--
Uranium 238 + D	pCi/g	2.27E+00	N/A	2.64E+00	pCi/g	2.64E+00	Max	less than 10 samples	--	--	--
Radium 226 + D	pCi/g	2.80E+00	N/A	3.14E+00	pCi/g	3.14E+00	Max	less than 10 samples	--	--	--
Thorium 230	pCi/g	2.02E+00	N/A	2.18E+00	pCi/g	2.18E+00	Max	less than 10 samples	--	--	--
Lead 210 + D [1]	pCi/g	2.80E+00	N/A	3.14E+00	pCi/g	3.14E+00	Max	less than 10 samples	--	--	--

For non-detects, minimum detectable concentration was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation

(1) Lead-210 assumed in equilibrium with Radium-226

TABLE 3.7
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	1.26E+02	2.58E+03	1.04E+03	pCi/g	1.04E+03	Max	W-Test (2,3)	--	--	--
Uranium 238 + D	pCi/g	1.25E+02	2.66E+03	1.03E+03	pCi/g	1.03E+03	Max	W-Test (2,3)	--	--	--
Radium 226 + D	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--
Radium 228 + D	pCi/g	1.18E+01	3.68E+01	4.89E+01	pCi/g	3.68E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.27E+01	4.35E+01	4.77E+01	pCi/g	4.35E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	3.97E+01	1.77E+03	1.50E+02	pCi/g	1.50E+02	Max	W-Test (2,3)	--	--	--
Thorium 232	pCi/g	1.09E+01	3.29E+01	4.38E+01	pCi/g	3.29E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D[1]	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: Maximum Detected Value (Max), 95% UCL of log transformed data (95% UCL-T)

(1) Lead 210 assumed in equilibrium with Radium 226
(2) Shapiro Wilk W Test indicates data do not follow a normal distribution
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC

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TABLE 3.8
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulate
Exposure Point: Area G

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	1.26E+02	2.58E+03	1.04E+03	pCi/g	1.04E+03	Max	W-Test (2,3)	--	--	--
Uranium 238 + D	pCi/g	1.25E+02	2.66E+03	1.03E+03	pCi/g	1.03E+03	Max	W-Test (2,3)	--	--	--
Radium 226 + D	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--
Radium 228 + D	pCi/g	1.18E+01	3.68E+01	4.89E+01	pCi/g	3.68E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.27E+01	4.35E+01	4.77E+01	pCi/g	4.35E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	3.97E+01	1.77E+03	1.50E+02	pCi/g	1.50E+02	Max	W-Test (2,3)	--	--	--
Thorium 232	pCi/g	1.09E+01	3.29E+01	4.28E+01	pCi/g	3.29E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D[1]	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration. For duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk; refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of log-transformed data (95% UCL-T).

(1) Lead 210 assumed in equilibrium with Radium-226.
(2) Shapiro-Wilk W-Test indicates data do not follow a normal distribution.
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

401048

TABLE 3.9
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Radon Decay Products
Exposure Point: Area G

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	1.26E+02	2.58E+03	1.04E+03	pCi/g	1.04E+03	Max	W-Test (2,3)	--	--	--
Uranium 238 + D	pCi/g	1.25E+02	2.66E+03	1.03E+03	pCi/g	1.03E+03	Max	W-Test (2,3)	--	--	--
Radium 226 + D	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--
Radium 228 + D	pCi/g	1.18E+01	3.68E+01	4.89E+01	pCi/g	3.68E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.27E+01	4.35E+01	4.77E+01	pCi/g	4.35E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	3.97E+01	1.77E+03	1.50E+02	pCi/g	1.50E+02	Max	W-Test (2,3)	--	--	--
Thorium 232	pCi/g	1.09E+01	3.29E+01	4.78E+01	pCi/g	3.29E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D [1]	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: Maximum Detected Value (Max), 95% UCL of log-transformed data (95% UCL-T)

(1) Lead 210 assumed in equilibrium with Radium 226
(2) Shapiro-Wilk W-Test indicates data do not follow a normal distribution
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC

401049

TABLE 3.10
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home-Grown Produce
Exposure Point: Area G

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium 234	pCi/g	1.26E+02	2.58E+03	1.04E+03	pCi/g	1.04E+03	Max	W-Test (2,3)	--	--	--
Uranium 238 + D	pCi/g	1.25E+02	2.66E+03	1.03E+03	pCi/g	1.03E+03	Max	W-Test (2,3)	--	--	--
Radium 226 + D	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--
Radium 228 + D	pCi/g	1.18E+01	3.68E+01	4.89E+01	pCi/g	3.68E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 228 + D	pCi/g	1.27E+01	4.35E+01	4.77E+01	pCi/g	4.35E+01	95% UCL-T	W-Test (2)	--	--	--
Thorium 230	pCi/g	3.97E+01	1.77E+03	1.50E+02	pCi/g	1.50E+02	Max	W-Test (2,3)	--	--	--
Thorium 232	pCi/g	1.09E+01	3.29E+01	4.78E+01	pCi/g	3.29E+01	95% UCL-T	W-Test (2)	--	--	--
Lead 210 + D [1]	pCi/g	4.33E+01	3.31E+02	1.69E+02	pCi/g	1.69E+02	Max	W-Test (2,3)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration. for duplicate sample results, the maximum value was used in the calculation

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: Maximum Detected Value (Max), 95% UCL of log-transformed data (95% UCL-T)

(1) Lead-210 assumed in equilibrium with Radium-226
(2) Shapiro-Wilk W-Test indicates data do not follow a normal distribution
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC

401050

TABLE 3.11
MEDIUM SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer-Tap Water

Radionuclide of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Uranium-234	pCi/l	2.98E+00	4.01E+00	7.20E+00	pCi/l	4.01E+00	95% UCL-N	W-Test (1)	--	--	--
Radium-228 + D	pCi/l	2.43E+00	4.66E+00	7.80E+00	pCi/l	4.66E+00	95% UCL-T	W-Test (1)	--	--	--
Thorium-230	pCi/l	7.13E-01	1.71E+00	3.68E+00	pCi/l	1.71E+00	95% UCL-T	W-Test (1)	--	--	--

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: 95% UCL of log transformed data (95% UCL-T)

(1) Shapiro-Wilk W-Test indicates data do not follow a normal distribution

401051

TABLE 4-1

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A/Area G
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
External (Radiation)	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Exposure (CDI) (pCi-year/g) =
	ET	Exposure Time	hours/day	2	[1]	--	--	RS x ET x EF x (Fo x GSFo) x ED x CF1
	EF	Exposure Frequency	days/year	120	[1]	--	--	
	Fo	Fraction Outdoors	--	1	[1]	--	--	
	GSFo	Gamma Shielding Factor Outdoors	--	1	EPA, 1989	--	--	
	ED	Exposure Duration	years	6	[1]	--	--	
	CF1	Conversion Factor 1	year/hours	1.14E-04	--	--	--	
Ingestion	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Intake (pCi) =
	CF2	Conversion Factor 2	g/mg	1.00E-03	--	--	--	RS x CF2 x IR-S x FI x EF x ED
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	120	[1]	--	--	
	ED	Exposure Duration	years	6	[1]	--	--	

[1] Professional Judgement

Sources

USEPA, 1991. Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual - Supplemental Guidance: Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

USEPA, 1992. Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa

401052

TABLE 4.2

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A/ Area G
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
External (Radiation)	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Exposure (CDI) (pCi year/g) =
	Fi	Fraction Indoors	--	0.5	[1]	--	--	RS x FI x EF x [(Fi x GSFi) + (Fo x GSFo)] x ED x CF1
	Fo	Fraction Outdoors	--	0.5	[1]	--	--	
	GSFi	Gamma Shielding Factor Indoors	--	0.8	EPA, 1997	--	--	
	GSFo	Gamma Shielding Factor Outdoors	--	1	EPA, 1997	--	--	
	ET	Exposure Time	hours/day	8	EPA, 1991	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	--	--	
	CF1	Conversion Factor 1	year/hours	1.14E-04	--	--	--	
Ingestion	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Intake (pCi) =
	CF2	Conversion Factor 2	g/mg	1.00E-03	--	--	--	RS x CF2 x IR-S x FI x EF x ED
	IR-S	Ingestion Rate of Soil	mg/day	50	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	--	--	

[1] Professional Judgement

Sources

USEPA, 1991 Risk Assessment Guidance for Superfund Vol. I Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final OSWER Directive 9285.6-03

USEPA, 1997 Exposure Factors Handbook OHEA EPA 600/P-95/002Fa

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TABLE 4.3

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer-Tap Water
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
Ingestion	RG	Radionuclide Concentration in Groundwater	pCi/l	See Table 2	See Table 2	--	--	Intake (pCi) =
	IR	Ingestion Rate	l/day	1	USEPA, 1991	--	--	RG x IR x EF x ED
	EF	Exposure Frequency	days/year	250	USEPA, 1991	--	--	
	ED	Exposure Duration	years	25	USEPA, 1991	--	--	

[1] Professional Judgement

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund Vol. 1 Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final OSWER Directive 9285.6-03

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TABLE 4.4

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Future

Medium: All Soil

Exposure Medium: All Soil

Exposure Point: Area A/Area G

Receptor Population: Construction Worker

Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
External (Radiation)	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Exposure (CDI) (pCi-year/g) =
	Fi	Fraction Indoors	--	0.25	[1]	--	--	RS x ET x EF x [(Fi x GSFi) + (Fo x GSFo)] x ED x CF1
	Fo	Fraction Outdoors	--	0.75	[1]	--	--	
	GSFi	Gamma Shielding Factor Indoors	--	0.8	EPA, 1989	--	--	
	GSFo	Gamma Shielding Factor Outdoors	--	1	EPA, 1989	--	--	
	ET	Exposure Time	hours/day	8	[1]	--	--	
	EF	Exposure Frequency	days/year	60	[1]	--	--	
	ED	Exposure Duration	years	1	[1]	--	--	
	CF1	Conversion Factor 1	year/hours	1.14E-04	--	--	--	
Ingestion	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Intake (pCi) =
	CF2	Conversion Factor 2	g/mg	1.00E-03	--	--	--	RS x CF2 x IR-S x FI x EF x ED
	IR-S	Ingestion Rate of Soil	mg/day	480	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	60	[1]	--	--	
	ED	Exposure Duration	years	1	[1]	--	--	

[1] Professional Judgement

Sources

USEPA, 1991 Risk Assessment Guidance for Superfund Vol. 1 Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final OSWER Directive 9285.6-03

USEPA, 1997 Exposure Factors Handbook OHEA EPA/600/P-95/002Fa

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TABLE 4.5

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Exposure Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A/Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
Inhalation	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Intake (pCi) =
	PEF	Particulate Emission Factor	kg/m^3	1.34E-06	See Attachment 1	--	--	RS x PEF x CF4 x IN x ET x EF x ED
	CF4	Conversion Factor 4	g/kg	1000	--	--	--	
	IN	Inhalation Rate	m^3/hr	2.3	EPA, 1991	--	--	
	ET	Exposure Time	hours/day	8	[1]	--	--	
	EF	Exposure Frequency	days/year	60	[1]	--	--	
	ED	Exposure Duration	years	1	[1]	--	--	

[1] Professional Judgement

Sources

USEPA, 1991. Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03

TABLE 4.7

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A, Area G
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
External (Radiation)	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--	--	Exposure (CEDI) (pCi/year/g) =
	ET	Exposure Time	hours/day	17	EPA, 1989a	--	--	RS x ET x EF x [(Ei x GSEi) + (Eo x GSEo)] x ED x CF1
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	Ei	Time Fraction Indoors		0.875	EPA, 1997	--	--	
	Eo	Time Fraction Outdoors	-	0.125	EPA, 1997	--	--	
	GSEi	Gamma Shielding Factor Indoors	--	0.8	EPA, 1997	-	--	
	GSEo	Gamma Shielding Factor Outdoors	-	1	EPA, 1997			
	ED	Exposure Duration	years	6	EPA, 1991	--	--	
	CF1	Conversion Factor 1	year/hours	1.14E-04	--	--	--	
Ingestion	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	-	--	Intake (pCi) =
	CF2	Conversion Factor 2	g/mg	1.00E-03	[1]	--	--	RS x CF2 x IR-S x FI x EF x ED
	IR-S	Ingestion Rate of Soil	mg/day	200	EPA, 1991	--	--	
	FI	Fraction Ingested	-	1	-	-	-	
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	6	EPA, 1991	--	--	
Home Grown Produce	RS	Radionuclide Concentration in Soil	pCi/g	See Table 2	See Table 2	--		Intake (pCi) =
	IR-L	Ingestion Rate of Lettuce	g/day	4	EPA, 1986	-	-	RS x [(IR-L x PUF-L) + (IR-C x RUF-C) + (IR-T x PUF-T)] x EF x ED
	PUF-L	Plant Uptake Factor Lettuce	--	See Attachment G	See Attachment F	-	-	
	IR-C	Ingestion Rate of Carrots	g/day	27	EPA, 1986	-	-	
	RUF-C	Radionuclide Specific Root Uptake Factor Carrot	-	See Attachment G	See Attachment F	-		
	IR-T	Ingestion Rate of Tomatoes	g/day	24	EPA, 1986		-	
	PUF-T	Plant Uptake Factor Tomatoes	-	See Attachment G	See Attachment F			
	EF	Exposure Frequency	days/year	350	EPA, 1991		-	
	ED	Exposure Duration	years	6	EPA, 1991	-		

[1] Professional Judgement

Sources

[1] EPA, 1986. Methodology for the Assessment of Health Risk Associated with Multiple Pathways Exposure to Municipal Waste Combustor Emissions. Washington D.C. Office of Air Quality Planning and Standards, and Environmental Criteria and Assessment Office

[2] EPA, 1989a. Exposure Factors Handbook. EPA/600/8-89/043

[3] EPA, 1991. Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual. Supplemental Guidance. Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

[4] EPA, 1997. Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa

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TABLE 4.8

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe: Future

Medium: All Soil

Exposure Medium: Radon Decay Products

Exposure Point: Area A/Area G

Receptor Population: Resident

Receptor Age: Adult, Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
Inhalation	--	--	--	--	--	--	--	Intake (pCi) Intakes were modeled with RESRAD

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TABLE 4.9

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe Future

Medium Groundwater

Exposure Medium Groundwater

Exposure Point Upper Glacial Aquifer Tap Water

Receptor Population Resident

Receptor Age Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
Ingestion	RG	Radionuclide Concentration in Groundwater	pCi/l	See Table 2	See Table 2	--	--	Intake (pCi) =
	IR	Ingestion Rate	l/day	2	USEPA, 1991	--	--	RG x IR x EF x ED
	EF	Exposure Frequency	days/year	350	USEPA, 1991	--	--	
	ED	Exposure Duration	years	30	USEPA, 1991	--	--	

(1) Professional Judgement

Sources

USEPA, 1991: Risk Assessment Guidance for Superfund Vol. 1 Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final OSWER Directive 9285.6-03

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TABLE 4.10

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

CAPTAIN'S COVE

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point Upper Glacial Aquifer-Tap Water
Receptor Population Resident
Receptor Age Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Equation
Ingestion	RG	Radionuclide Concentration in Groundwater	pCi/l	See Table 2	See Table 2	--	--	Intake (pCi) =
	IR	Ingestion Rate	l/day	1	USEPA, 1991	--	--	RG x IR x EF x ED
	EF	Exposure Frequency	days/year	350	USEPA, 1991	--	--	
	ED	Exposure Duration	years	6	USEPA, 1991	--	--	

[1] Professional Judgement

Sources

USEPA, 1991 Risk Assessment Guidance for Superfund Vol 1 Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final OSWER Directive 9285.6-03

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TABLE 5.1

CANCER TOXICITY DATA -- EXTERNAL

CAPTAIN'S COVE RADIONUCLIDES OF POTENTIAL CONCERN

Radionuclide of Potential Concern (1)	External Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
Uranium 234	2.14E-11	Risk/pCi	A	HEAST	11/01/95
Uranium 238 + D	6.57E-08	Risk/pCi	A	HEAST	11/01/95
Radium 226 + D	6.74E-06	Risk/pCi	A	HEAST	11/01/95
Radium 228 + D	3.28E-06	Risk/pCi	A	HEAST	11/01/95
Thorium 228 + D	6.20E-06	Risk/pCi	A	HEAST	11/01/95
Thorium 230	4.40E-11	Risk/pCi	A	HEAST	11/01/95
Thorium 232	1.97E-11	Risk/pCi	A	HEAST	11/01/95
Lead 210 + D	1.45E-10	Risk/pCi	A	HEAST	11/01/95

(1) Risk from decay products (+D) included as appropriate

HEAST - Health Effects Assessment Summary Tables

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence

Known/Likely

Cannot be Determined

Not Likely

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TABLE 5.2

CANCER TOXICITY DATA -- ORAL

CAPTAIN'S COVE-RADIONUCLIDES OF POTENTIAL CONCERN

Radionuclide of Potential Concern (1)	Oral Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
Uranium 234	4.44E-11	Risk/pCi	A	HEAST	11/01/95
Uranium 238 + D	6.20E-11	Risk/pCi	A	HEAST	11/01/95
Radium 226 + D	2.96E-10	Risk/pCi	A	HEAST	11/01/95
Radium 228 + D	2.48E-10	Risk/pCi	A	HEAST	11/01/95
Thorium 228 + D	2.31E-10	Risk/pCi	A	HEAST	11/01/95
Thorium 230	3.75E-11	Risk/pCi	A	HEAST	11/01/95
Thorium 232	3.28E-11	Risk/pCi	A	HEAST	11/01/95
Lead 210 + D	1.01E-09	Risk/pCi	A	HEAST	11/01/95

(1) Risk from decay products (+D) included as appropriate

HEAST - Health Effects Assessment Summary Tables

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence

Known/Likely

Cannot be Determined

Not Likely

401062

TABLE 5.3

CANCER TOXICITY DATA -- INHALATION

CAPTAIN'S COVE-RADIONUCLIDES OF POTENTIAL CONCERN

Radionuclide of Potential Concern (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM-DD/YY)
Uranium 234	1.40E-08	Risk/pCi	A	HEAST	11/01/95
Uranium 238 + D	1.24E-08	Risk/pCi	A	HEAST	11/01/95
Radium 226 + D	2.75E-09	Risk/pCi	A	HEAST	11/01/95
Radium 228 + D	9.94E-10	Risk/pCi	A	HEAST	11/01/95
Thorium 228 + D	9.68E-08	Risk/pCi	A	HEAST	11/01/95
Thorium 230	1.72E-08	Risk/pCi	A	HEAST	11/01/95
Thorium 232	1.93E-08	Risk/pCi	A	HEAST	11/01/95
Lead 210 + D	3.86E-09	Risk/pCi	A	HEAST	11/01/95

(1) Risk from decay products (+D) included as appropriate

HEAST - Health Effects Assessment Summary Tables

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

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TABLE 6.1
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	2.53E+00	pCi/g	2.53E+00	pCi/g	M	4.15E-01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	8.9E-12
	Uranium 238 + D	2.89E+00	pCi/g	2.89E+00	pCi/g	M	4.74E-01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	3.1E-08
	Radium 226 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	7.60E-01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	5.1E-06
	Radium 228 + D	1.90E+00	pCi/g	1.90E+00	pCi/g	M	3.12E-01	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.0E-06
	Thorium 228 + D	1.83E+00	pCi/g	1.83E+00	pCi/g	M	3.00E-01	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.9E-06
	Thorium 230	4.47E+00	pCi/g	4.47E+00	pCi/g	M	7.34E-01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	3.2E-11
	Thorium 232	1.76E+00	pCi/g	1.76E+00	pCi/g	M	2.89E-01	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	5.7E-12
	Lead 210 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	7.60E-01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	1.1E-10
	(Total)										8.0E-06
Ingestion	Uranium 234	2.53E+00	pCi/g	2.53E+00	pCi/g	M	1.82E+02	pCi	4.44E-11	Risk/pCi soil	8.1E-09
	Uranium 238 + D	2.89E+00	pCi/g	2.89E+00	pCi/g	M	2.08E+02	pCi	6.20E-11	Risk/pCi soil	1.3E-08
	Radium 226 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	3.33E+02	pCi	2.96E-10	Risk/pCi soil	9.9E-08
	Radium 228 + D	1.90E+00	pCi/g	1.90E+00	pCi/g	M	1.37E+02	pCi	2.48E-10	Risk/pCi soil	3.4E-08
	Thorium 228 + D	1.83E+00	pCi/g	1.83E+00	pCi/g	M	1.32E+02	pCi	2.31E-10	Risk/pCi soil	3.0E-08
	Thorium 230	4.47E+00	pCi/g	4.47E+00	pCi/g	M	3.22E+02	pCi	3.75E-11	Risk/pCi soil	1.2E-08
	Thorium 232	1.76E+00	pCi/g	1.76E+00	pCi/g	M	1.27E+02	pCi	3.28E-11	Risk/pCi soil	4.2E-09
	Lead 210 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	3.33E+02	pCi	1.01E-09	Risk/pCi soil	3.4E-07
	(Total)										5.4E-07

(1) M = Medium-Specific

TABLE 6.2
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.03E-01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.2E-12
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.02E-01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	6.7E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.49E-01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.0E-06
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.61E-01	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	5.3E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.61E-01	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.0E-06
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.05E-01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.6E-12
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	1.30E-01	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	2.6E-12
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.49E-01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	2.2E-11
	(Total)										2.5E-06
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	4.53E+01	pCi	4.44E-11	Risk/pCi soil	2.0E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	4.49E+01	pCi	6.20E-11	Risk/pCi soil	2.8E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	6.53E+01	pCi	2.96E-10	Risk/pCi soil	1.9E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	7.04E+01	pCi	2.48E-10	Risk/pCi soil	1.7E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	7.06E+01	pCi	2.31E-10	Risk/pCi soil	1.6E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	4.62E+01	pCi	3.75E-11	Risk/pCi soil	1.7E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	5.68E+01	pCi	3.28E-11	Risk/pCi soil	1.9E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	6.53E+01	pCi	1.01E-09	Risk/pCi soil	6.6E-08
	(Total)										1.3E-07

(1) M Medium Specific N/A Not Applicable

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TABLE 6.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area A	8.0E-06	2.5E-06	5.5E-06
Ingestion	Soil	Area A	5.4E-07	1.3E-07	4.1E-07
				Total Risk	5.9E-06

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TABLE 6.4
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	2.53E+00	pCi/g	2.53E+00	pCi/g	M	1.30E+01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.8E-10
	Uranium 238 + D	2.89E+00	pCi/g	2.89E+00	pCi/g	M	1.48E+01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	9.7E-07
	Radium 226 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	2.38E+01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.6E-04
	Radium 228 + D	1.90E+00	pCi/g	1.90E+00	pCi/g	M	9.75E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	3.2E-05
	Thorium 228 + D	1.83E+00	pCi/g	1.83E+00	pCi/g	M	9.39E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	5.8E-05
	Thorium 230	4.47E+00	pCi/g	4.47E+00	pCi/g	M	2.29E+01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.0E-09
	Thorium 232	1.76E+00	pCi/g	1.76E+00	pCi/g	M	9.03E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	1.8E-10
	Lead 210 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	2.38E+01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	3.4E-09
	(Total)										2.5E-04
Ingestion	Uranium 234	2.53E+00	pCi/g	2.53E+00	pCi/g	M	7.91E+02	pCi	4.44E-11	Risk/pCi soil	3.5E-08
	Uranium 238 + D	2.89E+00	pCi/g	2.89E+00	pCi/g	M	9.03E+02	pCi	6.20E-11	Risk/pCi soil	5.6E-08
	Radium 226 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	1.45E+03	pCi	2.96E-10	Risk/pCi soil	4.3E-07
	Radium 228 + D	1.90E+00	pCi/g	1.90E+00	pCi/g	M	5.94E+02	pCi	2.48E-10	Risk/pCi soil	1.5E-07
	Thorium 228 + D	1.83E+00	pCi/g	1.83E+00	pCi/g	M	5.72E+02	pCi	2.31E-10	Risk/pCi soil	1.3E-07
	Thorium 230	4.47E+00	pCi/g	4.47E+00	pCi/g	M	1.40E+03	pCi	3.75E-11	Risk/pCi soil	5.2E-08
	Thorium 232	1.76E+00	pCi/g	1.76E+00	pCi/g	M	5.50E+02	pCi	3.28E-11	Risk/pCi soil	1.8E-08
	Lead 210 + D	4.63E+00	pCi/g	4.63E+00	pCi/g	M	1.45E+03	pCi	1.01E-09	Risk/pCi soil	1.5E-06
	(Total)										2.3E-06

(1) M - Medium Specific

401066

TABLE 6.5

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.23E+00	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	6.9E-11
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.20E+00	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.1E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.65E+00	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.1E-05
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.02E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.6E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.03E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	3.1E-05
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.29E+00	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.4E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.05E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	8.0E-11
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.65E+00	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	6.7E-10
	(Total)										7.9E-05
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.96E+02	pCi	4.44E-11	Risk/pCi soil	8.7E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.95E+02	pCi	6.20E-11	Risk/pCi soil	1.2E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.83E+02	pCi	2.96E-10	Risk/pCi soil	8.4E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	3.06E+02	pCi	2.48E-10	Risk/pCi soil	7.6E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	3.06E+02	pCi	2.31E-10	Risk/pCi soil	7.1E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.01E+02	pCi	3.75E-11	Risk/pCi soil	7.5E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.47E+02	pCi	3.28E-11	Risk/pCi soil	8.1E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.83E+02	pCi	1.01E-09	Risk/pCi soil	2.9E-07
	(Total)										5.5E-07

(1) M = Medium Specific N/A = Not Applicable

401067

TABLE 6.6

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/g	4.01E+00	pCi/g	M	2.50E+04	pCi-year/g	4.44E-11	Risk/yr per pCi/g water	1.1E-06
	Radium 228 + D	4.66E+00	pCi/g	4.66E+00	pCi/g	M	2.91E+04	pCi-year/g	2.48E-10	Risk/yr per pCi/g water	7.2E-06
	Thorium 230	1.71E+00	pCi/g	1.71E+00	pCi/g	M	1.07E+04	pCi-year/g	3.75E-11	Risk/yr per pCi/g water	4.0E-07
										Total Risk	8.7E-06

(1) M = Medium-Specific

401068

TABLE 6.7
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Groundwater
Exposure Medium: Background Groundwater
Exposure Point: Upper Glacial Aquifer-Tap Water
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/g	2.10E+00	pCi/g	M	1.31E+04	pCi-year/g	4.44E-11	Risk/yr per pCi/g water	5.8E-07
	Radium 228 + D	2.25E+00	pCi/g	2.25E+00	pCi/g	M	1.40E+04	pCi-year/g	2.48E-10	Risk/yr per pCi/g water	3.5E-06
	Thorium 230	6.33E-01	pCi/g	6.33E-01	pCi/g	M	3.96E+03	pCi-year/g	3.75E-11	Risk/yr per pCi/g water	1.5E-07
										Total Risk	4.2E-06

(1) M = Medium-Specific

401069

TABLE 6.8
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area A	2.5E-04	7.9E-05	1.7E-04
Ingestion	Soil	Area A	2.3E-06	5.5E-07	1.8E-06
	Groundwater	Upper Glacial Aquifer-Tap Water	8.7E-06	4.2E-06	4.5E-06
				Total Risk	1.8E-04

401070

TABLE 6.9
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	8.09E+00	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	1.7E-10
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	8.01E+00	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	5.3E-07
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.10E+01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	7.4E-05
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	2.47E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	8.1E-06
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	3.23E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	2.0E-05
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	1.05E+01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.6E-10
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	2.80E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	5.5E-11
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.10E+01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	1.6E-09
	(Total)										1.0E-04
Ingestion	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	4.48E+03	pCi-year/g	4.44E-11	Risk/yr per pCi/g soil	2.0E-07
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	4.44E+03	pCi-year/g	6.20E-11	Risk/yr per pCi/g soil	2.8E-07
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	6.12E+03	pCi-year/g	2.96E-10	Risk/yr per pCi/g soil	1.8E-06
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	1.37E+03	pCi-year/g	2.48E-10	Risk/yr per pCi/g soil	3.4E-07
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	1.79E+03	pCi-year/g	2.31E-10	Risk/yr per pCi/g soil	4.1E-07
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	5.80E+03	pCi-year/g	3.75E-11	Risk/yr per pCi/g soil	2.2E-07
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	1.55E+03	pCi-year/g	3.28E-11	Risk/yr per pCi/g soil	5.1E-08
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	6.12E+03	pCi-year/g	1.01E-09	Risk/yr per pCi/g soil	6.2E-06
	(Total)										9.5E-06

(1) M - Medium-Specific

401071

TABLE 6.10
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Construction Worker.
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.27E-02	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	7.0E-13
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.24E-02	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.1E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.72E-02	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.2E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.08E-02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.7E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.10E-02	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	3.2E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.34E-02	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.5E-12
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.10E-02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	8.1E-13
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.72E-02	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	6.8E-12
	(Total)										8.0E-07
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.81E+01	pCi-year/g	4.44E-11	Risk/yr per pCi/g soil	8.0E-10
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.80E+01	pCi-year/g	6.20E-11	Risk/yr per pCi/g soil	1.1E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.61E+01	pCi-year/g	2.96E-10	Risk/yr per pCi/g soil	7.7E-09
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	2.82E+01	pCi-year/g	2.48E-10	Risk/yr per pCi/g soil	7.0E-09
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	2.82E+01	pCi-year/g	2.31E-10	Risk/yr per pCi/g soil	6.5E-09
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.85E+01	pCi-year/g	3.75E-11	Risk/yr per pCi/g soil	6.9E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.27E+01	pCi-year/g	3.28E-11	Risk/yr per pCi/g soil	7.5E-10
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.61E+01	pCi-year/g	1.01E-09	Risk/yr per pCi/g soil	2.6E-08
	(Total)										5.1E-08

(1) M - Medium Specific N/A - Not Applicable

401072

401073

TABLE 6.11
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Uranium 234	1.56E+02	pCi/g	2.09E-01	pCi/m³	R	2.30E+02	pCi	1.40E-08	Risk/pCi	3.2E-06
	Uranium 238 + D	1.54E+02	pCi/g	2.06E-01	pCi/m³	R	2.28E+02	pCi	1.24E-08	Risk/pCi	2.8E-06
	Radium 226 + D	2.12E+02	pCi/g	2.85E-01	pCi/m³	R	3.14E+02	pCi	2.75E-09	Risk/pCi	8.6E-07
	Radium 228 + D	4.75E+01	pCi/g	6.36E-02	pCi/m³	R	7.02E+01	pCi	9.94E-10	Risk/pCi	7.0E-08
	Thorium 228 + D	6.22E+01	pCi/g	8.34E-02	pCi/m³	R	9.20E+01	pCi	9.68E-08	Risk/pCi	8.9E-06
	Thorium 230	2.01E+02	pCi/g	2.70E-01	pCi/m³	R	2.98E+02	pCi	1.72E-08	Risk/pCi	5.1E-06
	Thorium 232	5.39E+01	pCi/g	7.23E-02	pCi/m³	R	7.98E+01	pCi	1.93E-08	Risk/pCi	1.5E-06
	Lead 210 + D	2.12E+02	pCi/g	2.85E-01	pCi/m³	R	3.14E+02	pCi	3.86E-09	Risk/pCi	1.2E-06
	(Total)										
										Total Risk All ROPC	2.4E-05

(1) See respirable particulates model in Attachment F
(2) R = Route-Specific

401074

TABLE 6.12
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Particulates
Exposure Point: N/A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Inhalation	Uranium 234	6.29E-01	pCi/g	8.42E-04	pCi/m³	R	9.30E-01	pCi	1.40E-08	Risk/pCi	1.3E-08
	Uranium 238 + D	6.24E-01	pCi/g	8.36E-04	pCi/m³	R	9.23E-01	pCi	1.24E-08	Risk/pCi	1.1E-08
	Radium 226 + D	9.07E-01	pCi/g	1.22E-03	pCi/m³	R	1.34E+00	pCi	2.75E-09	Risk/pCi	3.7E-09
	Radium 228 + D	9.78E-01	pCi/g	1.31E-03	pCi/m³	R	1.45E+00	pCi	9.94E-10	Risk/pCi	1.4E-09
	Thorium 228 + D	9.80E-01	pCi/g	1.31E-03	pCi/m³	R	1.45E+00	pCi	9.68E-08	Risk/pCi	1.4E-07
	Thorium 230	6.42E-01	pCi/g	8.60E-04	pCi/m³	R	9.49E-01	pCi	1.72E-08	Risk/pCi	1.6E-08
	Thorium 232	7.89E-01	pCi/g	1.06E-03	pCi/m³	R	1.17E+00	pCi	1.93E-08	Risk/pCi	2.3E-08
	Lead 210 + D	9.07E-01	pCi/g	1.22E-03	pCi/m³	R	1.34E+00	pCi	3.86E-09	Risk/pCi	5.2E-09
	(Total)										
										Total Risk All ROPC	2.1E-07

N/A - Not Applicable
(1) See respirable particulates model in Attachment F
(2) R - Route-Specific

401075

TABLE 6.13
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area A	1.0E-04	8.0E-07	1.0E-04
Ingestion	Soil	Area A	9.5E-06	5.1E-08	9.4E-06
Inhalation	Soil	Area A	2.4E-05	2.1E-07	2.4E-05
				Total Risk	1.4E-04

401076

TABLE 6.14
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	2.69E+03	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	5.8E-08
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	2.66E+03	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	1.8E-04
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	3.67E+03	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	2.5E-02
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	8.21E+02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	2.7E-03
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	1.08E+03	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	6.7E-03
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	3.48E+03	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.5E-07
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	9.33E+02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	1.8E-08
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	3.67E+03	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	5.3E-07
	(Total)										3.4E-02
Ingestion	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	1.63E+05	pCi	4.44E-11	Risk/pCi soil	7.3E-06
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	1.62E+05	pCi	6.20E-11	Risk/pCi soil	1.0E-05
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	2.23E+05	pCi	2.96E-10	Risk/pCi soil	6.6E-05
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	4.99E+04	pCi	2.48E-10	Risk/pCi soil	1.2E-05
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	6.53E+04	pCi	2.31E-10	Risk/pCi soil	1.5E-05
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	2.11E+05	pCi	3.75E-11	Risk/pCi soil	7.9E-06
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	5.66E+04	pCi	3.28E-11	Risk/pCi soil	1.9E-06
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	2.23E+05	pCi	1.01E-09	Risk/pCi soil	2.3E-04
	(Total)										3.5E-04

(1) M = Medium-Specific

401077

TABLE 6.15
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.09E+01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.3E-10
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.08E+01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	7.1E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.57E+01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.1E-04
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.69E+01	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	5.5E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.70E+01	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.1E-04
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.11E+01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.9E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	1.37E+01	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	2.7E-10
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.57E+01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	2.3E-09
	(Total)										2.7E-04
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	6.60E+02	pCi	4.44E-11	Risk/pCi soil	2.9E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	6.55E+02	pCi	6.20E-11	Risk/pCi soil	4.1E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	9.52E+02	pCi	2.96E-10	Risk/pCi soil	2.8E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.03E+03	pCi	2.48E-10	Risk/pCi soil	2.5E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.03E+03	pCi	2.33E-10	Risk/pCi soil	2.4E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	6.74E+02	pCi	3.75E-11	Risk/pCi soil	2.5E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	8.29E+02	pCi	3.28E-11	Risk/pCi soil	2.7E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	9.52E+02	pCi	1.01E-09	Risk/pCi soil	9.6E-07
	(Total)										1.9E-06

(1) M = Medium Specific N/A = Not Applicable

401078

TABLE 6.16
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home-Grown Produce
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	9.70E+04	pCi	4.44E-11	Risk/pCi soil	4.3E-06
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	9.60E+04	pCi	6.20E-11	Risk/pCi soil	6.0E-06
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.32E+05	pCi	2.96E-10	Risk/pCi soil	3.9E-05
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	2.96E+04	pCi	2.48E-10	Risk/pCi soil	7.3E-06
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	3.88E+04	pCi	2.31E-10	Risk/pCi soil	9.0E-06
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	1.25E+05	pCi	3.75E-11	Risk/pCi soil	4.7E-06
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	3.36E+04	pCi	3.28E-11	Risk/pCi soil	1.1E-06
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.32E+05	pCi	1.01E-09	Risk/pCi soil	1.3E-04
	(Total)										2.1E-04

(1) M = Medium-Specific

401079

TABLE 6.17
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Home-Grown Produce
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.92E+02	pCi	4.44E-11	Risk/pCi soil	1.7E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.89E+02	pCi	6.20E-11	Risk/pCi soil	2.4E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.65E+02	pCi	2.96E-10	Risk/pCi soil	1.7E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	6.09E+02	pCi	2.48E-10	Risk/pCi soil	1.5E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	6.11E+02	pCi	2.31E-10	Risk/pCi soil	1.4E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	4.00E+02	pCi	3.75E-11	Risk/pCi soil	1.5E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.92E+02	pCi	3.28E-11	Risk/pCi soil	1.6E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.65E+02	pCi	1.01E-09	Risk/pCi soil	5.7E-07
	(Total)										1.1E-06

(1) M = Medium-Specific N/A = Not Applicable

401080

TABLE 6.18
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/l	4.01E+00	pCi/l	M	8.41E+04	pCi	4.44E-11	Risk/pCi water	3.7E-06
	Radium 228 + D	4.66E+00	pCi/l	4.66E+00	pCi/l	M	9.78E+04	pCi	2.48E-10	Risk/pCi water	2.4E-05
	Thorium 230	1.71E+00	pCi/l	1.71E+00	pCi/l	M	3.58E+04	pCi	3.75E-11	Risk/pCi water	1.3E-06
										Total Risk	2.9E-05

(1) M = Medium-Specific

401081

TABLE 6.19
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Groundwater
Exposure Medium: Background Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident Adult
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/l	2.10E+00	pCi/l	M	4.41E+04	pCi	4.44E-11	Risk/pCi water	2.0E-06
	Radium 228 + D	2.25E+00	pCi/l	2.25E+00	pCi/l	M	4.72E+04	pCi	2.48E-10	Risk/pCi water	1.2E-05
	Thorium 230	6.33E-01	pCi/l	6.33E-01	pCi/l	M	1.33E+04	pCi	3.75E-11	Risk/pCi water	5.0E-07
										Total Risk	1.4E-05

(1) M = Medium-Specific

401082

TABLE 6.20
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area A	3.4E-02	2.7E-04	3.4E-02
Ingestion	Soil	Area A	3.5E-04	1.9E-06	3.4E-04
	Home-grown Produce	Area A	2.1E-04	1.1E-06	2.0E-04
	Groundwater	Upper Glacial Aquifer- Tap Water	2.9E-05	1.4E-05	1.5E-05
Inhalation	Radon Decay Products*	Area A	9.7E-02	4.2E-04	9.7E-02
				Total Risk	1.3E-01

* It is not possible to use RAGS methodology to quantify the risk from radon decay products in the absence of radon and radon decay product data. Therefore, the radon inhalation pathway risk calculated with RESRAD is included here.

401083

TABLE 6.21
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	5.23E+02	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	1.1E-08
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	5.17E+02	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	3.4E-05
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	7.13E+02	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	4.8E-03
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	1.59E+02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	5.2E-04
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	2.09E+02	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.3E-03
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	6.76E+02	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	3.0E-08
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	1.81E+02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	3.6E-09
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	7.13E+02	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	1.0E-07
	(Total)										6.7E-03
Ingestion	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	6.54E+04	pCi	4.44E-11	Risk/pCi soil	2.9E-06
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	6.47E+04	pCi	6.20E-11	Risk/pCi soil	4.0E-06
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	8.92E+04	pCi	2.96E-10	Risk/pCi soil	2.6E-05
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	1.99E+04	pCi	2.48E-10	Risk/pCi soil	4.9E-06
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	2.61E+04	pCi	2.31E-10	Risk/pCi soil	6.0E-06
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	8.45E+04	pCi	3.75E-11	Risk/pCi soil	3.2E-06
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	2.26E+04	pCi	3.28E-11	Risk/pCi soil	7.4E-07
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	8.92E+04	pCi	1.01E-09	Risk/pCi soil	9.0E-05
	(Total)										1.4E-04

(1) M = Medium Specific

401084

TABLE 6.22
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	2.11E+00	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	4.5E-11
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	2.09E+00	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	1.4E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.05E+00	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	2.1E-05
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	3.28E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.1E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	3.29E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	2.0E-05
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.15E+00	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	9.5E-11
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.65E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	5.2E-11
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.05E+00	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	4.4E-10
	(Total)										5.2E-05
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	2.64E+02	pCi	4.44E-11	Risk/pCi soil	1.2E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	2.62E+02	pCi	6.20E-11	Risk/pCi soil	1.6E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.81E+02	pCi	2.96E-10	Risk/pCi soil	1.1E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	4.11E+02	pCi	2.48E-10	Risk/pCi soil	1.0E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	4.12E+02	pCi	2.31E-10	Risk/pCi soil	9.5E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.69E+02	pCi	3.75E-11	Risk/pCi soil	1.0E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	3.32E+02	pCi	3.28E-11	Risk/pCi soil	1.1E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.81E+02	pCi	1.01E-09	Risk/pCi soil	3.8E-07
	(Total)										7.4E-07

(1) M - Medium Specific N/A - Not Applicable

401085

TABLE 6.23
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home-Grown Produce
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	1.56E+02	pCi/g	1.56E+02	pCi/g	M	8.79E+03	pCi	4.44E-11	Risk/pCi soil	3.9E-07
	Uranium 238 + D	1.54E+02	pCi/g	1.54E+02	pCi/g	M	8.70E+03	pCi	6.20E-11	Risk/pCi soil	5.4E-07
	Radium 226 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.20E+04	pCi	2.96E-10	Risk/pCi soil	3.6E-06
	Radium 228 + D	4.75E+01	pCi/g	4.75E+01	pCi/g	M	2.68E+03	pCi	2.48E-10	Risk/pCi soil	6.7E-07
	Thorium 228 + D	6.22E+01	pCi/g	6.22E+01	pCi/g	M	3.51E+03	pCi	2.31E-10	Risk/pCi soil	8.1E-07
	Thorium 230	2.01E+02	pCi/g	2.01E+02	pCi/g	M	1.14E+04	pCi	3.75E-11	Risk/pCi soil	4.3E-07
	Thorium 232	5.39E+01	pCi/g	5.39E+01	pCi/g	M	3.05E+03	pCi	3.28E-11	Risk/pCi soil	1.0E-07
	Lead 210 + D	2.12E+02	pCi/g	2.12E+02	pCi/g	M	1.20E+04	pCi	1.01E-09	Risk/pCi soil	1.2E-05
	(Total)										1.9E-05

(1) M = Medium-Specific

401086

TABLE 6.24
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Home-Grown Produce
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.55E+01	pCi	4.44E-11	Risk/pCi soil	1.6E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.52E+01	pCi	6.20E-11	Risk/pCi soil	2.2E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.12E+01	pCi	2.96E-10	Risk/pCi soil	1.5E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.52E+01	pCi	2.48E-10	Risk/pCi soil	1.4E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.54E+01	pCi	2.31E-10	Risk/pCi soil	1.3E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.62E+01	pCi	3.75E-11	Risk/pCi soil	1.4E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.46E+01	pCi	3.28E-11	Risk/pCi soil	1.5E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.12E+01	pCi	1.01E-09	Risk/pCi soil	5.2E-08
	(Total)										1.0E-07

(1) M = Medium Specific N/A = Not Applicable

401087

TABLE 6.25
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/l	4.01E+00	pCi/l	M	8.41E+03	pCi	4.44E-11	Risk/pCi water	3.7E-07
	Radium 228 + D	4.66E+00	pCi/l	4.66E+00	pCi/l	M	9.78E+03	pCi	2.48E-10	Risk/pCi water	2.4E-06
	Thorium 230	1.71E+00	pCi/l	1.71E+00	pCi/l	M	3.58E+03	pCi	3.75E-11	Risk/pCi water	1.3E-07
										Total Risk	2.9E-06

(1) M = Medium-Specific

401088

TABLE 6.26
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/l	2.10E+00	pCi/l	M	4.41E+03	pCi	4.44E-11	Risk/pCi water	2.0E-07
	Radium 228 + D	2.25E+00	pCi/l	2.25E+00	pCi/l	M	4.72E+03	pCi	2.48E-10	Risk/pCi water	1.2E-06
	Thorium 230	6.33E-01	pCi/l	6.33E-01	pCi/l	M	1.33E+03	pCi	3.75E-11	Risk/pCi water	5.0E-08
										Total Risk	1.4E-06

(1) M = Medium-Specific

401089

TABLE 6.27
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area A	6.7E-03	5.2E-05	6.6E-03
Ingestion	Soil	Area A	1.4E-04	7.4E-07	1.4E-04
	Home-grown Produce	Area A	1.9E-05	1.0E-07	1.9E-05
	Groundwater	Upper Glacial Aquifer- Tap Water	2.9E-06	1.4E-06	1.5E-06
Inhalation	Radon Decay Products*	Area A	2.4E-02	1.0E-04	2.4E-02
				Total Risk	3.1E-02

* It is not possible to use RAGS methodology to quantify the risk from radon decay products in the absence of radon and radon decay product data. Therefore, the radon inhalation pathway risk calculated with RESRAD is included here.

401090

TABLE 6.28
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area G
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	2.66E+00	pCi/g	2.66E+00	pCi/g	M	4.37E-01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	9.3E-12
	Uranium 238 + D	2.64E+00	pCi/g	2.64E+00	pCi/g	M	4.33E-01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.8E-08
	Radium 226 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	5.15E-01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.5E-06
	Thorium 230	2.18E+00	pCi/g	2.18E+00	pCi/g	M	3.58E-01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.6E-11
	Lead 210 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	5.15E-01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	7.5E-11
	(Total)										3.5E-06
Ingestion	Uranium 234	2.66E+00	pCi/g	2.66E+00	pCi/g	M	1.92E+02	pCi	4.44E-11	Risk/pCi soil	8.5E-09
	Uranium 238 + D	2.64E+00	pCi/g	2.64E+00	pCi/g	M	1.90E+02	pCi	6.20E-11	Risk/pCi soil	1.2E-08
	Radium 226 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	2.26E+02	pCi	2.96E-10	Risk/pCi soil	6.7E-08
	Thorium 230	2.18E+00	pCi/g	2.18E+00	pCi/g	M	1.57E+02	pCi	3.75E-11	Risk/pCi soil	5.9E-09
	[illegible] 210 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	2.26E+02	pCi	1.01E-09	Risk/pCi soil	2.3E-07
	(Total)										3.2E-07

(1) M = Medium-Specific

401091

TABLE 6.29
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current, Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.03E-01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.2E-12
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.02E-01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	6.7E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.49E-01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.0E-06
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.61E-01	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	5.3E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.61E-01	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.0E-06
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.05E-01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.6E-12
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	1.30E-01	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	2.6E-12
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.49E-01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	2.2E-11
	(Total)										2.5E-06
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	4.53E+01	pCi	4.44E-11	Risk/pCi soil	2.0E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	4.49E+01	pCi	6.20E-11	Risk/pCi soil	2.8E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	6.53E+01	pCi	2.96E-10	Risk/pCi soil	1.9E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	7.04E+01	pCi	2.48E-10	Risk/pCi soil	1.7E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	7.06E+01	pCi	2.33E-10	Risk/pCi soil	1.6E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	4.62E+01	pCi	3.75E-11	Risk/pCi soil	1.7E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	5.68E+01	pCi	3.28E-11	Risk/pCi soil	1.9E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	6.53E+01	pCi	1.01E-09	Risk/pCi soil	6.6E-08
	(Total)										1.1E-07

(1) M - Medium Specific N/A - Not Applicable

401092

TABLE 6-30
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current / Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area G	3.5E-06	2.5E-06	9.7E-07
Ingestion	Soil	Area G	3.2E-07	1.3E-07	1.9E-07
				Total Risk	1.2E-06

401093

TABLE 6.31
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area G
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	2.66E+00	pCi/g	2.66E+00	pCi/g	M	1.36E+01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.9E-10
	Uranium 238 + D	2.64E+00	pCi/g	2.64E+00	pCi/g	M	1.35E+01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	8.9E-07
	Radium 226 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	1.61E+01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.1E-04
	Thorium 230	2.18E+00	pCi/g	2.18E+00	pCi/g	M	1.12E+01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.9E-10
	Lead 210 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	1.61E+01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	2.3E-09
	(Total)										1.1E-04
Ingestion	Uranium 234	2.66E+00	pCi/g	2.66E+00	pCi/g	M	8.31E+02	pCi	4.44E-11	Risk/pCi soil	3.7E-08
	Uranium 238 + D	2.64E+00	pCi/g	2.64E+00	pCi/g	M	8.25E+02	pCi	6.20E-11	Risk/pCi soil	5.1E-08
	Radium 226 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	9.81E+02	pCi	2.96E-10	Risk/pCi soil	2.9E-07
	Thorium 230	2.18E+00	pCi/g	2.18E+00	pCi/g	M	6.81E+02	pCi	3.75E-11	Risk/pCi soil	2.6E-08
	Lead 210 + D	3.14E+00	pCi/g	3.14E+00	pCi/g	M	9.81E+02	pCi	1.01E-09	Risk/pCi soil	9.9E-07
	(Total)										1.4E-06

(1) M = Medium-Specific

401094

TABLE 6.32
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.23E+00	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	6.9E-11
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.20E+00	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.1E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.65E+00	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.1E-05
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.02E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.6E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.03E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	3.1E-05
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.29E+00	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.4E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.05E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	8.0E-11
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.65E+00	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	6.7E-10
	(Total)										7.9E-05
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.96E+02	pCi	4.44E-11	Risk/pCi soil	8.7E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.95E+02	pCi	6.20E-11	Risk/pCi soil	1.2E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.83E+02	pCi	2.96E-10	Risk/pCi soil	8.4E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	3.06E+02	pCi	2.48E-10	Risk/pCi soil	7.6E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	3.06E+02	pCi	2.31E-10	Risk/pCi soil	7.1E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.01E+02	pCi	3.75E-11	Risk/pCi soil	7.5E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.47E+02	pCi	3.28E-11	Risk/pCi soil	8.1E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.83E+02	pCi	1.01E-09	Risk/pCi soil	2.9E-07
	(Total)										5.5E-07

(1) M - Medium Specific N/A - Not Applicable

401095

TABLE 6.33
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/g	4.01E+00	pCi/g	M	2.50E+04	pCi-year/g	4.44E-11	Risk/yr per pCi/g water	1.1E-06
	Radium 228 + D	4.66E+00	pCi/g	4.66E+00	pCi/g	M	2.91E+04	pCi-year/g	2.48E-10	Risk/yr per pCi/g water	7.2E-06
	Thorium 230	1.71E+00	pCi/g	1.71E+00	pCi/g	M	1.07E+04	pCi-year/g	3.75E-11	Risk/yr per pCi/g water	4.0E-07
										Total Risk	8.7E-06

(1) M = Medium-Specific

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TABLE 6.34
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Groundwater
Exposure Medium: Background Groundwater
Exposure Point: Upper Glacial Aquifer-Tap Water
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/g	2.10E+00	pCi/g	M	1.31E+04	pCi-year/g	4.44E-11	Risk/yr per pCi/g water	5.8E-07
	Radium 228 + D	2.25E+00	pCi/g	2.25E+00	pCi/g	M	1.40E+04	pCi-year/g	2.48E-10	Risk/yr per pCi/g water	3.5E-06
	Thorium 230	6.33E-01	pCi/g	6.33E-01	pCi/g	M	3.96E+03	pCi-year/g	3.75E-11	Risk/yr per pCi/g water	1.5E-07
										Total Risk	4.2E-06

(1) M = Medium-Specific

401097

TABLE 6.35
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area G	1.1E-04	7.9E-05	3.0E-05
Ingestion	Soil	Area G	1.4E-06	5.5E-07	8.4E-07
	Groundwater	Upper Glacial Aquifer - Tap Water	8.7E-06	4.2E-06	4.5E-06
				Total Risk	3.6E-05

401098

TABLE 6-36
.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	5.41E+01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	1.2E-09
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	5.36E+01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	3.5E-06
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	8.79E+00	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	5.9E-05
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	1.91E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	6.3E-06
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	2.26E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.4E-05
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	7.80E+00	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	3.4E-10
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	1.71E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	3.4E-11
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	8.79E+00	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	1.3E-09
	(Total)										8.3E-05
Ingestion	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	3.00E+04	pCi	4.44E-11	Risk/pCi soil	1.3E-06
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	2.97E+04	pCi	6.20E-11	Risk/pCi soil	1.8E-06
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	4.87E+03	pCi	2.96E-10	Risk/pCi soil	1.4E-06
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	1.06E+03	pCi	2.48E-10	Risk/pCi soil	2.6E-07
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	1.25E+03	pCi	2.31E-10	Risk/pCi soil	2.9E-07
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	4.32E+03	pCi	3.75E-11	Risk/pCi soil	1.6E-07
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	9.49E+02	pCi	3.28E-11	Risk/pCi soil	3.1E-08
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	4.87E+03	pCi	1.01E-09	Risk/pCi soil	4.9E-06
	(Total)										1.0E-05

(1) M = Medium-Specific

401099

TABLE 6.37
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.27E-02	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	7.0E-13
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.24E-02	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.1E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.72E-02	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.2E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.08E-02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.7E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.10E-02	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	3.2E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.34E-02	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.5E-12
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.10E-02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	8.1E-13
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	4.72E-02	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	6.8E-12
	(Total)										8.0E-07
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.81E+01	pCi-year/g	4.44E-11	Risk/yr per pCi/g soil	8.0E-10
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.80E+01	pCi-year/g	6.20E-11	Risk/yr per pCi/g soil	1.1E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.61E+01	pCi-year/g	2.96E-10	Risk/yr per pCi/g soil	7.7E-09
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	2.82E+01	pCi-year/g	2.48E-10	Risk/yr per pCi/g soil	7.0E-09
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	2.82E+01	pCi-year/g	2.31E-10	Risk/yr per pCi/g soil	6.5E-09
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.85E+01	pCi-year/g	3.75E-11	Risk/yr per pCi/g soil	6.9E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.27E+01	pCi-year/g	3.28E-11	Risk/yr per pCi/g soil	7.5E-10
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	2.61E+01	pCi-year/g	1.01E-09	Risk/yr per pCi/g soil	2.6E-08
	(Total)										5.1E-08

(1) M - Medium-Specific N/A - Not Applicable

401100

TABLE 6-38

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Uranium 234	1.04E+03	pCi/g	1.39E+00	pCi/m³	R	1.54E+03	pCi	1.40E-08	Risk/pCi	2.2E-05
	Uranium 238 + D	1.03E+03	pCi/g	1.38E+00	pCi/m³	R	1.53E+03	pCi	1.24E-08	Risk/pCi	1.9E-05
	Radium 226 + D	1.69E+02	pCi/g	2.26E-01	pCi/m³	R	2.50E+02	pCi	2.75E-09	Risk/pCi	6.9E-07
	Radium 228 + D	3.68E+01	pCi/g	4.93E-02	pCi/m³	R	5.45E+01	pCi	9.94E-10	Risk/pCi	5.4E-08
	Thorium 228 + D	4.35E+01	pCi/g	5.83E-02	pCi/m³	R	6.44E+01	pCi	9.68E-08	Risk/pCi	6.2E-06
	Thorium 230	1.50E+02	pCi/g	2.01E-01	pCi/m³	R	2.22E+02	pCi	1.72E-08	Risk/pCi	3.8E-06
	Thorium 232	3.29E+01	pCi/g	4.41E-02	pCi/m³	R	4.87E+01	pCi	1.93E-08	Risk/pCi	9.4E-07
	Lead 210 + D	1.69E+02	pCi/g	2.26E-01	pCi/m³	R	2.50E+02	pCi	3.86E-09	Risk/pCi	9.7E-07
	(Total)									Total Risk All ROPC	5.3E-05

(1) See respirable particulates model in Attachment F

(2) R = Route-Specific

401101

TABLE 6.39
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Particulates
Exposure Point: N/A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Inhalation	Uranium 234	6.29E-01	pCi/g	8.42E-04	pCi/m³	R	9.30E-01	pCi	1.40E-08	Risk/pCi	1.3E-08
	Uranium 238 + D	6.24E-01	pCi/g	8.36E-04	pCi/m³	R	9.23E-01	pCi	1.24E-08	Risk/pCi	1.1E-08
	Radium 226 + D	9.07E-01	pCi/g	1.22E-03	pCi/m³	R	1.34E+00	pCi	2.75E-09	Risk/pCi	3.7E-09
	Radium 228 + D	9.78E-01	pCi/g	1.31E-03	pCi/m³	R	1.45E+00	pCi	9.94E-10	Risk/pCi	1.4E-09
	Thorium 228 + D	9.80E-01	pCi/g	1.31E-03	pCi/m³	R	1.45E+00	pCi	9.68E-08	Risk/pCi	1.4E-07
	Thorium 230	6.42E-01	pCi/g	8.60E-04	pCi/m³	R	9.49E-01	pCi	1.72E-08	Risk/pCi	1.6E-08
	Thorium 232	7.89E-01	pCi/g	1.06E-03	pCi/m³	R	1.17E+00	pCi	1.93E-08	Risk/pCi	2.3E-08
	Lead 210 + D	9.07E-01	pCi/g	1.22E-03	pCi/m³	R	1.34E+00	pCi	3.86E-09	Risk/pCi	5.2E-09
	(Total)										
										Total Risk All ROPC	2.1E-07

N/A = Not Applicable
(1) See respirable particulates model in Attachment I
(2) R = Route-Specific

401102

TABLE 6.40
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area G	8.3E-05	8.0E-07	8.2E-05
Ingestion	Soil	Area G	1.0E-05	5.1E-08	1.0E-05
Inhalation	Soil	Area G	5.3E-05	2.1E-07	5.3E-05
				Total Risk	1.5E-04

401103

TABLE 6.41
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	1.80E+04	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	3.9E-07
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	1.78E+04	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	1.2E-03
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	2.92E+03	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	2.0E-02
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	6.37E+02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	2.1E-03
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	7.53E+02	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	4.7E-03
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	2.59E+03	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	1.1E-07
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	5.70E+02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	1.1E-08
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	2.92E+03	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	4.2E-07
	(Total)										2.8E-02
Ingestion	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	1.09E+06	pCi	4.44E-11	Risk/pCi soil	4.9E-05
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	1.08E+06	pCi	6.20E-11	Risk/pCi soil	6.7E-05
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	1.77E+05	pCi	2.96E-10	Risk/pCi soil	5.3E-05
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	3.87E+04	pCi	2.48E-10	Risk/pCi soil	9.6E-06
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	4.57E+04	pCi	2.31E-10	Risk/pCi soil	1.1E-05
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	1.58E+05	pCi	3.75E-11	Risk/pCi soil	5.9E-06
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	3.46E+04	pCi	3.28E-11	Risk/pCi soil	1.1E-06
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	1.77E+05	pCi	1.01E-09	Risk/pCi soil	1.8E-04
	(Total)										1.7E-04

(1) M = Medium Specific

401104

TABLE 6-42
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	1.09E+01	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	2.3E-10
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	1.08E+01	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	7.1E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.57E+01	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	1.1E-04
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.69E+01	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	5.5E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.70E+01	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	1.1E-04
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	1.11E+01	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	4.9E-10
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	1.37E+01	pCi-year/g	1.92E-11	Risk/yr per pCi/g soil	2.7E-10
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	1.57E+01	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	2.3E-09
	(Total)										2.2E-04
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	6.60E+02	pCi	4.44E-11	Risk/pCi soil	2.9E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	6.55E+02	pCi	6.20E-11	Risk/pCi soil	4.1E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	9.52E+02	pCi	2.96E-10	Risk/pCi soil	2.8E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	1.03E+03	pCi	2.48E-10	Risk/pCi soil	2.5E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	1.03E+03	pCi	2.31E-10	Risk/pCi soil	2.4E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	6.74E+02	pCi	3.75E-11	Risk/pCi soil	2.5E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	8.29E+02	pCi	3.28E-11	Risk/pCi soil	2.7E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	9.52E+02	pCi	1.01E-09	Risk/pCi soil	9.6E-07
	(Total)										1.9E-06

(1) M = Medium Specific N/A = Not Applicable

401105

TABLE 6.43
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home-Grown Produce
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	6.49E+05	pCi	4.44E-11	Risk/pCi soil	2.9E-05
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	6.42E+05	pCi	6.20E-11	Risk/pCi soil	4.0E-05
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	1.05E+05	pCi	2.96E-10	Risk/pCi soil	3.1E-05
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	2.29E+04	pCi	2.48E-10	Risk/pCi soil	5.7E-06
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	2.71E+04	pCi	2.31E-10	Risk/pCi soil	6.3E-06
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	9.35E+04	pCi	3.75E-11	Risk/pCi soil	3.5E-06
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	2.05E+04	pCi	3.28E-11	Risk/pCi soil	6.7E-07
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	1.05E+05	pCi	1.01E-09	Risk/pCi soil	1.1E-04
	(Total)										2.2E-04

(1) M = Medium-Specific

401106

TABLE 6.44
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Home-Grown Produce
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.92E+02	pCi	4.44E-11	Risk/pCi soil	1.7E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.89E+02	pCi	6.20E-11	Risk/pCi soil	2.4E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.65E+02	pCi	2.96E-10	Risk/pCi soil	1.7E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	6.09E+02	pCi	2.48E-10	Risk/pCi soil	1.5E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	6.11E+02	pCi	2.31E-10	Risk/pCi soil	1.4E-07
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	4.00E+02	pCi	3.75E-11	Risk/pCi soil	1.5E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.92E+02	pCi	3.28E-11	Risk/pCi soil	1.6E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.65E+02	pCi	1.01E-09	Risk/pCi soil	5.7E-07
	(Total)										1.1E-06

(1) M = Medium Specific N/A = Not Applicable

401107

TABLE 6.45
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer - Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/l	4.01E+00	pCi/l	M	8.41E+04	pCi	4.44E-11	Risk/pCi water	3.7E-06
	Radium 228 + D	4.66E+00	pCi/l	4.66E+00	pCi/l	M	9.78E+04	pCi	2.48E-10	Risk/pCi water	2.4E-05
	Thorium 230	1.71E+00	pCi/l	1.71E+00	pCi/l	M	3.58E+04	pCi	3.75E-11	Risk/pCi water	1.3E-06
										Total Risk	2.9E-05

(1) M = Medium-Specific

401108

TABLE 6.46
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Groundwater
Exposure Medium: Background Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident Adult
Receptor Age: Adult

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/l	2.10E+00	pCi/l	M	4.41E+04	pCi	4.44E-11	Risk/pCi water	2.0E-06
	Radium 228 + D	2.25E+00	pCi/l	2.25E+00	pCi/l	M	4.72E+04	pCi	2.48E-10	Risk/pCi water	1.2E-05
	Thorium 230	6.33E-01	pCi/l	6.33E-01	pCi/l	M	1.33E+04	pCi	3.75E-11	Risk/pCi water	5.0E-07
										Total Risk	1.4E-05

(1) M = Medium-Specific

TABLE 6.47
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area G	2.8E-02	2.7E-04	2.7E-02
Ingestion	Soil	Area G	3.7E-04	1.9E-06	3.7E-04
	Home-grown Produce	Area G	2.2E-04	1.1E-06	2.2E-04
	Groundwater	Upper Glacial Aquifer - Tap Water	2.9E-05	1.4E-05	1.5E-05
Inhalation	Radon Decay Products*	Area G	7.8E-02	4.2E-04	7.7E-02
				Total Risk	1.1E-01

* It is not possible to use RAGS methodology to quantify the risk from radon decay products in the absence of radon and radon decay product data. Therefore, the radon inhalation pathway risk calculated with RESRAD is included here.

401109

TABLE 6.48
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
External	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	3.50E+03	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	7.5E-08
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	3.46E+03	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	2.3E-04
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	5.67E+02	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	3.8E-03
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	1.24E+02	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	4.1E-04
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	1.46E+02	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	9.1E-04
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	5.04E+02	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	2.2E-08
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	1.11E+02	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	2.2E-09
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	5.67E+02	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	8.2E-08
	(Total)										5.4E-03
Ingestion	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	4.37E+05	pCi	4.44E-11	Risk/pCi soil	1.9E-05
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	4.33E+05	pCi	6.20E-11	Risk/pCi soil	2.7E-05
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	7.10E+04	pCi	2.96E-10	Risk/pCi soil	2.1E-07
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	1.55E+04	pCi	2.48E-10	Risk/pCi soil	[illegible]
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	1.83E+04	pCi	2.31E-10	Risk/pCi soil	4.2E-06
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	6.30E+04	pCi	3.25E-11	Risk/pCi soil	2.1E-06
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	1.38E+04	pCi	3.28E-11	Risk/pCi soil	4.5E-02
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	7.10E+04	pCi	1.01E-09	Risk/pCi soil	7.2E-05
	(Total)										1.5E-04

(1) M = Medium Specific

401110

401114

TABLE 6.49
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
External	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	2.11E+00	pCi-year/g	2.14E-11	Risk/yr per pCi/g soil	4.5E-11
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	2.09E+00	pCi-year/g	6.57E-08	Risk/yr per pCi/g soil	1.4E-07
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.05E+00	pCi-year/g	6.74E-06	Risk/yr per pCi/g soil	2.1E-05
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	3.28E+00	pCi-year/g	3.28E-06	Risk/yr per pCi/g soil	1.1E-05
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	3.29E+00	pCi-year/g	6.20E-06	Risk/yr per pCi/g soil	2.0E-05
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.15E+00	pCi-year/g	4.40E-11	Risk/yr per pCi/g soil	9.5E-11
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	2.65E+00	pCi-year/g	1.97E-11	Risk/yr per pCi/g soil	5.2E-11
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.05E+00	pCi-year/g	1.45E-10	Risk/yr per pCi/g soil	4.4E-10
	(Total)										5.2E-05
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	2.64E+02	pCi	4.44E-11	Risk/pCi soil	1.2E-08
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	2.62E+02	pCi	6.20E-11	Risk/pCi soil	1.6E-08
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.81E+02	pCi	2.96E-10	Risk/pCi soil	1.1E-07
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	4.11E+02	pCi	2.48E-10	Risk/pCi soil	1.0E-07
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	4.12E+02	pCi	2.31E-10	Risk/pCi soil	9.5E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	2.69E+02	pCi	3.75E-11	Risk/pCi soil	1.0E-08
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	3.32E+02	pCi	3.28E-11	Risk/pCi soil	1.1E-08
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	3.81E+02	pCi	1.01E-09	Risk/pCi soil	3.8E-07
	(Total)										7.4E-07

(1) M - Medium-Specific N/A - Not Applicable

401112

TABLE 6.50
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Home-Grown Produce
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	1.04E+03	pCi/g	1.04E+03	pCi/g	M	5.88E+04	pCi	4.44E-11	Risk/pCi soil	2.6E-06
	Uranium 238 + D	1.03E+03	pCi/g	1.03E+03	pCi/g	M	5.82E+04	pCi	6.20E-11	Risk/pCi soil	3.6E-06
	Radium 226 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	9.55E+03	pCi	2.96E-10	Risk/pCi soil	2.8E-06
	Radium 228 + D	3.68E+01	pCi/g	3.68E+01	pCi/g	M	2.08E+03	pCi	2.48E-10	Risk/pCi soil	5.2E-07
	Thorium 228 + D	4.35E+01	pCi/g	4.35E+01	pCi/g	M	2.46E+03	pCi	2.31E-10	Risk/pCi soil	5.7E-07
	Thorium 230	1.50E+02	pCi/g	1.50E+02	pCi/g	M	8.47E+03	pCi	3.75E-11	Risk/pCi soil	3.2E-07
	Thorium 232	3.29E+01	pCi/g	3.29E+01	pCi/g	M	1.86E+03	pCi	3.28E-11	Risk/pCi soil	6.1E-08
	Lead 210 + D	1.69E+02	pCi/g	1.69E+02	pCi/g	M	9.55E+03	pCi	1.01E-09	Risk/pCi soil	9.6E-06
	(Total)										2.0E-05

(1) M = Medium-Specific

TABLE 6.51
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Home Grown Produce
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	6.29E-01	pCi/g	6.29E-01	pCi/g	M	3.55E+01	pCi	4.44E-11	Risk/pCi soil	1.6E-09
	Uranium 238 + D	6.24E-01	pCi/g	6.24E-01	pCi/g	M	3.52E+01	pCi	6.20E-11	Risk/pCi soil	2.2E-09
	Radium 226 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.12E+01	pCi	2.96E-10	Risk/pCi soil	1.5E-08
	Radium 228 + D	9.78E-01	pCi/g	9.78E-01	pCi/g	M	5.52E+01	pCi	2.48E-10	Risk/pCi soil	1.4E-08
	Thorium 228 + D	9.80E-01	pCi/g	9.80E-01	pCi/g	M	5.54E+01	pCi	2.31E-10	Risk/pCi soil	1.3E-08
	Thorium 230	6.42E-01	pCi/g	6.42E-01	pCi/g	M	3.62E+01	pCi	3.75E-11	Risk/pCi soil	1.4E-09
	Thorium 232	7.89E-01	pCi/g	7.89E-01	pCi/g	M	4.46E+01	pCi	3.28E-11	Risk/pCi soil	1.5E-09
	Lead 210 + D	9.07E-01	pCi/g	9.07E-01	pCi/g	M	5.12E+01	pCi	1.01E-09	Risk/pCi soil	5.2E-08
	(Total)										1.0E-07

(1) M - Medium-Specific N/A - Not Applicable

401113

401114

TABLE 6.52
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Uranium 234	4.01E+00	pCi/l	4.01E+00	pCi/l	M	8.41E+03	pCi	4.44E-11	Risk/pCi water	3.7E-07
	Radium 228 + D	4.66E+00	pCi/l	4.66E+00	pCi/l	M	9.78E+03	pCi	2.48E-10	Risk/pCi water	2.4E-06
	Thorium 230	1.71E+00	pCi/l	1.71E+00	pCi/l	M	3.58E+03	pCi	3.75E-11	Risk/pCi water	1.3E-07
										Total Risk	2.9E-06

(1) M = Medium-Specific

401115

TABLE 6.53
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer- Tap Water
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Radionuclide of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Exposure	Exposure Units	Cancer Slope Factor	Cancer Slope Factor Units	Background Cancer Risk
Ingestion	Uranium 234	2.10E+00	pCi/l	2.10E+00	pCi/l	M	4.41E+03	pCi	4.44E-11	Risk/pCi water	2.0E-07
	Radium 228 + D	2.25E+00	pCi/l	2.25E+00	pCi/l	M	4.72E+03	pCi	2.48E-10	Risk/pCi water	1.2E-06
	Thorium 230	6.33E-01	pCi/l	6.33E-01	pCi/l	M	1.33E+03	pCi	3.75E-11	Risk/pCi water	5.0E-08
										Total Risk	1.4E-06

(1) M = Medium-Specific

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TABLE 6.54
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Exposure Medium	Exposure Point	Gross Risk	Background Risk	Net Risk
External	Soil	Area G	5.4E-03	5.2E-05	5.3E-03
Ingestion	Soil	Area G	1.5E-04	7.4E-07	1.5E-04
	Home-grown Produce	Area G	2.0E-05	1.0E-07	2.0E-05
	Groundwater	Upper Glacial Aquifer - Tap Water	2.9E-06	1.4E-06	1.5E-06
Inhalation	Radon Decay Products*	Area G	1.9E-02	1.0E-04	1.9E-02
				Total Risk	2.4E-02

* It is not possible to use RAGS methodology to quantify the risk from radon decay products in the absence of radon and radon decay product data. Therefore, the radon inhalation pathway risk calculated with RESRAD is included here.

ATTACHMENT H

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ATTACHMENT H

ATTACHMENT H
CHEMICAL RISK ASSESSMENT TABLES AND TOXICITY PROFILES

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

CAPTAIN'S COVE

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Surface Soil	Surface Soil	Area A and Area G	Trespasser	Adolescent	Ingestion	On-Site	Quant	Contaminated soil may be encountered by trespassers while on-site
						Dermal	On-Site	Quant	Contaminated soil may be encountered by trespassers while on-site
						Inhalation	On-Site	None	There are no volatile COPC in soil
				Site Worker	Adult	Ingestion	On-Site	Quant	Contaminated soil may be encountered by site workers while on-site
						Dermal	On-Site	Quant	Contaminated soil may be encountered by site workers while on-site
						Inhalation	On-Site	None	There are no volatile COPC in soil
			Area A	Visitor	Adult	Inhalation	On-Site	None	Exposure would be infrequent
	All Soil	All Soil	Area A and Area G	Construction Worker	Adult	Ingestion	On-Site	Quant	Contaminated soil may be encountered by construction workers during construction activities
						Dermal	On-Site	Quant	Contaminated soil may be encountered by construction workers during construction activities
						Inhalation	On-Site	None	There are no volatile COPC in soil
				Resident	Adult	Ingestion	On-Site	Quant	Residential development is possible
						Dermal	On-Site	Quant	Residential development is possible
						Inhalation	On-Site	None	There are no volatile COPC in soil
					Child	Ingestion	On-Site	Quant	Residential development is possible
						Dermal	On-Site	Quant	Residential development is possible
						Inhalation	On-Site	None	There are no volatile COPC in soil
		Particulates	Area and Area G	Construction Worker	Adult	Inhalation	On-Site	Quant	Contaminated particles may become airborne during excavation activities
				Trespasser	Adolescent	Inhalation	On-Site	None	Vegetation and pavement or buildings would hinder the resuspension of contaminated respirable particulates
				Site Worker	Adult	Inhalation	On-Site	None	Vegetation and pavement or buildings would hinder the resuspension of contaminated respirable particulates
				Resident	Adult	Inhalation	Off-Site	None	Vegetation and pavement or buildings would hinder the resuspension of contaminated respirable particulates
					Child	Inhalation	Off-Site	None	Vegetation and pavement or buildings would hinder the resuspension of contaminated respirable particulates
	Surface Water	Surface Water	Retention Ponds and low area	Trespasser	Adolescent	Dermal	On-Site	Quant	Contaminated surface water may be encountered by trespassers while on-site
	Sediment	Sediment	Retention Ponds	Trespasser	Adolescent	Ingestion	On-Site	Quant	Contaminated sediment may be encountered by trespassers while on-site
						Dermal	On-Site	Quant	Contaminated sediment may be encountered by trespassers while on-site
	Groundwater	Groundwater	Underlying the Site	Site Worker	Adult	Ingestion	On-Site	Quant	Potable use of the groundwater is possible
						Dermal	On-Site	Quant	Potable use of the groundwater is possible
				Resident	Adult	Ingestion	On-Site	Quant	Potable use of the groundwater is possible
						Dermal	On-Site	Quant	Potable use of the groundwater is possible
						Inhalation	On-Site	Quant	Potable use of the groundwater is possible
					Child	Ingestion	On-Site	Quant	Potable use of the groundwater is possible
						Dermal	On-Site	Quant	Potable use of the groundwater is possible
						Inhalation	On-Site	Quant	Potable use of the groundwater is possible

401120

TA[illegible]
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
7439-92-1	Lead	95.1		512		mg/kg	CC-SB-21-0-2	3/3	0.65-0.79	512	(2)	-- --	400	SSL	YES	NTX, ABKG
7439-95-4	Magnesium	1160		2480		mg/kg	CC-SB-19-0-2	3/3	1076-1314	2480	(2)	-- --	N/A	N/A	NO	NUT
7439-96-5	Manganese	194		1850		mg/kg	CC-SB-19-0-2	3/3	3.23-3.94	1850	(2)	1.6E+03 N	N/A	N/A	NO	BBKG
7439-97-6	Mercury	0.06	J	0.14		mg/kg	CC-SB-19-0-2	3/3	0.11-0.13	0.14	(2)	-- --	2	SSL	NO	BCTS
7440-02-0	Nickel	6.2	J	36.7		mg/kg	CC-SB-21-0-2	3/3	8.61-10.5	36.7	(2)	1.6E+03 N	130	SSL	NO	BCTS, BSL
7440-09-7	Potassium	631	J	805	J	mg/kg	CC-SB-19-0-2	3/3	1076-1314	805	(2)	-- --	N/A	N/A	NO	NUT
7782-49-2	Selenium	3.8		5.4		mg/kg	CC-SB-19-0-2	2/3	1.08-1.31	5.4	(2)	3.9E+02 N	5	SSL	NO	BCTS, BSL
7440-22-4	Silver	0.28	J	11.3		mg/kg	CC-SB-19-0-2	3/3	2.15-2.63	11.3	(2)	3.9E+02 N	34	SSL	NO	BCTS
7440-23-5	Sodium	49.3	J	688	J	mg/kg	CC-SB-21-0-2	3/3	1076-1314	688	(2)	-- --	N/A	N/A	NO	NUT
7440-28-0	Thallium	1.6	J	2.6	J	mg/kg	CC-SB-21-0-2	2/3	2.15-2.63	2.6	(2)	5.5E+00 N	0.7	SSL	NO	BBKG
7440-62-2	Vanadium	12.3		23.2		mg/kg	CC-SB-19-0-2	3/3	10.8-13.1	23.2	(2)	5.5E+02 N	6000	SSL	NO	BCTS, BSL
7440-66-6	Zinc	79.8		714		mg/kg	CC-SB-21-0-2	3/3	4.31-5.26	714	(2)	2.3E+04 N	12000	SSL	NO	BCTS, BSL

(1) Minimum/maximum detected concentration.
(2) Background values from LT-MP-5, LT-MP-5B, LT-MP-11D, LT-MP-11DB, LT-SB-13, LT-SB-13B, LT-TP-06. See Appendix A.
(3) U.S. EPA Region III, 1998d, Risk-Based Concentration Table, Soil Residential RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Deletion Reason:
Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

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TABLE
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	(3) Screening Toxicity Value		Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
319-84-6	alpha-BHC	0.0044		0.0044		mg/kg	CC-SB-13-4-6	1/19	0.0018-0.097	0.0044	N/A	1.0E-01	C	0.0005	SSL	NO	BCTS, BSL
319-85-7	beta-BHC	0.0084		0.015		mg/kg	CC-SB-27-0-2	2/19	0.0018-0.097	0.015	N/A	3.5E-01	C	0.003	SSL	NO	BCTS, BSL
319-85-7	delta-BHC	0.0075		0.017		mg/kg	CC-SB-27-0-2	3/19	0.0018-0.097	0.017	N/A	3.5E-01	C	N/A	N/A	NO	BCTS, BSL
57-74-9	Chlordane (total)	0.0033		0.43		mg/kg	CC-TP-2-4-5	11/19	0.0018-0.097	0.43	N/A	1.8E+00	C	10	SSL	NO	BCTS, BSL
72-54-8	4,4'-DDD	0.0047	EN	0.18		mg/kg	CC-TP-2-4-5	8/19	0.0035-0.19	0.18	N/A	2.7E+00	C	16	SSL	NO	BCTS, BSL
72-55-9	4,4'-DDE	0.002	J	0.12	E	mg/kg	CC-TP-2-4-5	11/19	0.0035-0.19	0.12	N/A	1.9E+00	C	54	SSL	NO	BCTS, BSL
50-29-3	4,4'-DDT	0.0066	EN	0.1	E	mg/kg	CC-SB-MW8-2-4	7/19	0.0035-0.19	0.1	N/A	1.9E+00	C	32	SSL	NO	BCTS, BSL
60-57-1	Dieldrin	0.0049	EN	0.0049	EN	mg/kg	CC-SB-20-4-6	1/19	0.0035-0.19	0.0049	N/A	4.0E-02	C	0.004	SSL	NO	BCTS, BSL
115-29-7	Endosulfan I	0.013	EN	0.1	EN	mg/kg	CC-SB-21-0-2	2/19	0.0018-0.097	0.1	N/A	4.7E+02	N	18	SSL	NO	BCTS, BSL
7421-93-4	Endrin aldehyde	0.0084	E	0.0084	E	mg/kg	CC-TP-3-5-6	1/19	0.0035-0.19	0.0084	N/A	--	--	N/A	N/A	YES	NTX
76-44-8	Heptachlor	0.0041	J	0.0041	J	mg/kg	CC-TP-4-5-6	1/19	0.0018-0.097	0.0041	N/A	1.4E-01	C	23	SSL	NO	BCTS, BSL
1024-57-3	Heptachlor epoxide	0.0022	J	0.034	E	mg/kg	CC-TP-2-4-5	5/19	0.0018-0.097	0.034	N/A	7.0E-02	C	0.7	SSL	NO	BCTS, BSL
12672-29-6	PCBs (total)	0.021	J	5.5		mg/kg	CC-SB-21-0-2	10/19	0.035-1.88	5.5	N/A	3.2E-01	C	1	SSL	YES	ACTS, ASL
7429-90-5	Aluminum	839		19700		mg/kg	CC-SB-14-2-4	19/19	42.9-63.6	19700	(2)	7.8E+04	N	N/A	N/A	NO	BCTS, BSL
7440-36-0	Antimony	1.9	J	1160	E	mg/kg	CC-SB-14-2-4	17/19	12.9-19.1	1160	(2)	3.1E+01	N	5	SSL	YES	ACTS, ASL
7440-38-2	Arsenic	3		2760		mg/kg	CC-TP-1-7-8	19/19	2.15-3.18	2760	(2)	4.3E-01	C	29	SSL	YES	ACTS, ASL
7440-39-3	Barium	6.5	J	1200		mg/kg	CC-SB-14-2-4	19/19	42.9-63.6	1200	(2)	5.5E+03	N	1600	SSL	YES	ACTS
7440-41-7	Beryllium	0.18	J	6.8		mg/kg	CC-SB-14-2-4	18/19	1.07-1.59	6.8	(2)	1.6E+02	N	63	SSL	NO	BCTS, BSL

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OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
TUNGSTEN CAPTAINS COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)		Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
83-32-9	Acenaphthene	0.052	J	0.36	J	mg/kg	CC-SB-18-4-6	4/19	0.354-4.65	0.36	N/A	4.7E+03	N	570	SSL	NO	BCTS, BSL
120-12-7	Anthracene	0.065	J	0.7	J	mg/kg	CC-SB-18-4-6	5/19	0.354-4.65	0.7	N/A	2.3E+04	N	12000	SSL	NO	BCTS, BSL
56-55-3	Benzo(a)Anthracene	0.055	J	2.7		mg/kg	CC-SB-18-4-6	11/19	0.354-4.65	2.7	N/A	8.7E-01	C	2	SSL	YES	ASL
205-99-2	Benzo(b)Fluoranthene	0.074	J	5.6		mg/kg	CC-SB-18-4-6	12/19	0.354-4.65	5.6	N/A	8.7E-01	C	5	SSL	YES	ASL
207-08-9	Benzo(k)Fluoranthene	0.11	J	0.21	J	mg/kg	CC-SB-12-4-6	3/19	0.354-4.65	0.21	N/A	8.7E+00	C	49	SSL	NO	BCTS, BSL
50-32-8	Benzo(a)Pyrene	0.051	J	3.2		mg/kg	CC-SB-18-4-6	10/19	0.354-4.65	3.2	N/A	8.7E-02	C	8	SSL	YES	ACTS, ASL
191-24-2	Benzo(g,h,i)Perylene	0.069	J	1.6		mg/kg	CC-SB-18-4-6	8/19	0.354-4.65	1.6	N/A	--	--	N/A	N/A	YES	NTX
86-74-8	Carbazole	0.063		0.48	J	mg/kg	CC-SB-18-4-6	4/19	0.354-4.65	0.48	N/A	3.2E+01	C	0.6	SSL	NO	BCTS, BSL
218-01-9	Chrysene	0.055	J	1.9		mg/kg	CC-SB-18-4-6	10/19	0.354-4.65	1.9	N/A	8.7E+01	C	160	SSL	NO	BCTS, BSL
53-70-3	Dibenz(a,h)Anthracene	0.054	J	0.31	J	mg/kg	CC-SB-18-4-6	2/19	0.354-4.65	0.31	N/A	8.7E-02	C	2	SSL	YES	ASL
132-64-9	Dibenzofuran	0.046	J	0.13	J	mg/kg	CC-SB-18-4-6	2/19	0.354-4.65	0.13	N/A	3.1E+02	N	N/A	N/A	NO	BCTS, BSL
206-44-0	Fluoranthene	0.084	J	5.8		mg/kg	CC-SB-18-4-6	12/19	0.354-4.65	5.8	N/A	3.1E+03	N	4300	SSL	NO	BCTS, BSL
86-73-7	Fluorene	0.043	J	0.25	J	mg/kg	CC-SB-18-4-6	5/19	0.354-4.65	0.25	N/A	3.1E+03	N	560	SSL	NO	BCTS, BSL
193-39-5	Indeno(1,2,3-cd)Pyrene	0.064	J	1.5		mg/kg	CC-SB-18-4-6	7/19	0.354-4.65	1.5	N/A	8.7E-01	C	14	SSL	YES	ASL
91-20-3	Naphthalene	0.041	J	0.041	J	mg/kg	CC-SB-13-4-6	1/19	0.354-4.65	0.041	N/A	1.6E+03	N	84	SSL	NO	BCTS, BSL
85-01-8	Phenanthrene	0.053	J	3		mg/kg	CC-SB-18-4-6	11/19	0.354-4.65	3	N/A	--	--	N/A	N/A	YES	NTX
129-00-0	Pyrene	0.087	J	4.5		mg/kg	CC-SB-18-4-6	13/19	0.354-4.65	4.5	N/A	2.3E+03	N	4200	SSL	NO	BCTS, BSL

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OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
16065-83-1	Chromium	5.7	E	91.2		mg/kg	CC-TP-3-5-6	19/19	2.15-3.18	91.2	(2)	1.2E+05 N	38	SSL	NO	BCTS, BSL
7440-48-4	Cobalt	2.1	J	379	E	mg/kg	CC-TP-4-5-6	19/19	10.7-15.9	379	(2)	4.7E+03 N	N/A	N/A	YES	ACTS
7440-50-8	Copper	16.5		11300		mg/kg	CC-TP-1-7-8	19/19	5.36-7.95	11300	(2)	3.1E+03 N	N/A	N/A	YES	ACTS, ASL
7439-89-6	Iron	5850		203000		mg/kg	CC-SB-14-2-4	19/19	21.5-31.8	203000	(2)	2.3E+04 N	N/A	N/A	YES	ACTS, ASL
7439-92-1	Lead	57.5		29500		mg/kg	CC-TP-1-7-8	19/19	0.64-0.95	29500	(2)	-- --	400	SSL	YES	NTX, ABKG
7439-95-4	Magnesium	248	J	39100		mg/kg	CC-TP-4-5-6	19/19	1073-1590	39100	(2)	-- --	N/A	N/A	NO	NUT
7439-96-5	Manganese	115		30900		mg/kg	CC-TP-6-5-6	19/19	3.22-4.77	30900	(2)	1.6E+03 N	N/A	N/A	YES	ACTS, ASL
7439-97-6	Mercury	0.04	J	2.4		mg/kg	CC-SB-18-4-6	19/19	0.11-0.16	2.4	(2)	-- --	2	SSL	NO	BCTS
7440-02-0	Nickel	2.2	J	145		mg/kg	CC-TP-1-7-8	19/19	8.58-12.7	145	(2)	1.6E+03 N	130	SSL	NO	BCTS, BSL
7440-09-7	Potassium	105	J	2500		mg/kg	CC-TP-2-4-5	19/19	1073-1590	2500	(2)	-- --	N/A	N/A	NO	NUT
7782-49-2	Selenium	1.3		72		mg/kg	CC-TP-1-7-8	18/19	1.07-1.59	72	(2)	3.9E+02 N	5	SSL	NO	BCTS, BSL
7440-22-4	Silver	0.28	J	245		mg/kg	CC-TP-1-7-8	19/19	2.15-3.18	245	(2)	3.9E+02 N	34	SSL	NO	BCTS
7440-23-5	Sodium	28.8	J	14100		mg/kg	CC-SB-14-2-4	19/19	1073-1590	14100	(2)	-- --	N/A	N/A	NO	NUT
7440-28-0	Thallium	1.6	J	2.6	J	mg/kg	CC-SB-21-0-2	3/18	2.15-3.18	2.6	(2)	5.5E+00 N	0.7	SSL	NO	BCTS, BSL
7440-62-2	Vanadium	7.4	J	41.7		mg/kg	CC-SB-14-2-4	19/19	10.7-15.9	41.7	(2)	5.5E+02 N	6000	SSL	NO	BCTS, BSL
7440-66-6	Zinc	27.7		17300		mg/kg	CC-SB-14-2-4	19/19	4.29-6.36	17300	(2)	2.3E+04 N	12000	SSL	NO	BCTS, BSL
57-12-5	Cyanide	0.61	J	0.79		mg/kg	CC-TP-1-7-8	2/19	0.54-0.8	0.79	(2)	1.6E+03 N	40	SSL	NO	BCTS, BSL

(1) Minimum/maximum detected concentration.
(2) Background values from LT-MP-5, LT-MP-5B, LT-MP-11D, LT-MP-11DB, LT-SB-13, LT-SB-13B, LT-TP-06. See Appendix A.
(3) U.S. EPA Region III, 1998d, Risk-Based Concentration Table, Soil Residential RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

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OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	(3) Screening Toxicity Value		Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
78-93-3	2-Butanone	0.012		0.012		mg/kg	CC-TP-5-6-7	1/10	0.011-0.013	0.012	N/A	4.7E+04	N	N/A	N/A	NO	BCTS, BSL
1330-20-7	Xylenes (total)	0.018		0.018		mg/kg	CC-TP-6-5-6	1/10	0.011-0.013	0.018	N/A	1.6E+05	N	190	SSL	NO	BCTS, BSL
83-32-9	Acenaphthene	0.47		4.1		mg/kg	CC-SB-22-2-4	3/10	0.356-4.41	4.1	N/A	4.7E+03	N	570	SSL	NO	BCTS, BSL
208-96-8	Acenaphthylene	0.077	J	0.077	J	mg/kg	CC-SB-22-2-4	1/10	0.356-4.41	0.077	N/A	--	--	N/A	N/A	YES	NTX
120-12-7	Anthracene	0.85		4.6		mg/kg	CC-SB-22-2-4	3/10	0.356-4.41	4.6	N/A	2.3E+04	N	12000	SSL	NO	BCTS, BSL
56-55-3	Benzo(a)Anthracene	0.054	J	4		mg/kg	CC-SB-22-2-4	6/10	0.356-4.41	4	N/A	8.7E-01	C	2	SSL	YES	ACTS, ASL
205-99-2	Benzo(b)Fluoranthene	0.19	J	3.7		mg/kg	CC-SB-22-2-4	6/10	0.356-4.41	3.7	N/A	8.7E-01	C	5	SSL	YES	ASL
207-08-9	Benzo(k)Fluoranthene	0.064	J	0.57	J	mg/kg	CC-SB-22-2-4	2/10	0.356-4.41	0.57	N/A	8.7E+00	C	49	SSL	NO	BCTS, BSL
50-32-8	Benzo(a)Pyrene	0.1	J	1.6		mg/kg	CC-SB-22-2-4	6/10	0.356-4.41	1.6	N/A	8.7E-02	C	8	SSL	YES	ACTS, ASL
191-24-2	Benzo(g,h,i)Perylene	0.077	J	0.45	J	mg/kg	CC-SB-22-2-4	5/10	0.356-4.41	0.45	N/A	--	--	N/A	N/A	YES	NTX
86-74-8	Carbazole	0.14	J	2.7		mg/kg	CC-SB-22-2-4	3/10	0.356-4.41	2.7	N/A	3.2E+01	C	0.6	SSL	NO	BCTS, BSL
218-01-9	Chrysene	0.1	J	3.1		mg/kg	CC-SB-22-2-4	6/10	0.356-4.41	3.1	N/A	8.7E+01	C	160	SSL	NO	BCTS, BSL
132-64-9	Dibenzofuran	0.23	J	2.5		mg/kg	CC-SB-04-2-4	3/10	0.356-4.41	2.5	N/A	3.1E+02	N	N/A	N/A	NO	BCTS, BSL
84-74-2	Di-n-butylphthalate	0.045	J	0.098	J	mg/kg	CC-SB-23-4-6	3/10	0.356-4.41	0.098	N/A	7.8E+03	N	2300	SSL	NO	BCTS, BSL
105-67-9	2,4-Dimethylphenol	0.12	J	0.12	J	mg/kg	CC-SB-04-2-4	1/10	0.356-4.41	0.12	N/A	1.6E+03	N	9	SSL	NO	BCTS, BSL
206-44-0	Fluoranthene	0.13	J	8.6		mg/kg	CC-SB-22-2-4	7/10	0.356-4.41	8.6	N/A	3.1E+03	N	4300	SSL	NO	BCTS, BSL
86-73-7	Fluorene	0.39		3.7		mg/kg	CC-SB-22-2-4	3/10	0.356-4.41	3.7	N/A	3.1E+03	N	560	SSL	NO	BCTS, BSL
193-39-5	Indeno(1,2,3-cd)Pyrene	0.085	J	0.49	J	mg/kg	CC-SB-22-2-4	5/10	0.356-4.41	0.49	N/A	8.7E-01	C	14	SSL	NO	BCTS, BSL
91-57-6	2-Methylnaphthalene	0.15	J	3.2		mg/kg	CC-SB-04-2-4	4/10	0.356-4.41	3.2	N/A	1.6E+03	N	N/A	N/A	NO	BCTS, BSL
106-44-5	4-Methylphenol	0.13	J	0.13	J	mg/kg	CC-SB-04-2-4	1/10	0.356-4.41	0.13	N/A	3.9E+02	N	N/A	N/A	NO	BCTS, BSL
91-20-3	Naphthalene	0.18	J	6.1		mg/kg	CC-SB-04-2-4	3/10	0.356-4.41	6.1	N/A	1.6E+03	N	84	SSL	NO	BCTS, BSL
86-30-6	N-nitrosodiphenylamine	0.14	J	0.14	J	mg/kg	CC-SB-04-2-4	1/10	0.356-4.41	0.14	N/A	1.3E+02	C	1	SSL	NO	BCTS, BSL
85-01-8	Phenanthrene	0.088	J	8.6		mg/kg	CC-SB-22-2-4	7/10	0.356-4.41	8.6	N/A	--	--	N/A	N/A	YES	NTX
108-95-2	Phenol	0.2	J	0.2	J	mg/kg	CC-SB-24-6-8	1/10	0.356-4.41	0.2	N/A	4.7E+04	N	100	SSL	NO	BCTS, BSL
129-00-0	Pyrene	0.04	J	9.5		mg/kg	CC-SB-22-2-4	8/10	0.356-4.41	9.5	N/A	2.3E+03	N	4200	SSL	NO	BCTS, BSL

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OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LT TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
7440-48-4	Cobalt	6.6	J	172		mg/kg	CC-SB-24-6-8	10/10	10.8-13.4	172	(2)	4.7E+03 N	N/A	N/A	NO	BCTS, BSL
7440-50-8	Copper	17.6		1850		mg/kg	CC-SB-26-6-8	10/10	5.39-6.68	1850	(2)	3.1E+03 N	N/A	N/A	NO	BCTS, BSL
7439-89-6	Iron	10500		132000		mg/kg	CC-SB-23-4-6	10/10	21.6-26.7	132000	(2)	2.3E+04 N	N/A	N/A	YES	ACTS, ASL
7439-92-1	Lead	21.9		3000		mg/kg	CC-SB-24-6-8	10/10	0.65-0.8	3000	(2)	-- --	400	SSL	YES	NTX, ABKG
7439-95-4	Magnesium	887	J	2990		mg/kg	CC-SB-04-2-4	10/10	1079-1335	2990	(2)	-- --	N/A	N/A	NO	NUT
7439-96-5	Manganese	269		215000		mg/kg	CC-SB-24-6-8	10/10	3.24-4	215000	(2)	1.6E+03 N	N/A	N/A	YES	ACTS, ASL
7439-97-6	Mercury	0.02	J	4.1		mg/kg	CC-TP-6-5-6	10/10	0.11-0.13	4.1	(2)	-- --	2	SSL	NO	BCTS
7440-02-0	Nickel	10		82.2		mg/kg	CC-SB-22-2-4	10/10	8.63-10.7	82.2	(2)	1.6E+03 N	130	SSL	NO	BCTS, BSL
7440-09-7	Potassium	339	J	1310		mg/kg	CC-SB-04-2-4	10/10	1079-1335	1310	(2)	-- --	N/A	N/A	NO	NUT
7782-49-2	Selenium	0.69	J	133		mg/kg	CC-SB-24-6-8	8/10	1.08-1.34	133	(2)	3.9E+02 N	5	SSL	NO	BCTS, BSL
7440-22-4	Silver	0.26	J	72.2		mg/kg	CC-TP-6-5-6	10/10	2.15-2.67	72.2	(2)	3.9E+02 N	34	SSL	NO	BCTS, BSL
7440-23-5	Sodium	30	J	9150		mg/kg	CC-SB-26-6-8	10/10	1079-1335	9150	(2)	-- --	N/A	N/A	NO	NUT
7440-28-0	Thallium	3.9		3.9		mg/kg	CC-SB-04-2-4	1/8	2.16-2.67	3.9	(2)	5.5E+00 N	0.7	SSL	NO	BCTS, BSL
7440-62-2	Vanadium	13.3	J	31.6		mg/kg	CC-SB-23-4-6	10/10	10.8-13.4	31.6	(2)	5.5E+02 N	6000	SSL	NO	BCTS, BSL, BBKG
7440-66-6	Zinc	33.8		1780		mg/kg	CC-SB-26-6-8	10/10	4.32-5.34	1780	(2)	2.3E+04 N	12000	SSL	NO	BCTS, BSL

(1) Minimum/maximum detected concentration.

(2) Background values from LT-MP-5, LT-MP-5B, LT-MP-11D, LT-MP-11DB, LT-SB-13, LT-SB-13B, LT-TP-06. See Appendix A.

(3) U.S. EPA Region III, 1998d, Risk-Based Concentration Table, Soil Residential RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)

(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)

(5) Rationale Codes Selection Reason:
- Infrequent Detection but Associated Historically (HIST)
- Frequent Detection (FD)
- Toxicity Information Available (TX)
- Above Screening Levels (ASL)
- Above Background Levels (ABKG)
- Above CTS (ACTS)

Deletion Reason:
- Infrequent Detection (IFD)
- Below Background Levels (BBKG)
- No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- Below CTS (BCTS)

Definitions:
- N/A = Not Applicable
- CRQL = Contract Required Quantitation Limit
- CRDL = Contract Required Detection Limit
- COPC = Chemical of Potential Concern
- ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
- RBC = Risk-Based Concentration
- CTS = Concentration / Toxicity Screen (See Appendix C)
- E = Estimated Value
- J = Estimated Value, compound present below CRQL but above IDL
- C = Carcinogenic
- N = Non-Carcinogenic

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TAB
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area G

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	(3) Screening Toxicity Value		Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
319-85-7	beta-BHC	0.0021	EN	0.0021	EN	mg/kg	CC-SB-23-4-6	1/10	0.0018-0.23	0.0021	N/A	3.5E-01	C	0.003	SSL	NO	BCTS, BSL
319-85-7	delta-BHC	0.0019	E	0.0019	E	mg/kg	CC-SB-22-2-4	1/10	0.0018-0.23	0.0019	N/A	3.5E-01	C	N/A	N/A	NO	BCTS, BSL
57-74-9	Chlordane (total)	0.0025		0.065		mg/kg	CC-SB-MW7-2-4	6/10	0.0018-0.23	0.065	N/A	1.8E+00	C	10	SSL	NO	BCTS, BSL
72-54-8	4,4'-DDD	0.003	J	0.061		mg/kg	CC-SB-MW7-2-4	4/10	0.0036-0.44	0.061	N/A	2.7E+00	C	16	SSL	NO	BCTS, BSL
72-55-9	4,4'-DDE	0.0086	EN	0.014	EN	mg/kg	CC-SB-23-4-6	2/10	0.0036-0.44	0.014	N/A	1.9E+00	C	54	SSL	NO	BCTS, BSL
50-29-3	4,4'-DDT	0.011	EN	0.028	EN	mg/kg	CC-SB-04-2-4	4/10	0.0036-0.44	0.028	N/A	1.9E+00	C	32	SSL	NO	BCTS, BSL
60-57-1	Dieldrin	0.0068	EN	0.012	EN	mg/kg	CC-SB-23-4-6	2/10	0.0036-0.44	0.012	N/A	4.0E-02	C	0.004	SSL	NO	BCTS, BSL
115-29-7	Endosulfan I	0.0024		0.25	EN	mg/kg	CC-TP-6-5-6	5/10	0.0018-0.23	0.25	N/A	4.7E+02	N	18	SSL	NO	BCTS, BSL
1031-07-8	Endosulfan sulfate	0.0052	EN	0.0052	EN	mg/kg	CC-SB-22-2-4	1/10	0.0036-0.44	0.0052	N/A	--	--	N/A	N/A	YES	NTX
53494-70-5	Endrin ketone	0.0068	EN	0.024	EN	mg/kg	CC-SB-MW7-2-4	6/10	0.0036-0.44	0.024	N/A	--	--	N/A	N/A	YES	NTX
76-44-8	Heptachlor	0.0039	EN	0.0039	EN	mg/kg	CC-SB-23-4-6	1/10	0.0018-0.23	0.0039	N/A	1.4E-01	C	23	SSL	NO	BCTS, BSL
1024-57-3	Heptachlor epoxide	0.0024		0.0057	J	mg/kg	CC-SB-MW7-2-4	2/10	0.0018-0.23	0.0057	N/A	7.0E-02	C	0.7	SSL	NO	BCTS, BSL
12672-29-6	PCBs (total)	0.152		12		mg/kg	CC-TP-6-5-6	6/10	0.036-4.4	12	N/A	3.2E-01	C	1	SSL	YES	ACTS, ASL
7429-90-5	Aluminum	3300		8230		mg/kg	CC-SB-04-2-4	10/10	43.1-53.4	8230	(2)	7.8E+04	N	N/A	N/A	NO	BCTS, BSL
7440-36-0	Antimony	2.1	J	201		mg/kg	CC-SB-24-6-8	6/10	12.9-16	201	(2)	3.1E+01	N	5	SSL	YES	ACTS, ASL
7440-38-2	Arsenic	3.9		341		mg/kg	CC-SB-26-6-8	10/10	2.16-2.67	341	(2)	4.3E-01	C	29	SSL	YES	ACTS, ASL
7440-39-3	Barium	41.2	J	855		mg/kg	CC-SB-24-6-8	10/10	43.2-53.4	855	(2)	5.5E+03	N	1600	SSL	NO	BCTS, BSL
7440-41-7	Beryllium	0.08	J	5.4		mg/kg	CC-TP-6-5-6	9/10	1.08-1.34	5.4	(2)	1.6E+02	N	63	SSL	NO	BSL, BBKG
7440-43-9	Cadmium	0.33	J	37.2		mg/kg	CC-SB-26-6-8	10/10	1.08-1.34	37.2	(2)	7.8E+01	N	8	SSL	YES	ACTS
7440-70-2	Calcium	988	J	204000		mg/kg	CC-SB-26-6-8	10/10	1079-1335	204000	(2)	--	--	N/A	N/A	NO	NUT
16065-83-1	Chromium	9.1	E	244		mg/kg	CC-SB-24-6-8	10/10	2.16-2.67	244	(2)	1.2E+05	N	38	SSL	NO	BCTS, BSL

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OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
TUNGSTEN CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Underlying the site

401128

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	(3) Screening Toxicity Value	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
71-43-2	Benzene	0.0084	J	0.013	J	mg/L	CC-MW-CDM-2	2/10	0.01	0.013	N/A	3.6E-04 C	0.005	MCL	YES	ACTS, AC
108-90-7	Chlorobenzene	0.0026	J	0.5		mg/L	CC-MW-CDM-2	5/10	0.01	0.5	N/A	3.5E-02 N	N/A	N/A	YES	ACTS, ASL
67-66-3	Chloroform	0.61		0.61		mg/L	CC-MW-CDM-2	1/10	0.01	0.61	N/A	1.5E-04 C	0.1/0.08	MCL	YES	ACTS, ASL
107-06-2	1,2-Dichloroethane	0.0042		0.0042		mg/L	CC-MW-CDM-4	1/10	0.01	0.0042	N/A	1.2E-04 C	0.005	MCL	YES	ACTS, ASL
540-59-0	1,2-Dichloroethene	0.0022	J	0.218		mg/L	CC-MW-CDM-2	2/10	0.01	0.218	N/A	5.5E-02 N	0.1/0.07	MCL	YES	ASL
75-09-2	Methylene chloride	0.026	J	0.026	J	mg/L	CC-MW-CDM-2	1/10	0.01	0.026	N/A	4.1E-03 C	0.005	MCL	YES	ASL
127-18-4	Tetrachloroethene	0.13		0.13		mg/L	CC-MW-CDM-2	1/10	0.01	0.13	N/A	1.1E-03 C	0.005	MCL	YES	ASL
108-88-3	Toluene	0.088		0.088		mg/L	CC-MW-3	1/10	0.01	0.088	N/A	7.5E-01 N	1	MCL	YES	ACTS
79-01-6	Trichloroethene	0.07		0.07		mg/L	CC-MW-CDM-2	1/10	0.01	0.07	N/A	1.6E-03 C	0.005	MCL	YES	ASL
75-01-4	Vinyl chloride	0.0026	J	0.19		mg/L	CC-MW-CDM-2	2/10	0.01	0.19	N/A	1.9E-05 C	0.002	MCL	YES	ASL
1330-20-7	Xylenes (total)	0.0025	J	0.0025	J	mg/L	CC-MW-3	1/10	0.01	0.0025	N/A	1.2E+01 N	10	MCL	NO	BCTS, BSL
83-32-9	Acenaphthene	0.0013	J	0.019		mg/L	CC-MW-2	2/10	0.01	0.019	N/A	2.2E+00 N	N/A	N/A	NO	BCTS, BSL
111-44-4	bis(2-chloroethyl)ether	0.0037	J	0.0037	J	mg/L	CC-MW-CDM-1	1/10	0.01	0.0037	N/A	6.1E-05 C	N/A	N/A	YES	ASL
117-81-7	bis(2-ethylhexyl)phthalate	0.0028	J	0.0028	J	mg/L	CC-MW-CDM-2	1/10	0.01	0.0028	N/A	4.8E-03 C	0.006	MCL	NO	BCTS, BSL
86-74-8	Carbazole	0.0018	J	0.0018	J	mg/L	CC-MW-2	1/10	0.01	0.0018	N/A	3.3E-03 C	N/A	N/A	NO	BCTS, BSL
95-57-8	2-Chlorophenol	0.0015	J	0.0021	J	mg/L	CC-MW-CDM-1	2/10	0.01	0.0021	N/A	1.8E-01 N	N/A	N/A	NO	BCTS, BSL
132-64-9	Dibenzofuran	0.0062	J	0.0062	J	mg/L	CC-MW-2	1/10	0.01	0.0062	N/A	2.4E-02 N	N/A	N/A	NO	BCTS, BSL
95-50-1	1,2-Dichlorobenzene	0.019		0.019		mg/L	CC-MW-CDM-2	1/10	0.01	0.019	N/A	6.4E-02 N	0.6	MCL	NO	BCTS, BSL
541-73-1	1,3-Dichlorobenzene	0.01		0.01		mg/L	CC-MW-CDM-2	1/10	0.01	0.01	N/A	1.4E-02 N	N/A	N/A	NO	BCTS, BSL
106-46-7	1,4-Dichlorobenzene	0.037		0.037		mg/L	CC-MW-CDM-2	1/10	0.01	0.037	N/A	4.7E-04 C	0.075	MCL	YES	ASL
84-66-2	Diethylphthalate	0.0012	J	0.0012	J	mg/L	CC-MW-3	1/10	0.01	0.0012	N/A	2.9E+01 N	N/A	N/A	NO	BCTS, BSL
86-73-7	Fluorene	0.0047	J	0.0047	J	mg/L	CC-MW-2	1/10	0.01	0.0047	N/A	1.5E+00 N	N/A	N/A	NO	BCTS, BSL
91-57-6	2-Methylnaphthalene	0.0017	J	0.0017	J	mg/L	CC-MW-3	1/10	0.01	0.0017	N/A	1.2E+02 N	N/A	N/A	NO	BCTS, BSL
106-44-5	4-Methylphenol	0.0022	J	0.0022	J	mg/L	CC-MW-3	1/10	0.01	0.0022	N/A	1.8E-01 N	N/A	N/A	NO	BSL
91-20-3	Naphthalene	0.0055	J	0.0055	J	mg/L	CC-MW-3	1/10	0.01	0.0055	N/A	7.3E+02 N	N/A	N/A	NO	BCTS, BSL
108-95-2	Phenol	0.0021	J	0.0021	J	mg/L	CC-MW-CDM-1	1/10	0.01	0.0021	N/A	2.2E+01 N	N/A	N/A	NO	BCTS, BSL
120-82-1	1,2,4-Trichlorobenzene	0.0025	J	0.031		mg/L	CC-MW-CDM-2	2/10	0.01	0.031	N/A	1.9E-01 N	0.07	MCL	NO	BCTS, BSL
1031-07-8	Endosulfan sulfate	0.00017		0.00017		mg/L	CC-MW-CDM-4	1/10	0.0001	0.00017	N/A	-- --	N/A	N/A	YES	NTX
7429-90-5	Aluminum	0.467		121		mg/L	CC-MW-5	10/10	0.2	121	(2)	3.7E+01 N	N/A	N/A	NO	BBKG
7440-36-0	Antimony	0.0155	J	0.0566	J	mg/L	CC-MW-6	3/10	0.06	0.0566	(2)	1.5E-02 N	0.006	MCL	YES	ASL
7440-38-2	Arsenic	0.0105	J	11.4		mg/L	CC-MW-8	10/10	0.01	11.4	(2)	4.5E-05 C	0.05	MCL	YES	ACTS, ASL
7440-39-3	Barium	0.121	J	0.448		mg/L	CC-MW-3	10/10	0.2	0.448	(2)	2.6E+00 N	2	MCL	NO	BCTS, BSL
7440-41-7	Beryllium	0.00017	J	0.0066		mg/L	CC-MW-5	7/10	0.005	0.0066	(2)	7.3E-02 N	0.004	MCL	NO	BCTS, BSL
7440-43-9	Cadmium	0.00071	J	0.0043	J	mg/L	CC-MW-6	4/10	0.005	0.0043	(2)	1.8E-02 N	0.005	MCL	NO	BCTS, BSL
7440-70-2	Calcium	30.2		203		mg/L	CC-MW-5	10/10	5	203	(2)	-- --	N/A	N/A	NO	NUT

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Underlying the site

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
71-43-2	Benzene	0.0084	J	0.013	J	mg/L	CC-MW-CDM-2	2/10	0.01	0.013	N/A	3.6E-04 C	0.005	MCL	YES	ACTS, AC
108-90-7	Chlorobenzene	0.0026	J	0.5		mg/L	CC-MW-CDM-2	5/10	0.01	0.5	N/A	3.5E-02 N	N/A	N/A	YES	ACTS, ASL
67-66-3	Chloroform	0.61		0.61		mg/L	CC-MW-CDM-2	1/10	0.01	0.61	N/A	1.5E-04 C	0.1/0.08	MCL	YES	ACTS, ASL
107-06-2	1,2-Dichloroethane	0.0042		0.0042		mg/L	CC-MW-CDM-4	1/10	0.01	0.0042	N/A	1.2E-04 C	0.005	MCL	YES	ACTS, ASL
540-59-0	1,2-Dichloroethene	0.0022	J	0.218		mg/L	CC-MW-CDM-2	2/10	0.01	0.218	N/A	5.5E-02 N	0.1/0.07	MCL	YES	ASL
75-09-2	Methylene chloride	0.026	J	0.026	J	mg/L	CC-MW-CDM-2	1/10	0.01	0.026	N/A	4.1E-03 C	0.005	MCL	YES	ASL
127-18-4	Tetrachloroethene	0.13		0.13		mg/L	CC-MW-CDM-2	1/10	0.01	0.13	N/A	1.1E-03 C	0.005	MCL	YES	ASL
108-88-3	Toluene	0.088		0.088		mg/L	CC-MW-3	1/10	0.01	0.088	N/A	7.5E-01 N	1	MCL	YES	ACTS
79-01-6	Trichloroethene	0.07		0.07		mg/L	CC-MW-CDM-2	1/10	0.01	0.07	N/A	1.6E-03 C	0.005	MCL	YES	ASL
75-01-4	Vinyl chloride	0.0026	J	0.19		mg/L	CC-MW-CDM-2	2/10	0.01	0.19	N/A	1.9E-05 C	0.002	MCL	YES	ASL
1330-20-7	Xylenes (total)	0.0025	J	0.0025	J	mg/L	CC-MW-3	1/10	0.01	0.0025	N/A	1.2E+01 N	10	MCL	NO	BCTS, BSL

(1) Minimum/maximum detected concentration.
(2) Background not applicable for volatile organics
(3) U.S. EPA Region III, 1998, Risk-Based Concentration Table, Tap Water RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Class A Carcinogen (AC)
Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions: N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

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TA

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Retention Ponds and low area

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)

(1) Minimum/maximum detected concentration.

(3) Not Available for surface water

(5) Rationale Codes Selection Reason:

Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)

Deletion Reason Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:

N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

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TA[illegible]
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LT TUNGSTEN-CAPTAIN'S COVE ADJUNCT SITE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Retention Ponds

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)	Potential ARAR/TBC Value (4)	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (5)
7439-95-4	Magnesium	332	J	2780	J	mg/kg	CC-SED-3	2/2	1221-3058	2780	(2)	--	--	--	NO	NUT
7439-96-5	Manganese	52.5		386	E	mg/kg	CC-SED-3	2/2	3.66-9.17	386	(2)	--	--	--	NO	BBKG
7439-97-6	Mercury	0.35	E	0.35	E	mg/kg	CC-SED-3	1/2	0.12-0.31	0.35	(2)	--	--	--	NO	BCTS
7440-02-0	Nickel	2.3	J	41.2	E	mg/kg	CC-SED-3	2/2	9.77-24.5	41.2	(2)	--	--	--	NO	BBKG
7440-09-7	Potassium	150	J	1420	J	mg/kg	CC-SED-3	2/2	1221-3058	1420	(2)	--	--	--	NO	NUT
7782-49-2	Selenium	3.1	E	3.1	E	mg/kg	CC-SED-3	1/2	1.22-3.06	3.1	(2)	--	--	--	NO	BCTS
7440-22-4	Silver	7.2	E	7.2	E	mg/kg	CC-SED-3	1/2	2.44-6.12	7.2	(2)	--	--	--	YES	ACTS
7440-23-5	Sodium	121	J	121	J	mg/kg	CC-SED-3	1/2	1221-3058	121	(2)	--	--	--	NO	NUT
7440-62-2	Vanadium	3.6	J	43.9	E	mg/kg	CC-SED-3	2/2	12.2-30.6	43.9	(2)	--	--	--	NO	BBKG
7440-66-6	Zinc	364	E	364	E	mg/kg	CC-SED-3	1/2	4.88-12.2	364	(2)	--	--	--	YES	ACTS

(1) Minimum/maximum detected concentration.

(2) Background values from LT-MP-5, LT-MP-5B, LT-MP-11D, LT-MP-11DB, LT-SB-13, LT-SB-13B, LT-TP-06. See Appendix A.

(3) Not Available for sediment

(5) Rationale Codes Selection Reason:
- Infrequent Detection but Associated Historically (IIST)
- Frequent Detection (FD)
- Toxicity Information Available (TX)
- Above Screening Levels (ASL)
- Above Background Levels (ABKG)
- Above CTS (ACTS)
- Class A Carcinogen (AC)

Deletion Reason:
- Infrequent Detection (IFD)
- Below Background Levels (BBKG)
- No Toxicity Information (NTX)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- Below CTS (BCTS)

Definitions:
- N/A = Not Applicable
- CRQL = Contract Required Quantitation Limit
- CRDL = Contract Required Detection Limit
- COPC = Chemical of Potential Concern
- ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
- RBC = Risk-Based Concentration
- CTS = Concentration / Toxicity Screen (See Appendix C)
- E = Estimated Value
- J = Estimated Value, compound present below CRQL but above IDL
- C = Carcinogenic
- N = Non-Carcinogenic

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TABLE 2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)Anthracene	mg/kg	6.2E-01	1.3E+00	2.7E+00		mg/kg	1.3E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Benzo(b)Fluoranthene	mg/kg	9.3E-01	2.2E+00	5.6E+00		mg/kg	2.2E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Benzo(a)Pyrene	mg/kg	7.4E-01	1.8E+00	3.2E+00		mg/kg	1.8E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Benzo(g,h,i)Perylene	mg/kg	5.9E-01	1.3E+00	1.6E+00		mg/kg	1.3E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Dibenz(a,h)Anthracene	mg/kg	5.7E-01	9.8E-01	3.1E-01	J	mg/kg	3.1E-01	Max	W-Test (1, 2)	N/A	N/A	N/A
Indeno(1,2,3-cd)Pyrene	mg/kg	5.7E-01	1.1E+00	1.5E+00		mg/kg	1.1E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Phenanthrene	mg/kg	7.0E-01	1.7E+00	3.0E+00		mg/kg	1.7E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Endrin aldehyde	mg/kg	1.1E-02	1.8E-03	8.4E-03	E	mg/kg	8.4E-03	Max	W-Test (1, 2)	N/A	N/A	N/A
PCBs (total)	mg/kg	5.8E-01	1.4E+00	5.5E+00		mg/kg	1.4E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Antimony	mg/kg	2.6E+02	3.9E+03	1.2E+03	E	mg/kg	1.2E+03	Max	W-Test (1, 2)	N/A	N/A	N/A
Arsenic	mg/kg	5.7E+02	1.6E+04	2.8E+03		mg/kg	2.8E+03	Max	W-Test (1, 2)	N/A	N/A	N/A
Barium	mg/kg	2.8E+02	7.4E+02	1.2E+03		mg/kg	7.4E+02	UCL-T	W-Test (1)	N/A	N/A	N/A
Cadmium	mg/kg	3.1E+01	3.9E+02	1.7E+02		mg/kg	1.7E+02	Max	W-Test (1, 2)	N/A	N/A	N/A
Cobalt	mg/kg	8.3E+01	4.5E+02	3.8E+02	E	mg/kg	3.8E+02	Max	W-Test (1, 2)	N/A	N/A	N/A
Copper	mg/kg	1.6E+03	1.0E+04	1.1E+04		mg/kg	1.0E+04	UCL-T	W-Test (1)	N/A	N/A	N/A
Iron	mg/kg	6.1E+04	1.2E+05	2.0E+05		mg/kg	1.2E+05	UCL-T	W-Test (1)	N/A	N/A	N/A
Lead	mg/kg	3.5E+03	2.5E+04	3.0E+04		mg/kg	2.5E+04	UCL-T	W-Test (1)	N/A	N/A	N/A
Manganese	mg/kg	4.7E+03	2.1E+04	3.1E+04		mg/kg	2.1E+04	UCL-T	W-Test (1)	N/A	N/A	N/A

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992

Statistics: Maximum Detected Value (Max); 95% UCL of Log-transformed Data (95% UCL-T)

(1) Shapiro-Wilk W Test indicates data do not follow a normal distribution

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC

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TABLE 4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area G

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(b)Fluoranthene	mg/kg	N/A	N/A	2.6E-01	J	mg/kg	2.6E-01	Max	< 10 samples	N/A	N/A	N/A
Benzo(a)Pyrene	mg/kg	N/A	N/A	1.3E-01	J	mg/kg	1.3E-01	Max	< 10 samples	N/A	N/A	N/A
Benzo(g,h,i)Perylene	mg/kg	N/A	N/A	7.7E-02	J	mg/kg	7.7E-02	Max	< 10 samples	N/A	N/A	N/A
Indeno(1,2,3-cd)Pyrene	mg/kg	N/A	N/A	9.2E-02	J	mg/kg	9.2E-02	Max	< 10 samples	N/A	N/A	N/A
Phenanthrene	mg/kg	N/A	N/A	1.6E-01	J	mg/kg	1.6E-01	Max	< 10 samples	N/A	N/A	N/A
Arsenic	mg/kg	N/A	N/A	6.6E+00		mg/kg	6.6E+00	Max	< 10 samples	N/A	N/A	N/A
Barium	mg/kg	N/A	N/A	5.3E+01		mg/kg	5.3E+01	Max	< 10 samples	N/A	N/A	N/A
Cadmium	mg/kg	N/A	N/A	4.2E-01		mg/kg	4.2E-01	Max	< 10 samples	N/A	N/A	N/A
Copper	mg/kg	N/A	N/A	2.5E+01		mg/kg	2.5E+01	Max	< 10 samples	N/A	N/A	N/A
Lead	mg/kg	N/A	N/A	3.1E+01		mg/kg	3.1E+01	Max	< 10 samples	N/A	N/A	N/A

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

Statistics: Maximum Detected Value (Max)

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MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area G

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Acenaphthylene	mg/kg	4.2E-01	8.8E-01	7.7E-02	J	mg/kg	7.7E-02	Max	W-Test (1, 2)	N/A	N/A	N/A
Benzo(a)Anthracene	mg/kg	9.3E-01	7.8E+00	4.0E+00		mg/kg	4.0E+00	Max	W-Test (1, 2)	N/A	N/A	N/A
Benzo(b)Fluoranthene	mg/kg	9.5E-01	3.6E+00	3.7E+00		mg/kg	3.6E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Benzo(a)Pyrene	mg/kg	6.0E-01	2.0E+00	1.6E+00		mg/kg	1.6E+00	Max	W-Test (1, 2)	N/A	N/A	N/A
Benzo(g,h,i)Perylene	mg/kg	4.1E-01	8.9E-01	4.5E-01	J	mg/kg	4.5E-01	Max	W-Test (1, 2)	N/A	N/A	N/A
Phenanthrene	mg/kg	1.7E+00	2.1E+01	8.6E+00		mg/kg	8.6E+00	Max	W-Test (1, 2)	N/A	N/A	N/A
Endosulfan sulfate	mg/kg	2.6E-02	1.2E-01	5.2E-03	EN	mg/kg	5.2E-03	Max	W-Test (1, 2)	N/A	N/A	N/A
Endrin ketone	mg/kg	9.6E-03	1.4E-02	2.4E-02	EN	mg/kg	1.4E-02	UCL-N	W-Test (3)	N/A	N/A	N/A
PCBs (total)	mg/kg	1.4E+00	9.6E+00	1.2E+01		mg/kg	9.6E+00	UCL-T	W-Test (1)	N/A	N/A	N/A
Antimony	mg/kg	3.5E+01	2.0E+02	2.0E+02		mg/kg	2.0E+02	UCL-T	W-Test (1)	N/A	N/A	N/A
Arsenic	mg/kg	1.1E+02	3.6E+03	3.4E+02		mg/kg	3.4E+02	Max	W-Test (1, 2)	N/A	N/A	N/A
Cadmium	mg/kg	1.0E+01	2.8E+02	3.7E+01		mg/kg	3.7E+01	Max	W-Test (1, 2)	N/A	N/A	N/A
Iron	mg/kg	5.4E+04	1.7E+05	1.3E+05		mg/kg	1.3E+05	Max	W-Test (1, 2)	N/A	N/A	N/A
Lead	mg/kg	6.8E+02	1.8E+04	3.0E+03		mg/kg	3.0E+03	Max	W-Test (1, 2)	N/A	N/A	N/A
Manganese	mg/kg	3.7E+04	4.2E+07	2.2E+05		mg/kg	2.2E+05	Max	W-Test (1, 2)	N/A	N/A	N/A

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T)

(1) Shapiro-Wilk W Test indicates data do not follow a normal distribution

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilk W Test indicates data follow a normal districution.

TABLE 3.8
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzene	mg/L	6.1E-03	7.6E-03	1.3E-02	J	mg/L	7.6E-03	UCL-T	W-Test (1)	N/A	N/A	N/A
Chlorobenzene	mg/L	5.4E-02	1.9E-01	5.0E-01		mg/L	1.9E-01	UCL-T	W-Test (1)	N/A	N/A	N/A
Chloroform	mg/L	6.6E-02	2.2E-01	6.1E-01		mg/L	2.2E-01	UCL-T	W-Test (1)	N/A	N/A	N/A
1,2-Dichloroethane	mg/L	4.9E-03	5.1E-03	4.2E-03		mg/L	5.1E-03	Max	W-Test (1, 2)	N/A	N/A	N/A
1,2-Dichloroethene	mg/L	2.6E-02	6.7E-02	2.2E-01		mg/L	6.7E-02	UCL-T	W-Test (1)	N/A	N/A	N/A
Methylene chloride	mg/L	7.1E-03	1.0E-02	2.6E-02	J	mg/L	1.0E-02	UCL-T	W-Test (1)	N/A	N/A	N/A
Tetrachloroethane	mg/L	1.8E-02	3.5E-02	1.3E-01		mg/L	3.5E-02	UCL-T	W-Test (1)	N/A	N/A	N/A
Toluene	mg/L	1.3E-02	2.4E-02	8.8E-02		mg/L	2.4E-02	UCL-T	W-Test (1)	N/A	N/A	N/A
Trichloroethene	mg/L	1.2E-02	2.0E-02	7.0E-02		mg/L	2.0E-02	UCL-T	W-Test (1)	N/A	N/A	N/A
Vinyl chloride	mg/L	2.3E-02	5.5E-02	1.9E-01		mg/L	5.5E-02	UCL-T	W-Test (1)	N/A	N/A	N/A

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Log-transformed Data (95% UCL-T)

(1) Shapiro-Wilk W Test indicates data do not follow a normal distribution.

(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

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TABLE 3.10
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CAPTAINS COVE

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Retention Ponds

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(g,h,i)Perylene	mg/kg	N/A	N/A	1.8E-01	J	mg/kg	1.8E-01	Max	< 10 samples	N/A	N/A	N/A
Phenanthrene	mg/kg	N/A	N/A	5.3E-01	J	mg/kg	5.3E-01	Max	< 10 samples	N/A	N/A	N/A
4-Methylphenol	mg/kg	N/A	N/A	5.2E-01	J	mg/kg	5.2E-01	Max	< 10 samples	N/A	N/A	N/A
Antimony	mg/kg	6.75E+00	N/A	1.2E+01	J	mg/kg	1.2E+01	Max	< 10 samples	N/A	N/A	N/A
Arsenic	mg/kg	9.38E+00	N/A	1.8E+01	E	mg/kg	1.8E+01	Max	< 10 samples	N/A	N/A	N/A
Cadmium	mg/kg	1.53E+00	N/A	2.8E+00	J	mg/kg	2.8E+00	Max	< 10 samples	N/A	N/A	N/A
Copper	mg/kg	9.17E+01	N/A	1.8E+02	E	mg/kg	1.8E+02	Max	< 10 samples	N/A	N/A	N/A
Lead	mg/kg	1.37E+02	N/A	2.7E+02	E	mg/kg	2.7E+02	Max	< 10 samples	N/A	N/A	N/A
Silver	mg/kg	N/A	N/A	7.2E+00	E	mg/kg	7.2E+00	Max	< 10 samples	N/A	N/A	N/A
Zinc	mg/kg	N/A	N/A	3.6E+02	E	mg/kg	3.6E+02	Max	< 10 samples	N/A	N/A	N/A

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

Statistics: Maximum Detected Value (Max)

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Retention Ponds and low area
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Surface Water	mg/l	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF2	Conversion Factor 2	l/cm^3	1.00E-03	--	--	--	CW x CF2 x PC x SA x ET x EF x ED x 1/BW x 1/AT
	PC	Permeability Coefficient	cm/hour	[2]	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	1,970	EPA, 1992	--	--	
	ET	Exposure Time	hours/day	2	[1]	--	--	
	EF	Exposure Frequency	days/year	120	[1]	--	--	
	ED	Exposure Duration	years	6	[1]	--	--	
	BW	Body Weight	kg	57.7	EPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific. See Text.

Sources:

USEPA, 1989a: Exposure Factors Handbook. EPA/600/8-89/043.

USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. Interim Report. ORD. EPA/600/8-91/011B

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TABLE 4.4

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A/Area G
Receptor Population: Site Worker
Receptor Age: Adults

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x IR-S x FI x EF x ED x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	50	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	
Dermal	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x SSAF x DABS x SA x EF x ED x 1/BW x 1/AT
	SSAF	Soil to Skin Adherence Factor	mg/cm^2	1	EPA, 1992	--	--	
	DABS	Dermal Absorption Factor (Solid)	--	[2]	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2/event	2570	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	250	EPA, 1991	--	--	
	ED	Exposure Duration	years	25	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. Interim Report. ORD EPA/600/8-91/011B.

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TABLE 4.6

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A/Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x IR-S x FI x EF x ED x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	480	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	60	[1]	--	--	
	ED	Exposure Duration	years	1	[1]	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	
Dermal	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x SSAF x DABS x SA x EF x ED x 1/BW x 1/AT
	SSAF	Soil to Skin Adherence Factor	mg/cm^2	1	EPA, 1992	--	--	
	DABS	Dermal Absorption Factor (Solid)	--	[2]	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2/event	2570	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	60	[1]	--	--	
	ED	Exposure Duration	years	1	[1]	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	365	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. Interim Report. ORD. EPA/600/8-91/011B.

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TABLE 4.8

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A/Area G
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x IR-S x FI x EF x ED x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	--	--	
	FI	Fraction Ingested	--	1	[1]	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	30	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	
Dermal	CS	Chemical Concentration in Soil	mg/kg	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF1	Conversion Factor 1	kg/mg	1.00E-06	--	--	--	CS x CF1 x SSAF x DABS x SA x EF x ED x 1/BW x 1/AT
	SSAF	Soil to Skin Adherence Factor	mg/cm^2	1	EPA, 1992	--	--	
	DABS	Dermal Absorption Factor (Solid)	--	[2]	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2/event	2425	EPA, 1992	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	30	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. Interim Report. ORD. EPA/600/8-91/011B.

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TABLE 4.10

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CA	Chemical Concentration in Air	mg/m^3	See Attachment F	See Attachment F	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-A	Inhalation Rate of Air	m^3/hour	0.83	EPA, 1989	--	--	CA x IR-A x ET x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	0.4	EPA, 1989	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	30	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific

Sources:

USEPA, 1989a: Exposure Factors Handbook. EPA/600/8-89/043.

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

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TABLE 4.12

VALUES USED FOR DAILY INTAKE CALCULATIONS

CAPTAINS COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Underlying the Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CG	Chemical Concentration in Groundwater	mg/l	See Table 3	See Table 3	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-G	Ingestion Rate of Groundwater	l/day	1	EPA, 1991	--	--	CG x IR-G x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	6	EPA, 1991	--	--	
	BW	Body Weight	kg	15	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	
Dermal	CG	Chemical Concentration in Groundwater	mg/l	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF1	Conversion Factor 2	l/cm^3	1.00E-03	--	--	--	CG x CF2 x PC x SA x ET x EF x ED x 1/BW x 1/AT
	PC	Permeability Coefficient	cm/hour	[2]	--	--	--	
	SA	Skin Surface Area Available for Contact	cm^2	6,980	EPA, 1992	--	--	
	ET	Exposure Time	hours/day	0.20	EPA, 1989	--	--	
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	6	EPA, 1991	--	--	
	BW	Body Weight	kg	15	EPA, 1991	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	--	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	--	--	--	

[1] Professional Judgement.

[2] Chemical Specific

Sources:

USEPA, 1989a: Exposure Factors Handbook. EPA/600/8-89/043.

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance Standard Default Exposure Factors Interim Final OSWER. Directive 9285.6-03.

USEPA, 1992: Dermal Exposure Assessment: Principles and Applications. Interim Report ORD EPA/600/8-91/011B

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TABLE 5-1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

CAPTAIN'S COVE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
Benzene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Chlorobenzene	Chronic	2E-02	mg/kg-day	100%	2E-02	mg/kg-day	Liver	1000	IRIS	04/01/97
Chloroform	Chronic	1E-02	mg/kg-day	100%	1E-02	mg/kg-day	Liver	1000	IRIS	04/01/97
1,2-Dichloroethane	Chronic	3E-02	mg/kg-day	100%	3E-02	mg/kg-day	Lung	1000	NCEA	03/01/97
cis-1,2-Dichloroethene	Chronic	1E-02	mg/kg-day	100%	1E-02	mg/kg-day	Hematopoietic	3000	HEAST	07/01/97
trans-1,2-Dichloroethene	Chronic	2E-02	mg/kg-day	100%	2E-02	mg/kg-day	Liver	1000	IRIS	03/01/97
1,2-Dichloroethene(total)	Chronic	9E-03	mg/kg-day	100%	9E-03	mg/kg-day	Liver	1000	HEAST	07/01/97
Methylene chloride	Chronic	6E-02	mg/kg-day	100%	6E-02	mg/kg-day	Liver	100	IRIS	04/01/97
Tetrachloroethene	Chronic	1E-02	mg/kg-day	100%	1E-02	mg/kg-day	NOAEL	NA	IRIS	04/01/97
Toluene	Chronic	2E-01	mg/kg-day	100%	2E-01	mg/kg-day	Liver and Kidney	1000	IRIS	03/01/97
Trichloroethene	Chronic	6E-03	mg/kg-day	100%	6E-03	mg/kg-day	Liver and Kidney	3000	NCEA	07/02/97
Vinyl chloride	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Acenaphthylene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Benzo[g,h,i]perylene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Phenanthrene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Benzo[a]anthracene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Benzo[a]pyrene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Benzo[b]fluoranthene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Dibenz[a,h]anthracene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Indeno[1,2,3-cd]pyrene	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
bis(2-Chloroethyl)ether	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
1,4-Dichlorobenzene	Chronic	3E-02	mg/kg-day	100%	3E-02	mg/kg-day	Liver and Kidney	1000	NCEA	03/01/97
4-Methylphenol	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Polychlorinated biphenyls	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Aroclor 1016	Chronic	7E-05	mg/kg-day	100%	7E-05	mg/kg-day	Developmental	81	IRIS	03/01/97
Aroclor 1248	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Aroclor 1254	Chronic	2E-05	mg/kg-day	100%	2E-05	mg/kg-day	Eye	300	IRIS	03/01/97
Endosulfan sulfate	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Endrin aldehyde	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--
Endrin ketone	Chronic	NA	NA	N/A	N/A	N/A	NA	NA	IRIS; HEAST	--

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

CAPTAIN'S COVE

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (1) (MM/DD/YY)
Benzene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Chlorobenzene	Chronic	2.0E-02	mg/m^3	5.7E-03	mg/kg-day	Liver and Kidney	10000	HEAST	7/1/97
Chloroform	Chronic	3.0E-04	mg/m^3	8.6E-05	mg/kg-day	Liver and Kidney	10 for C	NCEA	4/1/97
1,2-Dichloroethane	Chronic	5.0E-03	mg/m^3	1.4E-03	mg/kg-day	Gastrointestinal tract, liver and kidney	3000 for H,C,O	NCEA	3/1/97
cis-1,2-Dichloroethene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
trans-1,2-Dichloroethene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
1,2-Dichloroethene(total)	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Methylene chloride	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Liver	100	HEAST	7/1/97
Tetrachloroethene	Chronic	4.0E-01	mg/m^3	1.1E-01	mg/kg-day	Liver, kidney, and CNS	300 for H,A,S	NCEA	4/1/97
Toluene	Chronic	4.0E-01	mg/m^3	1.1E-01	mg/kg-day	CNS	300 for H,S,O	IRIS	3/1/97
Trichloroethene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Vinyl chloride	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Acenaphthylene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Benzo[g,h,i]perylene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Phenanthrene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Benzo[a]anthracene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Benzo[a]pyrene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Benzo[b]fluoranthene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Dibenz[a,h]anthracene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Indeno[1,2,3-cd]pyrene	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
bis(2-Chloroethyl)ether	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
1,4-Dichlorobenzene	Chronic	8.0E-01	mg/m^3	2.3E-01	mg/kg-day	Liver	100 for H,A,C	IRIS	3/1/97
4-Methylphenol	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Polychlorinated biphenyls	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Aroclor 1016	Chronic	NA	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

CAPTAIN'S COVE

Chemical of Potential Concern	Chronic/ Subchronic	Value	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of Primary Target Organ	Date (MM/DD/YY)
--	--	--	--	--	--	--	--

Aroclor 1248	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Aroclor 1254	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Endosulfan sulfate	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Endrin aldehyde	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Endrin ketone	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Aluminum	NA	1%	N/A	N/A	D	IRIS; HEAST	--
Antimony	NA	10%	N/A	N/A	B1	IRIS; HEAST	--
Arsenic	1.5E+00	80%	1.9E+00	(mg/kg-day)	A	IRIS	04/10/98
Barium	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Cadmium (water)	NA	N/A	N/A	N/A	B1	IRIS; HEAST	--
Cadmium (food)	NA	N/A	N/A	N/A	B1	IRIS; HEAST	--
Cobalt	NA	N/A	N/A	N/A	ND	IRIS; HEAST	--
Copper	NA	N/A	N/A	N/A	D	IRIS; HEAST	--
Iron	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Lead	NA	N/A	N/A	N/A	B2	IRIS; HEAST	--
Manganese	NA	N/A	N/A	N/A	D	IRIS; HEAST	--
Magnesium	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Nickel (soluble salts)	NA	N/A	N/A	N/A	NA	IRIS; HEAST	--
Silver	NA	N/A	N/A	N/A	D	IRIS; HEAST	--
Vanadium	NA	N/A	N/A	N/A	ND	IRIS; HEAST	--
Zinc	NA	N/A	N/A	N/A	D	IRIS; HEAST	--

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

NA = Not Available

N/A = Not Applicable

(1) Oral Slope Factor / Oral to Dermal Adjustment Factor = Adjusted Dermal Cancer Slope Factor

(2) IRIS searched 10/8/98

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

Aroclor 1248	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Aroclor 1254	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Endosulfan sulfate	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Endrin aldehyde	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Endrin ketone	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Aluminum	NA	NA	(2)	N/A	N/A	D	IRIS; HEAST	--
Antimony	NA	NA	(2)	N/A	N/A	B1	IRIS; HEAST	--
Arsenic	4.3E-03	ug/m^3	(2)	1.5E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/10/98
Barium	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Cadmium (water)	1.8E-03	ug/m^3	(2)	6.3E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	04/01/97
Cadmium (food)	1.8E-03	ug/m^3	(2)	6.3E+00	(mg/kg-day)	B1	IRIS	04/01/97
Cobalt	NA	NA	(2)	N/A	N/A	ND	IRIS; HEAST	--
Copper	NA	NA	(2)	N/A	N/A	D	IRIS; HEAST	--
Iron	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Lead	NA	NA	(2)	N/A	N/A	B2	IRIS; HEAST	--
Manganese	NA	NA	(2)	N/A	N/A	D	IRIS; HEAST	--
Magnesium	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Nickel (soluble salts)	NA	NA	(2)	N/A	N/A	NA	IRIS; HEAST	--
Silver	NA	NA	(2)	N/A	N/A	D	IRIS; HEAST	--
Vanadium	NA	NA	(2)	N/A	N/A	ND	IRIS; HEAST	--
Zinc	NA	NA	(2)	N/A	N/A	D	IRIS; HEAST	--

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

NA = Not Available

N/A = Not Applicable

(1) IRIS searched 10/8/98

(2) 70kg x $1/20m^3$/day x 1000ug/mg

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence

Known/Likely

Cannot be Determined

Not Likely

TABLE . RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	1.4E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	8.5E-08	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	1.8E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	3.1E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	2E-01
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	1.2E-04	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	3E-01
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	4.8E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	2E-01
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	2.3E-04	mg/kg-day	3.7E-02	mg/kg-day	N/A	N/A	6E-03
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	2.9E-04	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	(Total)												6E-01
Dermal	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	8.6E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	4E-01
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	2.8E-05	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	1E-01
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(Total)												5E-01
												Total Hazard Index Across All Exposure Routes/Pathways	1E+00

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.3 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Retention Ponds and low area
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	Aluminum	1.68E+01	mg/L	1.68E+01	mg/L	M	3.8E-04	mg/kg-day	5.0E-03	mg/kg-day	N/A	N/A	8E-02
	Antimony	2.51E-02	mg/L	2.51E-02	mg/L	M	5.6E-07	mg/kg-day	4.0E-05	mg/kg-day	N/A	N/A	1E-02
	Arsenic	3.99E-02	mg/L	3.99E-02	mg/L	M	9.0E-07	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	4E-03
	Barium	4.44E-01	mg/L	4.44E-01	mg/L	M	1.0E-05	mg/kg-day	3.5E-03	mg/kg-day	N/A	N/A	3E-03
	Cadmium	8.60E-03	mg/L	8.60E-03	mg/L	M	1.9E-07	mg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	8E-03
	Copper	3.33E-01	mg/L	3.33E-01	mg/L	M	7.5E-06	mg/kg-day	1.9E-02	mg/kg-day	N/A	N/A	4E-04
	Iron	6.20E+01	mg/L	6.20E+01	mg/L	M	1.4E-03	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	5E-03
	Lead	4.36E-01	mg/L	4.36E-01	mg/L	M	9.8E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Manganese	2.77E+00	mg/L	2.77E+00	mg/L	M	6.2E-05	mg/kg-day	1.2E-03	mg/kg-day	N/A	N/A	5E-02
	Nickel	6.52E-02	mg/L	6.52E-02	mg/L	M	1.5E-06	mg/kg-day	2.0E-03	mg/kg-day	N/A	N/A	7E-04
	Vanadium	6.05E-02	mg/L	6.05E-02	mg/L	M	1.4E-06	mg/kg-day	7.0E-03	mg/kg-day	N/A	N/A	2E-04
	(Total)												2E-01
												Total Hazard Index Across All Exposure Routes/Pathways	2E-01

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.5 RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	1.2E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	7.3E-08	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	1.5E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	2.7E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	1E-01
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	1.1E-04	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	3E-01
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	4.1E-05	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1E-01
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	1.9E-04	mg/kg-day	3.7E-02	mg/kg-day	N/A	N/A	5E-03
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	2.5E-04	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	(Total)												5E-01
Dermal	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	1.9E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	1E+00
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	6.3E-05	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	3E-01
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(Total)												1E+00
												Total Hazard Index Across All Exposure Routes/Pathways	2E+00

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.7 RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	7.4E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	1.8E-03	mg/kg-day	2E-02	mg/kg-day	N/A	N/A	9E-02
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	2.2E-03	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	2E-01
	1,2-Dichloroethane	4.20E-03	mg/L	4.20E-03	mg/L	M	4.1E-05	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	1E-03
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	6.5E-04	mg/kg-day	9E-03	mg/kg-day	N/A	N/A	7E-02
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	9.8E-05	mg/kg-day	6E-02	mg/kg-day	N/A	N/A	2E-03
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	3.4E-04	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	3E-02
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	2.4E-04	mg/kg-day	2E-01	mg/kg-day	N/A	N/A	1E-03
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	1.9E-04	mg/kg-day	6E-03	mg/kg-day	N/A	N/A	3E-02
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	5.4E-04	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	3.6E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	3.6E-04	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	1E-02
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	1.7E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	3.9E-04	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	1E+00
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	1.1E-01	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	4E+02
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	5.3E-03	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	5.4E-01	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	(Total)												4E+02

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TABLE 7.8 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	1.5E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	2.5E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	2.0E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	1.4E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	3.5E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	1.2E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Phenanthrene	1.66E+00	mg/kg	1.66E+00	mg/kg	M	1.9E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	9.5E-09	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	1.6E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	8E-02
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	1.3E-03	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	3E+00
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	3.1E-03	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1E+01
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	8.3E-04	mg/kg-day	7.0E-02	mg/kg-day	N/A	N/A	1E-02
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	2.0E-04	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	2E-01
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	4.3E-04	mg/kg-day	6.0E-02	mg/kg-day	N/A	N/A	7E-03
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	1.1E-02	mg/kg-day	3.7E-02	mg/kg-day	N/A	N/A	3E-01
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	1.3E-01	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	4E-01
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	2.8E-02	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	2.4E-02	mg/kg-day	2.3E-02	mg/kg-day	N/A	N/A	1E+00
	(Total)												2E+01

TABLE 7.9 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Hazard Calculation (2)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	Benzo(a)Anthracene	1.30E+00	mg/kg	1.74E-06	mg/m^3	R	7.5E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.93E-06	mg/m^3	R	1.3E-07	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Benzo(a)Pyrene	1.76E+00	mg/kg	2.36E-06	mg/m^3	R	1.0E-07	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.70E-06	mg/m^3	R	7.3E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	4.15E-07	mg/m^3	R	1.8E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.46E-06	mg/m^3	R	6.3E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Phenanthrene	1.60E+00	mg/kg	2.14E-06	mg/m^3	R	9.2E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	1.13E-08	mg/m^3	R	4.9E-10	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.90E-06	mg/m^3	R	8.2E-08	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Antimony	1.16E+03	mg/kg	1.55E-03	mg/m^3	R	6.7E-05	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Arsenic	2.76E+03	mg/kg	3.70E-03	mg/m^3	R	1.6E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Barium	7.36E+02	mg/kg	9.86E-04	mg/m^3	R	4.3E-05	mg/kg-day	N/A	N/A	5.00E-04	mg/m3	3E-01
	Cadmium	1.74E+02	mg/kg	2.33E-04	mg/m^3	R	1.0E-05	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Cobalt	3.79E+02	mg/kg	5.08E-04	mg/m^3	R	2.2E-05	mg/kg-day	N/A	N/A	2.00E-05	mg/m3	4E+00
	Copper	9.96E+03	mg/kg	1.34E-02	mg/m^3	R	5.8E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Iron	1.18E+05	mg/kg	1.58E-01	mg/m^3	R	6.8E-03	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Lead	2.48E+04	mg/kg	3.32E-02	mg/m^3	R	1.4E-03	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.82E-02	mg/m^3	R	1.2E-03	mg/kg-day	N/A	N/A	5.00E-05	mg/m3	9E+01
	(Total)												9E+01
												Total Hazard Index Across All Exposure Routes/Pathways	9E+01

(1) See respirable particulates model in Attachment F.
(2) R = Route-Specific
NA = Not Available
N/A = Not Applicable

TABLE 7.10 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	8.1E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	4E-01
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	6.2E-05	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	3E-01
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	2.2E-06	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	4E-02
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(Total)												7E-01
												Total Hazard Index Across All Exposure Routes/Pathways	1E+01

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.12 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	1.8E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	3.0E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	2.4E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	1.7E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	4.2E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	1.5E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Phenanthrene	1.66E+00	mg/kg	1.66E+00	mg/kg	M	2.3E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	1.2E-08	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	1.9E-06	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	1E-01
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	1.6E-03	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	4E+00
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	3.8E-03	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1E+01
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	1.0E-03	mg/kg-day	7.0E-02	mg/kg-day	N/A	N/A	1E-02
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	2.4E-04	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	2E-01
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	5.2E-04	mg/kg-day	6.0E-02	mg/kg-day	N/A	N/A	9E-03
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	1.4E-02	mg/kg-day	3.7E-02	mg/kg-day	N/A	N/A	4E-01
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	1.6E-01	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	5E-01
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	3.4E-02	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	2.9E-02	mg/kg-day	2.3E-02	mg/kg-day	N/A	N/A	1E+00
	(Total)												2E+01

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TABLE 7.13 RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	1.1E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	5.5E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	5.0E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	2.2E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	6.2E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	1.2E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	7.1E-09	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	2.0E-08	mg/kg-day	NA	NA	N/A	N/A	No Tox.Data
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	1.3E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	7E-01
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	2.8E-04	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	7E-01
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	4.7E-04	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	2E+00
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	5.1E-05	mg/kg-day	1.0E-03	mg/kg-day	N/A	N/A	5E-02
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	1.8E-01	mg/kg-day	3.0E-01	mg/kg-day	N/A	N/A	6E-01
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	4.1E-03	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	2.9E-01	mg/kg-day	2.3E-02	mg/kg-day	N/A	N/A	1E+01
	(Total)												2E+01

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TABLE 7.14 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	2.1E-04	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	5.2E-03	mg/kg-day	2E-02	mg/kg-day	N/A	N/A	3E-01
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	6.1E-03	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	6E-01
	1,2-Dichloroethane	4.20E-03	mg/L	4.20E-03	mg/L	M	1.2E-04	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	4E-03
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	1.8E-03	mg/kg-day	9E-03	mg/kg-day	N/A	N/A	2E-01
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	2.7E-04	mg/kg-day	6E-02	mg/kg-day	N/A	N/A	5E-03
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	9.6E-04	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	1E-01
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	6.7E-04	mg/kg-day	2E-01	mg/kg-day	N/A	N/A	3E-03
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	5.5E-04	mg/kg-day	6E-03	mg/kg-day	N/A	N/A	9E-02
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	1.5E-03	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	1.0E-04	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	1.0E-03	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	3E-02
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	4.7E-06	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	1.1E-03	mg/kg-day	4.0E-04	mg/kg-day	N/A	N/A	3E+00
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	3.1E-01	mg/kg-day	3.0E-04	mg/kg-day	N/A	N/A	1E+03
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	1.5E-02	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	1.5E+00	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	(Total)												1E+03

TABLE 7.15 RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Hazard Calculation (2)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	Benzene	7.61E-03	mg/L	2.25E-02	mg/m^3	R	1.0E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Chlorobenzene	1.89E-01	mg/L	5.14E-01	mg/m^3	R	2.3E-03	mg/kg-day	N/A	N/A	2.00E-02	mg/m3	4E-01
	Chloroform	2.21E-01	mg/L	6.60E-01	mg/m^3	R	3.0E-03	mg/kg-day	N/A	N/A	3.00E-04	mg/m3	4E+01
	1,2-Dichloroethane	4.20E-03	mg/L	1.44E-02	mg/m^3	R	6.5E-05	mg/kg-day	N/A	N/A	5.00E-03	mg/m3	5E-02
	1,2-Dichloroethene	6.68E-02	mg/L	2.16E-01	mg/m^3	R	9.8E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Methylene chloride	9.99E-03	mg/L	3.30E-02	mg/m^3	R	1.5E-04	mg/kg-day	N/A	N/A	3.00E+00	mg/m3	2E-04
	Tetrachloroethane	3.49E-02	mg/L	9.17E-02	mg/m^3	R	4.2E-04	mg/kg-day	N/A	N/A	4.00E-01	mg/m3	4E-03
	Toluene	2.43E-02	mg/L	6.58E-02	mg/m^3	R	3.0E-04	mg/kg-day	N/A	N/A	4.00E-01	mg/m3	3E-03
	Trichloroethene	1.99E-02	mg/L	5.60E-02	mg/m^3	R	2.5E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	Vinyl chloride	5.52E-02	mg/L	4.07E-02	mg/m^3	R	1.9E-04	mg/kg-day	N/A	N/A	NA	N/A	No Tox Data
	(Total)												4E+01

Total Hazard Index Across All Exposure Routes/Pathways 4E+01

(1) See shower model in Attachment F.

(2) R = Route-Specific

NA = Not Available

N/A = Not Applicable

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TABLE 7.16 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	1.66E+00	mg/kg	1.66E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	1.1E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	6E-01
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	4.6E-03	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	2E+01
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	9.7E-05	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	2E+00
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(Total)												2E+01
												Total Hazard Index Across All Exposure Routes/Pathways	2E+02

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.17 RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	7.5E-05	mg/kg-day	2.0E-05	mg/kg-day	N/A	N/A	4E+00
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	5.7E-04	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	2E+00
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	2.1E-05	mg/kg-day	5.0E-05	mg/kg-day	N/A	N/A	4E-01
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(Total)												7E+00
												Total Hazard Index Across All Exposure Routes/Pathways	2E+02

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 7.18 RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	1.4E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	6.9E-04	mg/kg-day	2E-02	mg/kg-day	N/A	N/A	3E-02
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	1.8E-04	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	2E-02
	1,2-Dichloroethane	4.20E-03	mg/L	4.20E-03	mg/L	M	2.0E-06	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	7E-05
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	6.0E-05	mg/kg-day	9E-03	mg/kg-day	N/A	N/A	7E-03
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	4.0E-06	mg/kg-day	6E-02	mg/kg-day	N/A	N/A	7E-05
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	1.5E-04	mg/kg-day	1E-02	mg/kg-day	N/A	N/A	1E-02
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	9.8E-05	mg/kg-day	2E-01	mg/kg-day	N/A	N/A	5E-04
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	2.8E-05	mg/kg-day	6E-03	mg/kg-day	N/A	N/A	5E-03
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	3.6E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	6.9E-07	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	2.0E-04	mg/kg-day	3E-02	mg/kg-day	N/A	N/A	7E-03
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	0.0E+00	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	3.6E-06	mg/kg-day	4.0E-05	mg/kg-day	N/A	N/A	9E-02
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	1.0E-03	mg/kg-day	2.4E-04	mg/kg-day	N/A	N/A	4E+00
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	4.9E-05	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	4.9E-03	mg/kg-day	NA	NA	N/A	N/A	No Tox Data
	(Total)												4E+00
												Total Hazard Index Across All Exposure Routes/Pathways	2E+03

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

401161

TABLE 8.1 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	1.2E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	9E-08
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	7.3E-09	mg/kg-day	NA	N/A	No Tox Data
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	1.5E-08	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	2.7E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	5E-07
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	1.1E-05	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	4.1E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6E-06
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	1.9E-05	mg/kg-day	NA	N/A	No Tox Data
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	2.5E-05	mg/kg-day	NA	N/A	No Tox Data
	(Total)										7E-06
Dermal	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	7.4E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1E-06
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	2.4E-06	mg/kg-day	1.88E+00	(mg/kg-day)$^{-1}$	5E-06
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	(Total)										6E-06
										Total Risk Across All Exposure Routes/Pathways	1E-05

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

401162

TABLE 8.3 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Retention Ponds and low area
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	Aluminum	1.68E+01	mg/L	1.68E+01	mg/L	M	1.6E-05	mg/kg-day	NA	N/A	No Tox Data
	Antimony	2.51E-02	mg/L	2.51E-02	mg/L	M	2.4E-08	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	3.99E-02	mg/L	3.99E-02	mg/L	M	3.8E-08	mg/kg-day	1.88E+00	$(mg/kg\text{-}day)^{-1}$	7E-08
	Barium	4.44E-01	mg/L	4.44E-01	mg/L	M	4.3E-07	mg/kg-day	NA	N/A	No Tox Data
	Cadmium	8.60E-03	mg/L	8.60E-03	mg/L	M	8.3E-09	mg/kg-day	NA	N/A	No Tox Data
	Copper	3.33E-01	mg/L	3.33E-01	mg/L	M	3.2E-07	mg/kg-day	NA	N/A	No Tox Data
	Iron	6.20E+01	mg/L	6.20E+01	mg/L	M	6.0E-05	mg/kg-day	NA	N/A	No Tox Data
	Lead	4.36E-01	mg/L	4.36E-01	mg/L	M	4.2E-07	mg/kg-day	NA	N/A	No Tox Data
	Manganese	2.77E+00	mg/L	2.77E+00	mg/L	M	2.7E-06	mg/kg-day	NA	N/A	No Tox Data
	Nickel	6.52E-02	mg/L	6.52E-02	mg/L	M	6.3E-08	mg/kg-day	NA	N/A	No Tox Data
	Vanadium	6.05E-02	mg/L	6.05E-02	mg/L	M	5.8E-08	mg/kg-day	NA	N/A	No Tox Data
	(Total)										7E-08
										Total Risk Across All Exposure Routes/Pathways	7E-08

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

401163

TABLE 8.5 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Area A
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	4.4E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3E-07
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	2.6E-08	mg/kg-day	NA	N/A	No Tox Data
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	5.4E-08	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	9.6E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	2E-06
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	3.8E-05	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	1.5E-05	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2E-05
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	6.9E-05	mg/kg-day	NA	N/A	No Tox Data
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	8.9E-05	mg/kg-day	NA	N/A	No Tox Data
	(Total)										2E-05
Dermal	Benzo(a)Pyrene	2.50E-01	mg/kg	2.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.50E-01	mg/kg	1.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	5.50E+00	mg/kg	5.50E+00	mg/kg	M	6.9E-06	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1E-05
	Antimony	2.16E+02	mg/kg	2.16E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Arsenic	8.39E+01	mg/kg	8.39E+01	mg/kg	M	2.3E-05	mg/kg-day	1.88E+00	(mg/kg-day)$^{-1}$	4E-05
	Copper	3.95E+02	mg/kg	3.95E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Lead	5.12E+02	mg/kg	5.12E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	(Total)										6E-05
										Total Risk Across All Exposure Routes/Pathways	8E-05

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

401164

TABLE 8.2 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	2.7E-08	mg/kg-day	2.90E-02	(mg/kg-day) $^{-1}$	8E-10
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	6.6E-07	mg/kg-day	NA	N/A	No Tox Data
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	7.7E-07	mg/kg-day	6.10E-03	(mg/kg-day) $^{-1}$	5E-09
	1,2-Dichloroethane	4.92E-03	mg/L	4.92E-03	mg/L	M	1.7E-08	mg/kg-day	9.10E-02	(mg/kg-day) $^{-1}$	2E-09
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	2.3E-07	mg/kg-day	NA	N/A	No Tox Data
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	3.5E-08	mg/kg-day	7.50E-03	(mg/kg-day) $^{-1}$	3E-10
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	1.2E-07	mg/kg-day	5.20E-02	(mg/kg-day) $^{-1}$	6E-09
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	8.5E-08	mg/kg-day	NA	N/A	No Tox Data
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	7.0E-08	mg/kg-day	1.10E-02	(mg/kg-day) $^{-1}$	8E-10
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	1.9E-07	mg/kg-day	1.90E+00	(mg/kg-day) $^{-1}$	4E-07
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	1.3E-08	mg/kg-day	1.10E+00	(mg/kg-day) $^{-1}$	1E-08
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	1.3E-07	mg/kg-day	2.40E-02	(mg/kg-day) $^{-1}$	3E-09
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	5.9E-10	mg/kg-day	NA	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	1.4E-07	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	4.0E-05	mg/kg-day	1.50E+00	(mg/kg-day) $^{-1}$	6E-05
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	1.9E-06	mg/kg-day	NA	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	1.9E-04	mg/kg-day	NA	N/A	No Tox Data
	(Total)										6E-05

401165

TABLE 8.8 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	2.1E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2E-08
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	3.5E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3E-08
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	2.8E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2E-07
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	2.0E-08	mg/kg-day	NA	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	5.0E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	4E-08
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	1.7E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1E-08
	Phenanthrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	2.6E-08	mg/kg-day	NA	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	1.4E-10	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	2.3E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	5E-08
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	1.9E-05	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	4.4E-05	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	7E-05
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	1.2E-05	mg/kg-day	NA	N/A	No Tox Data
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	2.8E-06	mg/kg-day	NA	N/A	No Tox Data
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	6.1E-06	mg/kg-day	NA	N/A	No Tox Data
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	1.6E-04	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	1.9E-03	mg/kg-day	NA	N/A	No Tox Data
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	4.0E-04	mg/kg-day	NA	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	3.4E-04	mg/kg-day	NA	N/A	No Tox Data
	(Total)										7E-05

401166

TABLE 8.9 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: Particulates
Exposure Point: Area A
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Benzo(a)Anthracene	1.30E+00	mg/kg	1.74E-06	mg/m^3	R	1.1E-09	mg/kg-day	NA	N/A	No Tox Data
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.93E-06	mg/m^3	R	1.8E-09	mg/kg-day	NA	N/A	No Tox Data
	Benzo(a)Pyrene	1.76E+00	mg/kg	2.36E-06	mg/m^3	R	1.5E-09	mg/kg-day	NA	N/A	No Tox Data
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.70E-06	mg/m^3	R	1.0E-09	mg/kg-day	NA	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	4.15E-07	mg/m^3	R	2.6E-10	mg/kg-day	NA	N/A	No Tox Data
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.46E-06	mg/m^3	R	9.0E-10	mg/kg-day	NA	N/A	No Tox Data
	Phenanthrene	1.60E+00	mg/kg	2.14E-06	mg/m^3	R	1.3E-09	mg/kg-day	NA	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	1.13E-08	mg/m^3	R	6.9E-12	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.90E-06	mg/m^3	R	1.2E-09	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2E-09
	Antimony	1.16E+03	mg/kg	1.55E-03	mg/m^3	R	9.6E-07	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	2.76E+03	mg/kg	3.70E-03	mg/m^3	R	2.3E-06	mg/kg-day	1.51E+01	$(mg/kg\text{-}day)^{-1}$	3E-05
	Barium	7.36E+02	mg/kg	9.86E-04	mg/m^3	R	6.1E-07	mg/kg-day	NA	N/A	No Tox Data
	Cadmium	1.74E+02	mg/kg	2.33E-04	mg/m^3	R	1.4E-07	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	9E-07
	Cobalt	3.79E+02	mg/kg	5.08E-04	mg/m^3	R	3.1E-07	mg/kg-day	NA	N/A	No Tox Data
	Copper	9.96E+03	mg/kg	1.34E-02	mg/m^3	R	8.2E-06	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.18E+05	mg/kg	1.58E-01	mg/m^3	R	9.7E-05	mg/kg-day	NA	N/A	No Tox Data
	Lead	2.48E+04	mg/kg	3.32E-02	mg/m^3	R	2.0E-05	mg/kg-day	NA	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.82E-02	mg/m^3	R	1.7E-05	mg/kg-day	NA	N/A	No Tox Data
	(Total)										4E-05
										Total Risk Across All Exposure Routes/Pathways	4E-05

(1) See respirable particulates model in Attachment F.
(2) R = Route-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 8.10 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	1.2E-07	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2E-07
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	8.8E-07	mg/kg-day	1.88E+00	$(mg/kg\text{-}day)^{-1}$	2E-06
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	3.2E-08	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	(Total)										2E-06
										Total Risk Across All Exposure Routes/Pathways	1E-05

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 8.12 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	6.1E-07	mg/kg-day	7.30E-01	(mg/kg-day) $^{-1}$	4E-07
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	1.0E-06	mg/kg-day	7.30E-01	(mg/kg-day) $^{-1}$	7E-07
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	8.3E-07	mg/kg-day	7.30E+00	(mg/kg-day) $^{-1}$	6E-06
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	6.0E-07	mg/kg-day	NA	N/A	No Tox Data
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	1.5E-07	mg/kg-day	7.30E+00	(mg/kg-day) $^{-1}$	1E-06
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	5.1E-07	mg/kg-day	7.30E-01	(mg/kg-day) $^{-1}$	4E-07
	Phenanthrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	7.5E-07	mg/kg-day	NA	N/A	No Tox Data
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	3.9E-09	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	6.6E-07	mg/kg-day	2.00E+00	(mg/kg-day) $^{-1}$	1E-06
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	5.4E-04	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	1.3E-03	mg/kg-day	1.50E+00	(mg/kg-day) $^{-1}$	2E-03
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	3.5E-04	mg/kg-day	NA	N/A	No Tox Data
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	8.2E-05	mg/kg-day	NA	N/A	No Tox Data
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	1.8E-04	mg/kg-day	NA	N/A	No Tox Data
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	4.7E-03	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	5.5E-02	mg/kg-day	NA	N/A	No Tox Data
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	1.2E-02	mg/kg-day	NA	N/A	No Tox Data
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	9.9E-03	mg/kg-day	NA	N/A	No Tox Data
	(Total)										2E-03

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TABLE 8.13 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	3.6E-08	mg/kg-day	NA	N/A	No Tox Data
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	1.9E-06	mg/kg-day	7.30E-01	(mg/kg-day) $^{-1}$	1E-06
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	1.7E-06	mg/kg-day	7.30E-01	(mg/kg-day) $^{-1}$	1E-06
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	7.5E-07	mg/kg-day	7.30E+00	(mg/kg-day) $^{-1}$	5E-06
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	2.1E-07	mg/kg-day	NA	N/A	No Tox Data
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	4.0E-06	mg/kg-day	NA	N/A	No Tox Data
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	2.4E-09	mg/kg-day	NA	N/A	No Tox Data
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	6.8E-09	mg/kg-day	NA	N/A	No Tox Data
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	4.5E-06	mg/kg-day	2.00E+00	(mg/kg-day) $^{-1}$	9E-06
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	9.4E-05	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	1.6E-04	mg/kg-day	1.50E+00	(mg/kg-day) $^{-1}$	2E-04
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	1.7E-05	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	6.2E-02	mg/kg-day	NA	N/A	No Tox Data
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	1.4E-03	mg/kg-day	NA	N/A	No Tox Data
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	1.0E-01	mg/kg-day	NA	N/A	No Tox Data
	(Total)										3E-04

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TABLE 8.14 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	8.9E-08	mg/kg-day	2.90E-02	$(mg/kg\text{-}day)^{-1}$	3E-09
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	2.2E-06	mg/kg-day	NA	N/A	No Tox Data
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	2.6E-06	mg/kg-day	6.10E-03	$(mg/kg\text{-}day)^{-1}$	2E-08
	1,2-Dichloroethane	4.92E-03	mg/L	4.92E-03	mg/L	M	5.8E-08	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	5E-09
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	7.8E-07	mg/kg-day	NA	N/A	No Tox Data
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	1.2E-07	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	9E-10
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	4.1E-07	mg/kg-day	5.20E-02	$(mg/kg\text{-}day)^{-1}$	2E-08
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	2.9E-07	mg/kg-day	NA	N/A	No Tox Data
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	2.3E-07	mg/kg-day	1.10E-02	$(mg/kg\text{-}day)^{-1}$	3E-09
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	6.5E-07	mg/kg-day	1.90E+00	$(mg/kg\text{-}day)^{-1}$	1E-06
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	4.3E-08	mg/kg-day	1.10E+00	$(mg/kg\text{-}day)^{-1}$	5E-08
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	4.3E-07	mg/kg-day	2.40E-02	$(mg/kg\text{-}day)^{-1}$	1E-08
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	2.0E-09	mg/kg-day	NA	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	4.7E-07	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	1.3E-04	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2E-04
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	6.4E-06	mg/kg-day	NA	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	6.4E-04	mg/kg-day	NA	N/A	No Tox Data
	(Total)										2E-04

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TABLE 8.15 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value (1)	Route EPC Units	EPC Selected for Risk Calculation (2)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Benzene	7.61E-03	mg/L	2.25E-02	mg/L	R	4.4E-05	mg/kg-day	7.80E-06	$(mg/kg\text{-}day)^{-1}$	3E-10
	Chlorobenzene	1.89E-01	mg/L	5.14E-01	mg/L	R	1.0E-03	mg/kg-day	NA	N/A	No Tox Data
	Chloroform	2.21E-01	mg/L	6.60E-01	mg/L	R	1.3E-03	mg/kg-day	2.30E-05	$(mg/kg\text{-}day)^{-1}$	3E-08
	1,2-Dichloroethane	4.92E-03	mg/L	1.44E-02	mg/L	R	2.8E-05	mg/kg-day	2.60E-05	$(mg/kg\text{-}day)^{-1}$	7E-10
	1,2-Dichloroethene	6.68E-02	mg/L	2.16E-01	mg/L	R	4.2E-04	mg/kg-day	NA	N/A	No Tox Data
	Methylene chloride	9.99E-03	mg/L	3.30E-02	mg/L	R	6.4E-05	mg/kg-day	4.70E-07	$(mg/kg\text{-}day)^{-1}$	3E-11
	Tetrachloroethane	3.49E-02	mg/L	9.17E-02	mg/L	R	1.8E-04	mg/kg-day	5.80E-07	$(mg/kg\text{-}day)^{-1}$	1E-10
	Toluene	2.43E-02	mg/L	6.58E-02	mg/L	R	1.3E-04	mg/kg-day	NA	N/A	No Tox Data
	Trichloroethene	1.99E-02	mg/L	5.60E-02	mg/L	R	1.1E-04	mg/kg-day	1.70E-06	$(mg/kg\text{-}day)^{-1}$	2E-10
	Vinyl chloride	5.52E-02	mg/L	4.07E-02	mg/L	R	7.9E-05	mg/kg-day	8.40E-05	$(mg/kg\text{-}day)^{-1}$	7E-09
	(Total)										4E-08
										Total Risk Across All Exposure Routes/Pathways	4E-08

(1) See shower model in Attachment F.
(2) R = Route-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 8.16 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area A
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	Benzo[a]anthracene	1.30E+00	mg/kg	1.30E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo[b]fluoranthene	2.18E+00	mg/kg	2.18E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.76E+00	mg/kg	1.76E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	1.27E+00	mg/kg	1.27E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Dibenz[a,h]anthracene	3.10E-01	mg/kg	3.10E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Indeno[1,2,3-cd]pyrene	1.09E+00	mg/kg	1.09E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Endrin aldehyde	8.40E-03	mg/kg	8.40E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	1.42E+00	mg/kg	1.42E+00	mg/kg	M	9.5E-07	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2E-06
	Antimony	1.16E+03	mg/kg	1.16E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Arsenic	2.76E+03	mg/kg	2.76E+03	mg/kg	M	4.0E-04	mg/kg-day	1.88E+00	$(mg/kg\text{-}day)^{-1}$	7E-04
	Barium	7.36E+02	mg/kg	7.36E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Cadmium	1.74E+02	mg/kg	1.74E+02	mg/kg	M	8.3E-06	mg/kg-day	NA	N/A	No Tox Data
	Cobalt	3.79E+02	mg/kg	3.79E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Copper	9.96E+03	mg/kg	9.96E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Iron	1.18E+05	mg/kg	1.18E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Lead	2.48E+04	mg/kg	2.48E+04	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Manganese	2.10E+04	mg/kg	2.10E+04	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	(Total)										7E-04
										Total Risk Across All Exposure Routes/Pathways	5E-03

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 8.17 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: All Soil
Exposure Medium: All Soil
Exposure Point: Area G
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	Acenaphthylene	7.70E-02	mg/kg	7.70E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo[a]anthracene	4.00E+00	mg/kg	4.00E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(b)Fluoranthene	3.62E+00	mg/kg	3.62E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(a)Pyrene	1.60E+00	mg/kg	1.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Benzo(g,h,i)Perylene	4.50E-01	mg/kg	4.50E-01	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Phenanthrene	8.60E+00	mg/kg	8.60E+00	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Endosulfan sulfate	5.20E-03	mg/kg	5.20E-03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Endrin ketone	1.44E-02	mg/kg	1.44E-02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	PCBs (total)	9.64E+00	mg/kg	9.64E+00	mg/kg	M	6.5E-06	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1E-05
	Antimony	2.01E+02	mg/kg	2.01E+02	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Arsenic	3.41E+02	mg/kg	3.41E+02	mg/kg	M	4.9E-05	mg/kg-day	1.88E+00	$(mg/kg\text{-}day)^{-1}$	9E-05
	Cadmium	3.72E+01	mg/kg	3.72E+01	mg/kg	M	1.8E-06	mg/kg-day	NA	N/A	No Tox Data
	Iron	1.32E+05	mg/kg	1.32E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Lead	3.00E+03	mg/kg	3.00E+03	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	Manganese	2.15E+05	mg/kg	2.15E+05	mg/kg	M	N/A	N/A	N/A	N/A	N/A
	(Total)										1E-04
										Total Risk Across All Exposure Routes/Pathways	7E-04

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 8.18 RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CAPTAIN'S COVE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Upper Glacial Aquifer
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	Benzene	7.61E-03	mg/L	7.61E-03	mg/L	M	1.2E-06	mg/kg-day	2.90E-02	(mg/kg-day)$^{-1}$	4E-08
	Chlorobenzene	1.89E-01	mg/L	1.89E-01	mg/L	M	5.9E-05	mg/kg-day	NA	N/A	No Tox Data
	Chloroform	2.21E-01	mg/L	2.21E-01	mg/L	M	1.5E-05	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	9E-08
	1,2-Dichloroethane	4.92E-03	mg/L	4.92E-03	mg/L	M	2.0E-07	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	2E-08
	1,2-Dichloroethene	6.68E-02	mg/L	6.68E-02	mg/L	M	5.1E-06	mg/kg-day	NA	N/A	No Tox Data
	Methylene chloride	9.99E-03	mg/L	9.99E-03	mg/L	M	3.4E-07	mg/kg-day	7.50E-03	(mg/kg-day)$^{-1}$	3E-09
	Tetrachloroethane	3.49E-02	mg/L	3.49E-02	mg/L	M	1.3E-05	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	7E-07
	Toluene	2.43E-02	mg/L	2.43E-02	mg/L	M	8.4E-06	mg/kg-day	NA	N/A	No Tox Data
	Trichloroethene	1.99E-02	mg/L	1.99E-02	mg/L	M	2.4E-06	mg/kg-day	1.10E-02	(mg/kg-day)$^{-1}$	3E-08
	Vinyl chloride	5.52E-02	mg/L	5.52E-02	mg/L	M	3.1E-06	mg/kg-day	1.90E+00	(mg/kg-day)$^{-1}$	6E-06
	bis(2-chloroethyl)ether	3.70E-03	mg/L	3.70E-03	mg/L	M	5.9E-08	mg/kg-day	1.10E+00	(mg/kg-day)$^{-1}$	7E-08
	1,4-Dichlorobenzene	3.70E-02	mg/L	3.70E-02	mg/L	M	1.8E-05	mg/kg-day	2.40E-02	(mg/kg-day)$^{-1}$	4E-07
	Endosulfan sulfate	1.70E-04	mg/L	1.70E-04	mg/L	M	0.0E+00	mg/kg-day	NA	N/A	No Tox Data
	Antimony	4.02E-02	mg/L	4.02E-02	mg/L	M	3.1E-07	mg/kg-day	NA	N/A	No Tox Data
	Arsenic	1.14E+01	mg/L	1.14E+01	mg/L	M	8.7E-05	mg/kg-day	1.88E+00	(mg/kg-day)$^{-1}$	2E-04
	Lead	5.44E-01	mg/L	5.44E-01	mg/L	M	4.2E-06	mg/kg-day	NA	N/A	No Tox Data
	Magnesium	5.49E+01	mg/L	5.49E+01	mg/L	M	4.2E-04	mg/kg-day	NA	N/A	No Tox Data
	(Total)										2E-04
										Total Risk Across All Exposure Routes/Pathways	3E-04

(1) M = Medium-Specific
NA = Not Available
N/A = Not Applicable

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TABLE 9.1 RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Area A	Benzo(a)Pyrene	9E-08	--	N/A	9E-08	Benzo(a)Pyrene		No Tox Data	--	N/A	--
			Benzo(g,h,i)Perylene	No Tox Data	--	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	--	N/A	--
			Phenanthrene	No Tox Data	--	N/A	--	Phenanthrene		No Tox Data	--	N/A	--
			PCBs (total)	5E-07	--	1E-06	2E-06	PCBs (total)	Developmental	2E-01	--	4E-01	6E-01
			Antimony	No Tox Data	--	N/A	--	Antimony	Hematopoietic	3E-01	--	N/A	3E-01
			Arsenic	6E-06	--	5E-06	1E-05	Arsenic	Hematopoietic	2E-01	--	1E-01	3E-01
			Copper	No Tox Data	--	N/A	--	Copper	GI tract	6E-03	--	N/A	6E-03
			Lead	No Tox Data	--	N/A	--	Lead		No Tox Data	--	N/A	--
			(Total)	7E-06	--	6E-06	1E-05	(Total)		6E-01	--	5E-01	1E+00

Total Risk Across Soil: 1E-05

Total Risk Across All Media and All Exposure Routes: 1E-05

Total Hazard Index Across All Media and All Exposure Routes: 1E+00

Total Hematopoietic HI = 6E-01

Total GI tract HI = 6E-03

Total Developmental HI = 6E-01

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TABLE RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Retention Ponds and low area	Aluminum	--	--	No Tox Data	--	Aluminum	CNS	--	--	8E-02	8E-02
			Antimony	--	--	No Tox Data	--	Antimony	Hematopoietic	--	--	1E-02	1E-02
			Arsenic	--	--	7E-08	7E-08	Arsenic	Hematopoietic	--	--	4E-03	4E-03
			Barium	--	--	No Tox Data	--	Barium	Hematopoietic	--	--	3E-03	3E-03
			Cadmium	--	--	No Tox Data	--	Cadmium	Kidney	--	--	8E-03	8E-03
			Copper	--	--	No Tox Data	--	Copper	GI tract	--	--	4E-04	4E-04
			Iron	--	--	No Tox Data	--	Iron	Liver	--	--	5E-03	5E-03
			Lead	--	--	No Tox Data	--	Lead		--	--	No Tox Data	--
			Manganese	--	--	No Tox Data	--	Manganese	CNS	--	--	5E-02	5E-02
			Nickel	--	--	No Tox Data	--	Nickel	Whole body	--	--	7E-04	7E-04
			Vanadium	--	--	No Tox Data	--	Vanadium	NA	--	--	2E-04	2E-04
			(Total)	--	--	7E-08	7E-08	(Total)		--	--	2E-01	2E-01
Sediment	Sediment	Retention Ponds	Benzo(g,h,i)Perylene	No Tox Data	--	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	--	N/A	--
			Phenanthrene	No Tox Data	--	N/A	--	Phenanthrene		No Tox Data	--	N/A	--
			4-Methylphenol	No Tox Data	--	N/A	--	4-Methylphenol		No Tox Data	--	N/A	--
			Antimony	1E-06	--	1E-06	--	Antimony	Hematopoietic	2E-02	--	N/A	2E-02
			Arsenic	No Tox Data	--	No Tox Data	#VALUE!	Arsenic	Hematopoietic	3E-02	--	2E-02	6E-02
			Cadmium	No Tox Data	--	N/A	--	Cadmium	Kidney	2E-03	--	6E-03	8E-03
			Copper	No Tox Data	--	N/A	--	Copper	GI tract	3E-03	--	N/A	3E-03
			Lead	No Tox Data	--	N/A	--	Lead		No Tox Data	--	N/A	--
			Silver	No Tox Data	--	N/A	--	Silver	Skin	8E-04	--	N/A	8E-04
			Zinc	1E-06	--	1E-06	--	Zinc	Hematopoietic	3E-02	--	N/A	3E-02
			(Total)	3E-06	--	2E-06	#VALUE!	(Total)		9E-02	--	3E-02	1E-01

Total Risk Across Surface Water	7E-08
Total Risk Across Sediment	#VALUE!
Total Risk Across All Media and All Exposure Routes	#VALUE!
Total Hazard Index Across All Media and All Exposure Routes	3E-01

Total Hematopoietic HI =	1E-01
Total GI tract HI =	3E-03
Total CNS HI =	1E-01
Total Kidney HI =	2E-02
Total Liver HI =	5E-03
Total Skin HI =	8E-04
Total Whole body HI =	7E-04

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TABLE 9.5 RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Area G	Benzo(b)Fluoranthene	3E-08	--	N/A	3E-08	Benzo(b)Fluoranthene		No Tox Data	--	N/A	--
			Benzo(a)Pyrene	2E-07	--	N/A	2E-07	Benzo(a)Pyrene		No Tox Data	--	N/A	--
			Benzo(g,h,i)Perylene	No Tox Data	--	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	--	N/A	--
			Indeno[1,2,3-cd]pyrene	1E-08	--	N/A	1E-08	Indeno[1,2,3-cd]pyrene		No Tox Data	--	N/A	--
			Phenanthrene	No Tox Data	--	N/A	--	Phenanthrene		No Tox Data	--	N/A	--
			Arsenic	2E-06	--	3E-06	5E-06	Arsenic	Hematopoietic	1E-02	--	2E-02	3E-02
			Barium	No Tox Data	--	N/A	--	Barium	Hematopoietic	4E-04	--	N/A	4E-04
			Cadmium	No Tox Data	--	No Tox Data	--	Cadmium	Kidney	2E-04	--	2E-03	2E-03
			Copper	No Tox Data	--	N/A	--	Copper	GI tract	3E-04	--	N/A	3E-04
			Lead	No Tox Data	--	N/A	--	Lead		No Tox Data	--	N/A	--
			(Total)	2E-06	--	3E-06	5E-06	(Total)		1E-02	--	2E-02	3E-02

Total Risk Across Soil: 5E-06

Total Risk Across All Media and All Exposure Routes: 5E-06

Total Hazard Index Across All Media and All Exposure Routes: 3E-02

Total Hematopoietic HI = 3E-02

Total Kidney HI = 2E-03

Total GI tract HI = 3E-04

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TABLE [illegible]

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S FIELD

Scenario Timeframe Future
Receptor Population Construction Worker
Receptor Age Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area A	Benzo[a]anthracene	2E-08	No Tox Data	N/A	2E-08	Benzo[a]anthracene		No Tox Data	No Tox Data	N/A	--
			Benzo[b]fluoranthene	3E-08	No Tox Data	N/A	3E-08	Benzo[b]fluoranthene		No Tox Data	No Tox Data	N/A	--
			Benzo(a)Pyrene	2E-07	No Tox Data	N/A	2E-07	Benzo(a)Pyrene		No Tox Data	No Tox Data	N/A	--
			Benzo(g,h,i)Perylene	No Tox Data	No Tox Data	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	No Tox Data	N/A	--
			Dibenz[a,h]anthracene	4E-08	No Tox Data	N/A	4E-08	Dibenz[a,h]anthracene		No Tox Data	No Tox Data	N/A	--
			Indeno[1,2,3-cd]pyrene	1E-08	No Tox Data	N/A	1E-08	Indeno[1,2,3-cd]pyrene		No Tox Data	No Tox Data	N/A	--
			Phenanthrene	No Tox Data	No Tox Data	N/A	--	Phenanthrene		No Tox Data	No Tox Data	N/A	--
			Endrin aldehyde	No Tox Data	No Tox Data	N/A	--	Endrin aldehyde		No Tox Data	No Tox Data	N/A	--
			PCBs (total)	5E-08	2E-09	3E-08	8E-08	PCBs (total)	Developmental	8E-02	No Tox Data	6E-02	1E-01
			Antimony	No Tox Data	No Tox Data	N/A	--	Antimony	Hematopoietic	3E+00	No Tox Data	N/A	3E+00
			Arsenic	7E-05	3E-05	1E-05	1E-04	Arsenic	Hematopoietic	1E+01	No Tox Data	2E+00	1E+01
			Barium	No Tox Data	No Tox Data	N/A	--	Barium	Hematopoietic	1E-02	3E-01	N/A	3E-01
			Cadmium	No Tox Data	9E-07	No Tox Data	9E-07	Cadmium	Kidney	2E-01	No Tox Data	2E-01	4E-01
			Cobalt	No Tox Data	No Tox Data	N/A	--	Cobalt	Hematopoietic	7E-03	4E+00	N/A	4E+00
			Copper	No Tox Data	No Tox Data	N/A	--	Copper	GI tract	3E-01	No Tox Data	N/A	3E-01
			Iron	No Tox Data	No Tox Data	N/A	--	Iron	Liver	4E-01	No Tox Data	N/A	4E-01
			Lead	No Tox Data	No Tox Data	N/A	--	Lead		No Tox Data	No Tox Data	N/A	--
			Manganese	No Tox Data	No Tox Data	N/A	--	Manganese	CNS	1E+00	9E+01	N/A	9E+01
			(Total)	7E-05	4E-05	1E-05	1E-04	(Total)		2E+01	9E+01	2E+00	1E+02

Total Risk Across Soil: 1E-04

Total Risk Across All Media and All Exposure Routes: 1E-04

Total Hazard Index Across All Media and All Exposure Routes: 1E+02

Total Liver HI =	4E-01
Total Developmental HI =	1E-01
Total Hematopoietic HI =	2E+01
Total Kidney HI =	4E-01
Total GI tract HI =	3E-01
Total CNS HI =	9E+01

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TABLE [illegible]

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area A	Benzo[a]anthracene	1E-06	--	N/A	1E-06	Benzo[a]anthracene		No Tox Data	--	N/A	--
			Benzo[b]fluoranthene	2E-06	--	N/A	2E-06	Benzo[b]fluoranthene		No Tox Data	--	N/A	--
			Benzo(a)Pyrene	2E-05	--	N/A	2E-05	Benzo(a)Pyrene		No Tox Data	--	N/A	--
			Benzo(g,h,i)Perylene	No Tox Data	--	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	--	N/A	--
			Dibenz[a,h]anthracene	4E-06	--	N/A	4E-06	Dibenz[a,h]anthracene		No Tox Data	--	N/A	--
			Indeno[1,2,3-cd]pyrene	1E-06	--	N/A	1E-06	Indeno[1,2,3-cd]pyrene		No Tox Data	--	N/A	--
			Phenanthrene	No Tox Data	--	N/A	--	Phenanthrene		No Tox Data	--	N/A	--
			Endrin aldehyde	No Tox Data	--	N/A	--	Endrin aldehyde		No Tox Data	--	N/A	--
			PCBs (total)	4E-06	--	6E-06	1E-05	PCBs (total)	Developmental	1E-01	--	3E-01	4E-01
			Antimony	No Tox Data	--	N/A	-	Antimony	Hematopoietic	4E+00	--	N/A	4E+00
			Arsenic	6E-03	--	3E-03	9E-03	Arsenic	Hematopoietic	1E+01	--	1E+01	2E+01
			Barium	No Tox Data	--	N/A	--	Barium	Hematopoietic	1E-02	--	N/A	1E-02
			Cadmium	No Tox Data	--	No Tox Data	--	Cadmium	Kidney	2E-01	--	1E+00	1E+00
			Cobalt	No Tox Data	--	N/A	--	Cobalt	Hematopoietic	9E-03	--	N/A	9E-03
			Copper	No Tox Data	--	N/A	--	Copper	GI tract	4E-01	--	N/A	4E-01
			Iron	No Tox Data	--	N/A	--	Iron	Liver	5E-01	--	N/A	5E-01
			Lead	No Tox Data	--	N/A	--	Lead		No Tox Data	--	N/A	--
			Manganese	No Tox Data	--	N/A	--	Manganese	CNS	1E+00	--	N/A	1E+00
			(Total)	7E-03	--	3E-03	9E-03	(Total)		2E+01	--	1E+01	3E+01

Total Risk Across Soil: 9E-03

Total Risk Across All Media and All Exposure Routes: 9E-03

Total Hazard Index Across All Media and All Exposure Routes: 3E+01

Total Liver HI =	5E-01
Total Developmental HI =	4E-01
Total Hematopoietic HI =	3E+01
Total Kidney HI =	1E+00
Total GI tract HI =	4E-01
Total CNS HI =	1E+00

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TABLE 9.11 RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Upper Glacial Aquifer-Tap water	Benzene	3E-09	3E-10	1E-07	1E-07	Benzene		No Tox Data	No Tox Data	No Tox Data	--
			Chlorobenzene	No Tox Data	No Tox Data	No Tox Data	--	Chlorobenzene	Liver	3E-01	4E-01	2E-02	7E-01
			Chloroform	2E-08	3E-08	3E-07	3E-07	Chloroform	Liver	6E-01	4E+01	1E-02	4E+01
			1,2-Dichloroethane	5E-09	7E-10	5E-08	6E-08	1,2-Dichloroethane	Lung	4E-03	5E-02	4E-05	5E-02
			1,2-Dichloroethene	No Tox Data	No Tox Data	No Tox Data	--	1,2-Dichloroethene	Liver	2E-01	No Tox Data	4E-03	2E-01
			Methylene chloride	9E-10	3E-11	8E-09	9E-09	Methylene chloride	Liver	5E-03	2E-04	4E-05	5E-03
			Tetrachloroethane	2E-08	1E-10	2E-06	2E-06	Tetrachloroethane	NOAEL	1E-01	4E-03	9E-03	1E-01
			Toluene	No Tox Data	No Tox Data	No Tox Data	--	Toluene	Liver and Kidney	3E-03	3E-03	3E-04	6E-03
			Trichloroethene	3E-09	2E-10	8E-08	8E-08	Trichloroethene	Liver and Kidney	9E-02	No Tox Data	3E-03	9E-02
			Vinyl chloride	1E-06	7E-09	2E-05	2E-05	Vinyl chloride		No Tox Data	No Tox Data	No Tox Data	--
			bis(2-chloroethyl)ether	5E-08	--	2E-07	2E-07	bis(2-chloroethyl)ether		No Tox Data	--	No Tox Data	--
			1,4-Dichlorobenzene	1E-08	--	1E-06	1E-06	1,4-Dichlorobenzene	Liver and Kidney	3E-02	--	4E-03	4E-02
			Endosulfan sulfate	No Tox Data	--	No Tox Data	--	Endosulfan sulfate		No Tox Data	--	No Tox Data	--
			Antimony	No Tox Data	--	No Tox Data	--	Antimony	Hematopoietic	3E+00	--	5E-02	3E+00
			Arsenic	2E-04	--	5E-04	7E-04	Arsenic	Hematopoietic	1E+03	--	3E+00	1E+03
			Lead	No Tox Data	--	No Tox Data	--	Lead		No Tox Data	--	No Tox Data	--
			Magnesium	No Tox Data	--	No Tox Data	--	Magnesium		No Tox Data	--	No Tox Data	--
			(Total)	2E-04	4E-08	5E-04	7E-04	(Total)		1E+03	4E+01	3E+00	1E+03

Total Risk Across Groundwater: 7E-04

Total Risk Across All Media and All Exposure Routes: 7E-04

Total Hazard Index Across All Media and All Exposure Routes: 1E+03

Total Liver HI = 4E+01

Total Lung HI = 5E-02

Total Kidney HI = 1E-01

Total Hematopoietic HI = 1E+03

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TABLE 9.1 (RME)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area G	Acenaphthylene	No Tox Data	--	N/A	--	Acenaphthylene		No Tox Data	--	N/A	--
			Benzo[a]anthracene	3E-06	--	N/A	3E-06	Benzo[a]anthracene		No Tox Data	--	N/A	--
			Benzo(b)Fluoranthene	3E-06	--	N/A	3E-06	Benzo(b)Fluoranthene		No Tox Data	--	N/A	--
			Benzo(a)Pyrene	1E-05	--	N/A	1E-05	Benzo(a)Pyrene		No Tox Data	--	N/A	--
			Benzo(g,h,i)Perylene	No Tox Data	--	N/A	--	Benzo(g,h,i)Perylene		No Tox Data	--	N/A	--
			Phenanthrene	No Tox Data	--	N/A	--	Phenanthrene		No Tox Data	--	N/A	--
			Endosulfan sulfate	No Tox Data	--	N/A	--	Endosulfan sulfate		No Tox Data	--	N/A	--
			Endrin ketone	No Tox Data	--	N/A	--	Endrin ketone		No Tox Data	--	N/A	--
			PCBs (total)	2E-05	--	1E-05	3E-05	PCBs (total)	Developmental	6E+00	--	4E+00	1E+01
			Antimony	No Tox Data	--	N/A	--	Antimony	Hematopoietic	6E+00	--	N/A	6E+00
			Arsenic	6E-04	--	9E-05	7E-04	Arsenic	Hematopoietic	1E+01	--	2E+00	2E+01
			Cadmium	No Tox Data	--	No Tox Data	--	Cadmium	Kidney	5E-01	--	4E-01	9E-01
			Iron	No Tox Data	--	N/A	--	Iron	Liver	6E+00	--	N/A	6E+00
			Lead	No Tox Data	--	N/A	--	Lead		No Tox Data	--	N/A	--
			Manganese	No Tox Data	--	N/A	--	Manganese	CNS	1E+02	--	N/A	1E+02
			(Total)	6E-04	--	1E-04	7E-04	(Total)		2E+02	--	7E+00	2E+02

Total Risk Across Soil: 7E-04

Total Risk Across All Media and All Exposure Routes: 7E-04

Total Hazard Index Across All Media and All Exposure Routes: 2E+02

Total Liver HI = 6E+00

Total Developmental HI = 1E+01

Total Hematopoietic HI = 2E+01

Total Kidney HI = 9E-01

Total CNS HI = 1E+02

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TABLE 10.1 RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Area A						PCBs (total)	Developmental	1E-01	--	1E+00	1E+00
			(Total)	--	--	--	--	(Total)		1E-01	--	1E+00	1E+00

Total Risk Across Soil: --

Total Risk Across All Media and All Exposure Routes: --

Total Hazard Index Across All Media and All Exposure Routes: 1E+00

Total Hematopoietic HI = --

Total Developmental HI = 1E+00

Total GI tract HI = --

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TABLE 10.3 RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area A											
								Antimony	Hematopoietic	3E+00	No Tox Data	N/A	3E+00
								Arsenic	Hematopoietic	1E+01	No Tox Data	2E+00	1E+01
								Cobalt	Hematopoietic	7E-03	4E+00	N/A	4E+00
								Manganese	CNS	1E+00	9E+01	N/A	9E+01
			(Total)	--	--	--	--	(Total)		1E+01	9E+01	2E+00	1E+02

Total Risk Across Soil: --

Total Risk Across All Media and All Exposure Routes: --

Total Hazard Index Across All Media and All Exposure Routes: 1E+02

Total Liver HI = --

Total Developmental HI = --

Total Hematopoietic HI = 2E+01

Total Kidney HI = --

Total GI tract HI = --

Total CNS HI = 9E+01

401184

TABLE 10.5 RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area A						Antimony	Hematopoietic	4E+00	--	N/A	4E+00
			Arsenic	6E-03	--	3E-03	9E-03	Arsenic	Hematopoietic	1E+01	--	1E+01	2E+01
			(Total)	6E-03	--	3E-03	9E-03	(Total)		2E+01	--	1E+01	3E+01

Total Risk Across Soil: 9E-03

Total Risk Across All Media and All Exposure Routes: 9E-03

Total Hazard Index Across All Media and All Exposure Routes: 3E+01

Total Liver HI = --

Total Developmental HI = --

Total Hematopoietic HI = 3E+01

Total Kidney HI = --

Total GI tract HI = --

Total CNS HI = --

401185

TABLE 10.2 RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
All Soil	All Soil	Area G						PCBs (total)	Developmental	7E-01	--	2E+00	3E+00
			Arsenic	8E-04	--	3E-04	1E-03	Arsenic	Hematopoietic	2E+00	--	1E+00	3E+00
								Manganese	CNS	1E+01	--	N/A	1E+01
			(Total)	8E-04	--	3E-04	1E-03	(Total)		2E+01	--	4E+00	2E+01

Total Risk Across Soil: 1E-03

Total Risk Across All Media and All Exposure Routes: 1E-03

Total Hazard Index Across All Media and All Exposure Routes: 2E+01

Total Liver HI = --

Total Developmental HI = 3E+00

Total Hematopoietic HI = 3E+00

Total Kidney HI = --

Total CNS HI = 1E+01

401186

TABLE 10.9 RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

CAPTAIN'S COVE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Upper Glacial Aquifer-Tap water						Chloroform	Liver	6E-01	4E+01	1E-02	4E+01
								Antimony	Hematopoietic	3E+00	--	5E-02	3E+00
			Arsenic	2E-04	--	5E-04	7E-04	Arsenic	Hematopoietic	1E+03	--	3E+00	1E+03
			(Total)	2E-04	--	5E-04	7E-04	(Total)		1E+03	4E+01	3E+00	1E+03

Total Risk Across Groundwater: 7E-04

Total Risk Across All Media and All Exposure Routes: 7E-04

Total Hazard Index Across All Media and All Exposure Routes: 1E+03

Total Liver HI = 4E+01

Total Lung HI = --

Total Kidney HI = --

Total Hematopoietic HI = 1E+03

401187

ATTACHMENT I

401188

ATTACHMENT I

SITE NAME: Captains Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: S&ME, Inc.

PHYSICAL PARAMETERS

Sample ID No.	CC-TP-4-7-8	CC-SB-24-6-8	CC-TP-3-7-8
Matrix	SOIL	SOIL	SOIL
Atterberg Limits (%)			
Corrected Liquid Limit % Moisture:		24	
Plastic Limit % Moisture		20	
Plasticity Index	NP	4	NP
Moisture Content (%)	R	24.2 E	R
Grain Size Distribution (% passing):			
Grain Size 3" (75.000mm)	100	100	100
Grain Size 2" (50.000mm)	100	100	100
Grain Size 1.5" (37.500mm)	100	100	100
Grain Size 1.0" (25.000mm)	100	100	100
Grain Size 3/4" (19.000mm)	100	100	100
Grain Size 3/8" (9.500mm)	98.9	96.5	96.8
Grain Size No. 4 (4.750mm)	87.4	94.1	94.9
Grain Size No. 10 (2.000mm)	73.6	90.8	92.9
Grain Size No. 20 (0.850mm)	48.0	87.8	90.8
Grain Size No. 40 (0.425mm)	14.9	82.3	85.0
Grain Size No. 50 (0.300mm)	6.0	78.4	67.8
Grain Size No. 100 (0.150mm)	2.7	70.1	9.1
Grain Size No. 200 (0.075mm)	2.0	59.3	3.3
Grain Size Distribution (% passing):			
Grain Size (0.051mm)	1.5	*	1.9
Grain Size (0.050mm)	*	*	*
Grain Size (0.048mm)	*	*	*
Grain Size (0.046mm)	*	*	*
Grain Size (0.044mm)	*	47.0	*
Grain Size (0.041mm)	*	*	*
Grain Size (0.025mm)	0.9	*	1.1
Grain Size (0.024mm)	*	*	*
Grain Size (0.023mm)	*	37.2	*
Grain Size (0.021mm)	*	*	*
Grain Size (0.013mm)	0.4	*	0.6
Grain Size (0.012mm)	*	28.7	*
Grain Size (0.011mm)	*	*	*
Grain Size (0.007mm)	0.1	*	0.2
Grain Size (0.006mm)	*	18.9	*
Grain Size (0.003mm)	0.0	10.0	0.0

NOTES:
* = not required
NP=Nonplastic

401190

SITE NAME: Captains Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: S&ME, Inc.

PHYSICAL PARAMETERS			
Sample ID No.	CC-WS-4	CC-SED-1	CC-SB-15-0-2
Matrix	SOIL	SOIL	SOIL
Atterberg Limits (%)			
Corrected Liquid Limit % Moisture:			19
Plastic Limit % Moisture			15
Plasticity Index	NP	NP	4
Moisture Content (%)	R	R	R
Grain Size Distribution (% passing):			
Grain Size 3" (75.000mm)	100	100	100
Grain Size 2" (50.000mm)	100	100	100
Grain Size 1.5" (37.500mm)	100	100	100
Grain Size 1.0" (25.000mm)	100	100	100
Grain Size 3/4" (19.000mm)	100	92.1	100
Grain Size 3/8" (9.500mm)	99.7	75.1	93.0
Grain Size No. 4 (4.750mm)	98.8	57.9	87.8
Grain Size No. 10 (2.000mm)	98.4	45.4	81.6
Grain Size No. 20 (0.850mm)	96.3	29.8	71.5
Grain Size No. 40 (0.425mm)	58.2	11.9	59.8
Grain Size No. 50 (0.300mm)	34.4	5.8	52.4
Grain Size No. 100 (0.150mm)	9.7	2.6	42.6
Grain Size No. 200 (0.075mm)	5.1	2.0	36.7
Grain Size Distribution (% passing):			
Grain Size (0.051mm)	*	*	*
Grain Size (0.050mm)	3.6	1.9	*
Grain Size (0.048mm)	*	*	*
Grain Size (0.046mm)	*	*	29.8
Grain Size (0.044mm)	*	*	*
Grain Size (0.041mm)	*	*	*
Grain Size (0.025mm)	2.2	1.1	*
Grain Size (0.024mm)	*	*	*
Grain Size (0.023mm)	*	*	26.5
Grain Size (0.021mm)	*	*	*
Grain Size (0.013mm)	1.6	0.9	*
Grain Size (0.012mm)	*	*	20.4
Grain Size (0.011mm)	*	*	*
Grain Size (0.007mm)	1.0	0.3	*
Grain Size (0.006mm)	*	*	16.9
Grain Size (0.003mm)	0.2	0.1	11.8

NOTES:
* = not required
NP=Nonplastic

SITE NAME: Captains Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: S&ME, Inc.

PHYSICAL PARAMETERS

Sample ID No.	CC-TP-5-1-2	SB-01-8-10	SB-23-4-6
Matrix	SOIL	SOIL	SOIL
Atterberg Limits (%)			
Corrected Liquid Limit % Moisture:	20	24	32
Plastic Limit % Moisture	19	17	30
Plasticity Index	1	7	2
Moisture Content (%)	R	11.6	R
Grain Size Distribution (% passing):			
Grain Size 3" (75.000mm)	100	100	100
Grain Size 2" (50.000mm)	100	100	100
Grain Size 1.5" (37.500mm)	100	100	100
Grain Size 1.0" (25.000mm)	100	100	100
Grain Size 3/4" (19.000mm)	88.2	97.1	97
Grain Size 3/8" (9.500mm)	78.9	91.9	92.5
Grain Size No. 4 (4.750mm)	69.8	88.2	89.7
Grain Size No. 10 (2.000mm)	62.1	82.7	86.0
Grain Size No. 20 (0.850mm)	52.5	76.6	82.8
Grain Size No. 40 (0.425mm)	38.6	66.6	77.0
Grain Size No. 50 (0.300mm)	31.1	57.4	73.6
Grain Size No. 100 (0.150mm)	22.6	45.8	67.9
Grain Size No. 200 (0.075mm)	18.9	39.9	62.7
Grain Size Distribution (% passing):			
Grain Size (0.051mm)	*	*	*
Grain Size (0.050mm)	*	*	*
Grain Size (0.048mm)	14.6	*	*
Grain Size (0.046mm)	*	30.2	*
Grain Size (0.044mm)	*	*	*
Grain Size (0.041mm)	*	*	61.3
Grain Size (0.025mm)	*	*	*
Grain Size (0.024mm)	11.9	*	*
Grain Size (0.023mm)	*	25.5	*
Grain Size (0.021mm)	*	*	53.8
Grain Size (0.013mm)	9.9	*	*
Grain Size (0.012mm)	*	22.1	*
Grain Size (0.011mm)	*	*	48.3
Grain Size (0.007mm)	*	*	*
Grain Size (0.006mm)	7.0	16.4	34.6
Grain Size (0.003mm)	5.2	12.4	5.9

NOTES:
* = not required
NP=Nonplastic

ATTACHMENT J

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ATTACHMENT J

VOLATILES

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES							
Sample ID No.	CC-TP-1-7-8	CC-TP-2-4-5	CC-TP-3-2-3	CC-TP-3-5-6	CC-TP-4-5-6	CC-TP-5-6-7	CC-TP-6-5-6
Lab No.	9804123-1	9804123-5	9804123-10	9804123-7	9804110-11	9804110-6	9804110-5
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	ug/kg	mg/L	ug/kg	ug/kg	ug/kg	ug/kg
Depth	7–8	4–5	2–3	5–6	5–6	6–7	5–6
Dilution Factor	1	1	5	1	1	1	1
Percent Moisture	32.9	29	TCLP	26.6	37.1	13	25.1
Chloromethane			NR				
Vinyl Chloride							
Bromomethane			NR				
Chloroethane			NR				
1,1-Dichloroethene							
Acetone		140 E	NR				
Carbon Disulfide			NR	12 J			
Methylene Chloride			NR				
1,2-Dichloroethene			NR				
1,1-Dichloroethane			NR				
2-Butanone		50				12	
Chloroform							
1,2-Dichloroethane							
1,1,1-Trichloroethane			NR				
Carbon Tetrachloride							
Benzene							
Trichloroethene							
1,2-Dichloropropane			NR				
Bromodichloromethane			NR				
cis-1,3-Dichloropropene			NR				
trans-1,3-Dichloropropene			NR				
1,1,2-Trichloroethane			NR				
Bromoform			NR				
Dibromodichloromethane			NR				
4-Methyl-2-Pentanone			NR				
Toluene			NR				
2-Hexanone			NR				
Tetrachloroethene							
Chlorobenzene							
Ethylbenzene			NR				
Xylenes (total)			NR				18
Styrene			NR				
1,1,2,2-Tetrachloroethane			NR				

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

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SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-SED-1	CC-SED-3	CC-SW-1	CC-SW-2	CC-SW-3	CC-SB-04-2-4	CC-SB-04-4-6	CC-SB-05-2-4
Lab No.	9804135-3	9804135-1	9804135-8	9804135-7	9804135-86	9804263-3	9804263-4	9805023-1
Matrix	SOIL	SOIL	WATER	WATER	WATER	SOIL	SOIL	SOIL
Units	ug/kg	ug/kg	ug/L	ug/L	ug/L	ug/kg	ug/kg	ug/kg
Depth	0–1	0–1	-	-	-	2–4	4–6	2–4
Dilution Factor	1	1	1	1	1	1	1	1
Percent Moisture	18.1	67.3	-	-	-	20.9	7.3	12
Chloromethane								
Vinyl Chloride								
Bromomethane								
Chloroethane								
1,1-Dichloroethene								
Acetone		520 E						18 E
Carbon Disulfide								
Methylene Chloride								
1,2-Dichloroethene								
1,1-Dichloroethane								
2-Butanone		110 E						
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane								
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane								
Bromodichloromethane								
cis-1,3-Dichloropropene								
trans-1,3-Dichloropropene								
1,1,2-Trichloroethane								
Bromoform								
Dibromodichloromethane								
4-Methyl-2-Pentanone								
Toluene								
2-Hexanone								
Tetrachloroethene								
Chlorobenzene								
Ethylbenzene								
Xylenes (total)								
Styrene								
1,1,2,2-Tetrachloroethane								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401197

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-SB-07-0-2	CC-SB-08-0-2	CC-SB-09-0-2	CC-SB-12-4-6	CC-SB-13-4-6	CC-SB-14-2-4	CC-SB-15-2-4	CC-SB-16-6-8
Lab No.	9805057-8	9805072	9804216-5	9805057-7	9805013-4	9805013-6	9804167-4	9804216-6
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/L
Depth	0–2	0–2	0–2	4–6	4–6	2–4	2–4	6–8
Dilution Factor	1	1	1	1	1	1	1	5
Percent Moisture	21.8	9.8	10.8	17.8	14.7	34.9	20.0	TCLP
Chloromethane								NR
Vinyl Chloride								
Bromomethane								NR
Chloroethane								NR
1,1-Dichloroethene								
Acetone				390 E				NR
Carbon Disulfide								NR
Methylene Chloride								NR
1,2-Dichloroethene								NR
1,1-Dichloroethane								NR
2-Butanone				89 E			14	
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane								NR
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane								NR
Bromodichloromethane								NR
cis-1,3-Dichloropropene								NR
trans-1,3-Dichloropropene								NR
1,1,2-Trichloroethane								NR
Bromoform								NR
Dibromodichloromethane								NR
4-Methyl-2-Pentanone								NR
Toluene								NR
2-Hexanone								NR
Tetrachloroethene								
Chlorobenzene								
Ethylbenzene								NR
Xylenes (total)								NR
Styrene								NR
1,1,2,2-Tetrachloroethane								NR

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401198

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-SB-16-8-10	CC-SB-17-2-4	CC-SB-18-4-6	CC-SB-19-0-2	CC-SB-20-4-6	CC-SB-21-0-2	CC-SB-21-2-4	CC-SB-22-2-4
Lab No.	9804216-3	9804167-1	9805013-1	9805013-7	9804187-3	9804187-4	9804187-5	9804246-3
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Depth	8–10	2–4	4–6	0–2	4–6	0–2	2–4	2–4
Dilution Factor	1	1	1	1	1	1	50	1
Percent Moisture	6.8	16.9	19.6	23.9	16.5	12.4	13.1	9.1
Chloromethane								
Vinyl Chloride								
Bromomethane								
Chloroethane								
1,1-Dichloroethene								
Acetone								
Carbon Disulfide	11 E							
Methylene Chloride								
1,2-Dichloroethene								
1,1-Dichloroethane								
2-Butanone	10 J	11 J						
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane								
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane								
Bromodichloromethane								
cis-1,3-Dichloropropene								
trans-1,3-Dichloropropene								
1,1,2-Trichloroethane								
Bromoform								
Dibromodichloromethane								
4-Methyl-2-Pentanone								
Toluene								
2-Hexanone								
Tetrachloroethene								
Chlorobenzene						42 E	42000	
Ethylbenzene								
Xylenes (total)								
Styrene								
1,1,2,2-Tetrachloroethane								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-SB-23-4-6	CC-SB-24-4-6	CC-SB-24-6-8	CC-SB-25-2-4	CC-SB-26-6-8	CC-SB-27-0-2	CC-SB-MW7-2-4	CC-SB-MW8-2-4
Lab No.	9804246	9804246-13	9804246	9805023-3	9804263-2	98005057-3	9804263-5	9805057-6
Matrix	SOIL	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	mg/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Depth	4–6	4–6	6–8	2–4	6-8	6-8	2–4	2–4
Dilution Factor	1	5	1	1	1	1	1	1
Percent Moisture	21.5	TCLP	21.5	12	24.6	7.1	8.8	10.5
Chloromethane		NR						
Vinyl Chloride								
Bromomethane		NR						
Chloroethane		NR						
1,1-Dichloroethene								
Acetone		NR		20 E		11 E		14 E
Carbon Disulfide		NR						
Methylene Chloride		NR						
1,2-Dichloroethene		NR						
1,1-Dichloroethane		NR						
2-Butanone								
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane		NR						
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane		NR						
Bromodichloromethane		NR						
cis-1,3-Dichloropropene		NR						
trans-1,3-Dichloropropene		NR						
1,1,2-Trichloroethane		NR						
Bromoform		NR						
Dibromodichloromethane		NR						
4-Methyl-2-Pentanone		NR						
Toluene		NR						
2-Hexanone		NR						
Tetrachloroethene								4 J
Chlorobenzene								
Ethylbenzene		NR						
Xylenes (total)		NR						
Styrene		NR						
1,1,2,2-Tetrachloroethane		NR						

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%

401200

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-TCLP-4	CC-TCLP-5	CC-MW-1	CC-MW-2	CC-MW-3	CC-MW-5	CC-MW-6	CC-MW-7
Lab No.	9805129-3	9805129-4	9806117-5	9806117-6	9806079-7	9806079-10	9806117-2	9806079-2
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Depth	NA	NA	-	-	-	-	-	-
Dilution Factor	5	5	1	1	1	1	1	1
Percent Moisture	TCLP / NA	TCLP / NA	-	-	-	-	-	-
Chloromethane	NR	NR						
Vinyl Chloride					2.6 J			
Bromomethane	NR	NR						
Chloroethane	NR	NR						
1,1-Dichloroethene								
Acetone	NR	NR						
Carbon Disulfide	NR	NR						
Methylene Chloride	NR	NR						
1,2-Dichloroethene	NR	NR			2.2 J			
1,1-Dichloroethane	NR	NR						
2-Butanone								
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane	NR	NR						
Carbon Tetrachloride								
Benzene					8.4 J			
Trichloroethene								
1,2-Dichloropropane	NR	NR						
Bromodichloromethane	NR	NR						
cis-1,3-Dichloropropene	NR	NR						
trans-1,3-Dichloropropene	NR	NR						
1,1,2-Trichloroethane	NR	NR						
Bromoform	NR	NR						
Dibromodichloromethane	NR	NR						
4-Methyl-2-Pentanone	NR	NR						
Toluene	NR	NR			88			
2-Hexanone	NR	NR						
Tetrachloroethene								
Chlorobenzene			2.6 J	4.5 J		6.2 J		
Ethylbenzene	NR	NR						
Xylenes (total)	NR	NR			2.5 J			
Styrene	NR	NR						
1,1,2,2-Tetrachloroethane	NR	NR						

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401201

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-MW-8	CC-MW-CDM-1	CC-MW-CDM-2	CC-MW-CDM-3	CC-MW-CDM-4	CC-TP-DUP-01-6-7	CC-SED-DUP-01	CC-SW-DUP-01
Lab No.	9806117-4	9806079-3	9806079-6	9806079-8	9806079-9	9804110-7	9804135-2	9804135-5
Matrix	WATER	WATER	WATER	WATER	WATER	SOIL	SOIL	WATER
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/kg	ug/kg	ug/L
Depth	-	-	-	-	-	6–7	0–1	-
Dilution Factor	1	1	5	1	1	1	1	1
Percent Moisture	-	-	-	-	-	13	56.7	-
Chloromethane								
Vinyl Chloride			190					
Bromomethane								
Chloroethane								
1,1-Dichloroethene								
Acetone							490 E	
Carbon Disulfide								
Methylene Chloride			28 J					
1,2-Dichloroethene			218					
1,1-Dichloroethane								
2-Butanone							110 E	
Chloroform			610					
1,2-Dichloroethane					4.2			
1,1,1-Trichloroethane								
Carbon Tetrachloride								
Benzene			13 J					
Trichloroethene			70					
1,2-Dichloropropane								
Bromodichloromethane								
cis-1,3-Dichloropropene								
trans-1,3-Dichloropropene								
1,1,2-Trichloroethane								
Bromoform								
Dibromodichloromethane								
4-Methyl-2-Pentanone								
Toluene								
2-Hexanone								
Tetrachloroethene			130					
Chlorobenzene			500		3.5 J			
Ethylbenzene								
Xylenes (total)								
Styrene								
1,1,2,2-Tetrachloroethane								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor > 1 and/or percent moisture > 0%.

401202

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-SB-DUP1-2-4	CC-SB-DUP-02	CC-MW-DUP	CC-MW-TB-1	CC-MW-TB-2	CC-MW-TB-3	CC-SB-TB-1	CC-SW-TB-2
Lab No.	9804246-5	9805057-4	9806117-3	9806079-1	9806079-5		9804110-1	9804135-4
Matrix	SOIL	SOIL	WATER	WATER	WATER		WATER	WATER
Units	ug/kg	ug/kg	ug/L	ug/L	ug/L		ug/L	ug/L
Depth	2--4	0--2	-	-	-		-	-
Dilution Factor	1	1	1	1	1		1	1
Percent Moisture	10.6	8.9	-	-	-		-	-
Chloromethane								
Vinyl Chloride								
Bromomethane								
Chloroethane								
1,1-Dichloroethene								
Acetone		10 J					5.5 J	
Carbon Disulfide								
Methylene Chloride							2.2 J	
1,2-Dichloroethene								
1,1-Dichloroethane								
2-Butanone								
Chloroform								
1,2-Dichloroethane								
1,1,1-Trichloroethane								
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane								
Bromodichloromethane								
cis-1,3-Dichloropropene								
trans-1,3-Dichloropropene								
1,1,2-Trichloroethane								
Bromoform								
Dibromodichloromethane								
4-Methyl-2-Pentanone								
Toluene								
2-Hexanone								
Tetrachloroethene								
Chlorobenzene								
Ethylbenzene								
Xylenes (total)								
Styrene								
1,1,2,2-Tetrachloroethane								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%

401203

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES								
Sample ID No.	CC-MW-FB-01	CC-SB-FB-1	CC-SB-FB-2	CC-SB-FB-3	CC-SB-FB-4	CC-SB-FB-5	CC-SB-FB-6	CC-SB-FB-07
Lab No.	9806079-4	9804110-2	9804110-3	9804167-5	9804187-6	9804246-5	9805023-2	9805190-1
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Depth	-	-	-	-	-	-	-	-
Dilution Factor	1	1	1	1	1	1	1	1
Percent Moisture	-	-	-	-	-	-	-	-
Chloromethane								
Vinyl Chloride								
Bromomethane								
Chloroethane								
1,1-Dichloroethene								
Acetone		7.4 J	8.6 J			4.1 J		23 E
Carbon Disulfide								
Methylene Chloride			2.1 J	2.6 J	2.8 J	4.3 J	5.1 J	
1,2-Dichloroethene								
1,1-Dichloroethane								
2-Butanone								
Chloroform								
1,2-Dichloroethane								4.7 J
1,1,1-Trichloroethane								
Carbon Tetrachloride								
Benzene								
Trichloroethene								
1,2-Dichloropropane								
Bromodichloromethane								
cis-1,3-Dichloropropene								
trans-1,3-Dichloropropene								
1,1,2-Trichloroethane								
Bromoform								
Dibromodichloromethane								
4-Methyl-2-Pentanone								
Toluene								
2-Hexanone								
Tetrachloroethene								
Chlorobenzene								
Ethylbenzene								
Xylenes (total)								
Styrene								
1,1,2,2-Tetrachloroethane								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%

401204

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

VOLATILES			
Sample ID No.	CC-SB-FB-08	CC-MW-TB-3	
Lab No.		9806117-1	
Matrix		WATER	
Units		ug/L	
Depth		-	
Dilution Factor		1	
Percent Moisture		-	
Chloromethane			
Vinyl Chloride			
Bromomethane			
Chloroethane			
1,1-Dichloroethene			
Acetone			
Carbon Disulfide			
Methylene Chloride			
1,2-Dichloroethene			
1,1-Dichloroethane			
2-Butanone			
Chloroform			
1,2-Dichloroethane			
1,1,1-Trichloroethane			
Carbon Tetrachloride			
Benzene			
Trichloroethene			
1,2-Dichloropropane			
Bromodichloromethane			
cis-1,3-Dichloropropene			
trans-1,3-Dichloropropene			
1,1,2-Trichloroethane			
Bromoform			
Dibromodichloromethane			
4-Methyl-2-Pentanone			
Toluene			
2-Hexanone			
Tetrachloroethene			
Chlorobenzene			
Ethylbenzene			
Xylenes (total)			
Styrene			
1,1,2,2-Tetrachloroethane			

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates pos
E - estimated value
J - estimated value, compound present below CRQL but above ID
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401205

SEMI-VOLATILES

SITE NAME: Captain's Cove
PROJECT # 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

SEMI-VOLATILES											
Sample ID No.	CC-TP-1-7-8	CC-TP-2-4-5	CC-TP-3-2-3	CC-TP-3-5-8	CC-TP-4-5-8	CC-TP-5-6-7	CC-TP-6-5-6	CC-BED-1	CC-BED-3	CC-SW-1	CC-SW-2
Lab No.	9604123-1	9604123-5	9604123-10	9604123-7	9604110-11	9604110-6	9604110-5	9604135-3	9604135-1	9604135-6	9604135-7
Matrix	SOIL	SOIL	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	WATER
Units	ug/kg	ug/kg	mg/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/L	ug/L
Depth	7-8	4-5	2-3	5-6	5-6	6-7	5-6	0-1	0-1	-	-
Dilution Factor	1	10	1	10	1	1	10	1	1	1	1
Percent Moisture	32.9	29	TCLP	27.8	37.1	13	25.1	18.1	87.3	-	-
Phenol			(Pyridine)								
bis(2-chloroethyl)ether			(3-Methylphenol)								
2-Chlorophenol			NR								
1,3-Dichlorobenzene			NR								
1,4-Dichlorobenzene											
1,2-Dichlorobenzene			NR								
2-Methylphenol									740 J		
2,2'-oxybis(1-Chloropropane)			NR								
4-Methylphenol											
N-Nitroso-di-n-dipropylamine			NR								
Hexachloroethane											
Nitrobenzene											
Isophorone			NR								
2-Nitrophenol			NR								
2,4-Dimethylphenol			NR						260 J		
bis(2-Chloroethoxy)methane			NR								
2,4-Dichlorophenol			NR								
1,2,4-Trichlorobenzene			NR								
Naphthalene			NR								
4-Chloroaniline			NR								
Hexachlorobutadiene											
4-Chloro-3-Methylphenol			NR								
2-Methylnaphthalene			NR				710 J				
Hexachlorocyclopentadiene			NR								
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene			NR								
2-Nitroaniline			NR								
Dimethylphthalate			NR								
Acenaphthylene			NR								
2,6-Dinitrotoluene			NR								
3-Nitroaniline			NR								
Acenaphthene			NR								
2,4-Dinitrophenol			NR								
4-Nitrophenol			NR								
Dibenzofuran			NR								
2,4-Dinitrotoluene											
Diethylphthalate			NR								
4-Chorophenyl-phenyl ether			NR								
Fluorene			NR								
4-Nitroaniline			NR								
4,6-Dinitro-2-methylphenol			NR								
N-nitrosodiphenylamine			NR								
4-Bromophenyl-phenyl ether			NR								
Hexachlorobenzene											
Pentachlorophenol											
Phenanthrene		870 J	NR				1100 J		240 J		
Anthracene			NR								
Carbazole			NR								
Di-n-butylphthalate			NR			45 J					
Fluoranthene		600 J	NR				530 J		310 J		
Pyrene		860 J	NR	480 J		40 J	1000 J		450 J		
Butylbenzylphthalate			NR								
3,3'-Dichlorobenzidine			NR								
Benzo(a)anthracene		510 J	NR						230 J		
Chrysene			NR								
bis(2-ethylhexyl)phthalate			NR								
Di-n-octylphthalate			NR								
Benzo(b)fluoranthene			NR		74 J				220 J		
Benzo(k)fluoranthene			NR								
Benzo(a)pyrene			NR								
Indeno(1,2,3-cd)pyrene			NR								
Dibenz(a,h)anthracene			NR								
Benzo(g,h,i)perylene			NR								

NOTES
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample. Indicated possible laboratory blank contamination
E - estimated value

J - estimated value - compound present below CRQL but above IDL
[illegible]
[illegible]

NR - analysis not required
Detection limits elevated if Dilution Factor > 1 and/or percent moisture > 0%

401207

SITE NAME Captain's Cove
PROJECT # 8001-202
EPA CASE NO NA
LAB NAME: Paragon Analytics

SEMI-VOLATILES

Sample ID No	CC-SW-3	CC-SB-04 2-4	CC-SB-04 4-6	CC-SB-05 2-4	CC-SB-07-0-2	CC-SB-08-0-2	CC-SB-09-0-2	CC-SB-12-4-6	CC-SB-13-4-6	CC-SB-14-2-4	CC-SB-15-2-4
Lab No	9804135-6	9804263 3	9804263 4	9805073-1	9805057-8	9805072-1	9804218-5	9805057-7	9805013-4	9805013-6	9804187-4
Matrix	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Depth	-	2-4	4-6	2-4	0-2	0-2	0-2	4-6	4-6	2-4	2-4
Dilution Factor	1	2	1	1	1	1	1	5	1	1	1
Percent Moisture	-	20.9	7.3	12	21.8	9.8	10.8	17.6	14.7	34.9	20
Phenol											
bis(2-chloroethyl)ether											
2-Chlorophenol											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
1,2-Dichlorobenzene											
2-Methylphenol											
2,2'-oxybis(1-Chloropropane)											
4-Methylphenol		130 J									
N-Nitroso-di-n-dipropylamine											
Hexachloroethane											
Nitrobenzene											
Isophorone											
2-Nitrophenol											
2,4-Dimethylphenol		120 J									
bis(2-Chloroethoxy)methane											
2,4-Dichlorophenol											
1,2,4-Trichlorobenzene											
Naphthalene		6100	180 J						41 J		
4-Chloroaniline											
Hexachlorobutadiene											
4-Chloro-3-Methylphenol											
2-Methylnaphthalene		3200	150 J								
Hexachlorocyclopentadiene											
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene											
2-Nitroaniline											
Dimethylphthalate											
Acenaphthylene											
2,6-Dinitrotoluene											
3-Nitroaniline											
Acenaphthene		3400	670						57 J		
2,4-Dinitrophenol											
4-Nitrophenol											
Dibenzofuran		2500	230 J								
2,4-Dinitrotoluene											
Diethylphthalate											
4-Chorophenyl-phenyl ether											
Fluorene		2900	390						43 J		
4-Nitroaniline											
4,6-Dinitro-2-methylphenol											
N-nitrosodiphenylamine		140 J									
4-Bromophenyl-phenyl ether											
Hexachlorobenzene											
Pentachlorophenol											
Phenanthrene		5800	1000	100 J	93 J	160 J		430 J	700	53 J	
Anthracene		1600	850						130 J		
Carbazole		1400	140 J						99 J		
Di-n-butylphthalate											
Fluoranthene		4500	1900	120 J	99 J	170 J		600 J	1000	160 J	
Pyrene		3900	2000	87 J	210 J	200 J		830 J	890	110 J	
Butylbenzylphthalate											
3,3'-Dichlorobenzidine											
Benzo(a)anthracene		1400	830	55 J	86 J	54 J		400 J	450	120 J	
Chrysene		990	750	55 J	95 J	140 J		330 J	360 J	95 J	
bis(2-ethylhexyl)phthalate											
Di-n-octylphthalate											
Benzo(b)fluoranthene		1200	1100	110 J	150 J	260 J		430 J	640	250 J	
Benzo(k)fluoranthene					46 J	64 J		210 J	190 J		
Benzo(a)pyrene		870 J	510	51 J	88 J	130 J		380 J	440	92 J	
Indeno(1,2,3-cd)pyrene		250 J	200 J			92 J		250 J	220 J	64 J	
Dibenz(a,h)anthracene									54 J		
Benzo(g,h,i)perylene		240 J	210 J			77 J		220 J	230 J	74 J	

NOTES
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicated possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not meet EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor > 1 and/or percent moisture > 0%

401208

SITE NAME Captain's Cove
PROJECT # 8001-202
EPA CASE NO NA
LAB NAME Paragon Analytics

SEMI VOLATILES Sample ID No	CC-SB-16-6-8	CC-SB-16-8-10	CC-SB-17-2-4	CC-SB-18-4-6	CC-SB-19-0-2	CC-SB-20-4-6	CC-SB-21-0-2	CC-SB-21-2-4	CC-SB-22-2-4	CC-SB-23-4-6	CC-SB-24-4-6
Lab No	9604216-6	9604216-3	9604187-1	9605013-1	9605013-7	9604187-6	9604187-4	9604187-5	9604246-3	9604246-11	9604246-13
Matrix	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER
Units	mg/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/L
Depth	-	8-10	2-4	4-6	0-2	4-6	0-2	2-4	2-4	4-6	4-6
Dilution Factor	1	1	1	2	1	1	10	2	2	1	1
Percent Moisture	TCLP	8.8	18.9	19.8	23.9	16.5	12.4	13.1	9.1	18.8	TCLP
Phenol	(Pyridine)										(Pyridine)
bis(2-chloroethyl)ether	(3-Methylphenol)										(3-Methylphenol)
2-Chlorophenol	NR										NR
1,3-Dichlorobenzene	NR										NR
1,4-Dichlorobenzene											
1,2-Dichlorobenzene	NR										NR
2-Methylphenol											
2,2'-oxybis(1-Chloropropane)	NR										NR
4-Methylphenol											
N-Nitroso-di-n-dipropylamine	NR										NR
Hexachloroethane											
Nitrobenzene											
Isophorone	NR										NR
2-Nitrophenol	NR										NR
2,4-Dimethylphenol	NR										NR
bis(2-Chloroethoxy)methane	NR										NR
2,4-Dichlorophenol	NR										NR
1,2,4-Trichlorobenzene	NR										NR
Naphthalene	NR								730 J		NR
4-Chloroaniline	NR										NR
Hexachlorobutadiene											
4-Chloro-3-Methylphenol	NR										NR
2-Methylnaphthalene	NR								1300		NR
Hexachlorocyclopentadiene	NR										NR
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene	NR										NR
2-Nitroaniline	NR										NR
Dimethylphthalate	NR										NR
Acenaphthylene	NR								77 J		NR
2,6-Dinitrotoluene	NR										NR
3-Nitroaniline	NR										NR
Acenaphthene	NR			360 J					4100		NR
2,4-Dinitrophenol	NR										NR
4-Nitrophenol	NR										NR
Dibenzofuran	NR			130 J					2400		NR
2,4-Dinitrotoluene											
Diethylphthalate	NR										NR
4-Chorophenyl-phenyl ether	NR										NR
Fluorene	NR			250 J	45 J				3700		NR
4-Nitroaniline	NR										NR
4,6-Dinitro-2-methylphenol	NR										NR
N-nitrosodiphenylamine	NR										NR
4-Bromophenyl-phenyl ether	NR										NR
Hexachlorobenzene											
Pentachlorophenol											
Phenanthrene	NR		190 J	3000	310 J				8600	88 J	NR
Anthracene	NR			700 J	65 J				4600		NR
Carbazole	NR			480 J					2700		NR
Di-n-butylphthalate	NR								76 J	98 J	NR
Fluoranthene	NR		250 J	5800	440 J	84 J			8600	130 J	NR
Pyrene	NR		270 J	4500	300 J	90 J			9500	150 J	NR
Butylbenzylphthalate	NR										NR
3,3'-Dichlorobenzidine	NR										NR
Benzo(a)anthracene	NR		170 J	2700	240 J				4000	100 J	NR
Chrysene	NR		140 J	1900	170 J				3100	100 J	NR
bis(2-ethylhexyl)phthalate	NR										NR
Di-n-octylphthalate	NR										NR
Benzo(b)fluoranthene	NR		270 J	5600	430 J	110 J			3700	[illegible]	NR
Benzo(k)fluoranthene	NR										NR
Benzo(a)pyrene	NR		150 J	3200	250 J				1600	100 J	NR
Indeno(1,2,3-cd)pyrene	NR			1500	130 J				490 J		NR
Dibenz(a,h)anthracene	NR			310 J							NR
Benzo(g,h,i)perylene	NR		69 J	1600	150 J				450 J		NR

NOTES
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicated possible/probable blank contamination
E - estimated value

J - estimated value, compound present below CRQL but above IDL
analysis did not pass EPA QA/QC
presumptive evidence of the presence of the material

NR - analysis not required
Detection limits elevated if DIL[illegible] factor
> 1 and/or percent moisture > 0%

401209

SITE NAME Captain's Cove
PROJECT # 8001-202
EPA CASE NO NA
LAB NAME: Paragon Analytics

SEMI-VOLATILES											
Sample ID No	CC-SB-24-8-8	CC-SB-25-2-4	CC-SB-26-6-8	CC-SB-27-0-2	CC-SB-MW7-2-4	CC-SB-MW8-2-4	CC-TCLP-4	CC-TCLP-5	CC-MW-1	CC-MW-2	CC-MW-3
Lab No	9804246-10	9805073-3	9804263-2	9805057-3	9804263-5	9805057-6	9805129-3	9805129-4	9805180-4	9805180-5	9805175-2
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	WATER	WATER	WATER	WATER
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/L	mg/L	ug/L	ug/L	ug/L
Depth	6–8	2–4	6–8	0–2	2–4	2–4	NA	NA	-	-	-
Dilution Factor	1	1	1	1	2	1	1	1	1	1	1
Percent Moisture	21.5	12	24.6	7.1	8.8	10.5	TCLP / NA	TCLP / NA	-	-	-
Phenol	200 J						(Pyridine)	(Pyridine)			
bis(2-chloroethyl)ether							(3-Methylphenol)	(3-Methylphenol)			
2-Chlorophenol							NR	NR			
1,3-Dichlorobenzene							NR	NR			
1,4-Dichlorobenzene											
1,2-Dichlorobenzene							NR	NR			
2-Methylphenol											
2,2'-oxybis(1-Chloropropane)							NR	NR			
4-Methylphenol											2.2 J
N-Nitroso-di-n-dipropylamine							NR	NR			
Hexachloroethane											
Nitrobenzene											
Isophorone							NR	NR			
2-Nitrophenol							NR	NR			
2,4-Dimethylphenol							NR	NR			
bis(2-Chloroethoxy)methane							NR	NR			
2,4-Dichlorophenol							NR	NR			
1,2,4-Trichlorobenzene							NR	NR			
Naphthalene							NR	NR			5.5 J
4-Chloroaniline							NR	NR			
Hexachlorobutadiene											
4-Chloro-3-Methylphenol							NR	NR			
2-Methylnaphthalene							NR	NR			1.1 J
Hexachlorocyclopentadiene							NR	NR			
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene							NR	NR			
2-Nitroaniline							NR	NR			
Dimethylphthalate							NR	NR			
Acenaphthylene							NR	NR			
2,6-Dinitrotoluene							NR	NR			
3-Nitroaniline							NR	NR			
Acenaphthene		52 J				78 J	NR	NR		19	1.3 J
2,4-Dinitrophenol							NR	NR			
4-Nitrophenol							NR	NR			
Dibenzofuran						46 J	NR	NR		6.2 J	
2,4-Dinitrotoluene											
Diethylphthalate							NR	NR			1.2 J
4-Chorophenyl-phenyl ether							NR	NR			
Fluorene		53 J				88 J	NR	NR		4.7 J	
4-Nitroaniline							NR	NR			
4,6-Dinitro-2-methylphenol							NR	NR			
N-nitrosodiphenylamine							NR	NR			
4-Bromophenyl-phenyl ether							NR	NR			
Hexachlorobenzene											
Pentachlorophenol											
Phenanthrene		450			130 J	930	NR	NR			
Anthracene		120 J				180 J	NR	NR			
Carbazole		63				88 J	NR	NR		1.8 J	
Di-n-butylphthalate							NR	NR			
Fluoranthene		380		66 J	190 J	1000	NR	NR			
Pyrene		370 J		83 J	190 J	1700	NR	NR			
Butylbenzylphthalate							NR	NR			
3,3'-Dichlorobenzidine							NR	NR			
Benzo(a)anthracene		270 J		49 J	130 J	740	NR	NR			
Chrysene		180 J		51 J	120 J	590	NR	NR			
bis(2-ethylhexyl)phthalate							NR	NR			
Di-n-octylphthalate							NR	NR			
Benzo(b)fluoranthene		290 J		82 J	250 J	1100	NR	NR			
Benzo(k)fluoranthene		110 J					NR	NR			
Benzo(a)pyrene		220 J		59 J	140 J	640	NR	NR			
Indeno(1,2,3-cd)pyrene		120 J		43 J	65 J		NR	NR			
Dibenz(a,h)anthracene							NR	NR			
Benzo(g,h,i)perylene		110 J		46 J	100 J		NR	NR			

NOTES
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicated possible/probable blank contamination
E - estimated value
J estimated value compound present below CRQL but above IDL
R analysis did not pass EPA QA/QC
N presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor > 1 and/or percent moisture > 0%

401210

SITE NAME: Captain's Cove
PROJECT # 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

SEMI-VOLATILES											
Sample ID No.	CC-MW-5	CC-MW-6	CC-MW-7	CC-MW-8	CC-MW-CDM-1	CC-MW-CDM-2	CC-MW-CDM-3	CC-MW-CDM-4	CC-TP-DUP-01-8-7	CC-SED-DUP-01	CC-SW-DUP-01
Lab No	9805175-1	9805190-6	9805208-3	9805208-2	9805198-5	9805198-2	9805198-3	9805190-7	9804110-7	9804135-2	9804135-5
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	SOIL	SOIL	WATER
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/kg	ug/kg	ug/L
Depth	-	-	-	-	-	-	-	-	6-7	0-1	-
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Percent Moisture	-	-	-	-	-	-	-	-	13	56.7	-
Phenol					2.1 J						
bis(2-chloroethyl)ether					3.7 J						
2-Chlorophenol					2.1 J	1.5 J					
1,3-Dichlorobenzene						10					
1,4-Dichlorobenzene						37					
1,2-Dichlorobenzene						19					
2-Methylphenol											
2,2'-oxybis(1-Chloropropane)											
4-Methylphenol										520 J	
N-Nitroso-di-n-dipropylamine											
Hexachloroethane											
Nitrobenzene											
Isophorone											
2-Nitrophenol											
2,4-Dimethylphenol											
bis(2-Chloroethoxy)methane											
2,4-Dichlorophenol											
1,2,4-Trichlorobenzene					2.5 J	31					
Naphthalene											
4-Chloroaniline											
Hexachlorobutadiene											
4-Chloro-3-Methylphenol											
2-Methylnaphthalene											
Hexachlorocyclopentadiene											
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene											
2-Nitroaniline											
Dimethylphthalate											
Acenaphthylene											
2,6-Dinitrotoluene											
3-Nitroaniline											
Acenaphthene											
2,4-Dinitrophenol											
4-Nitrophenol											
Dibenzofuran											
2,4-Dinitrotoluene											
Diethylphthalate											
4-Chorophenyl-phenyl ether											
Fluorene											
4-Nitroaniline											
4,6-Dinitro-2-methylphenol											
N-nitrosodiphenylamine											
4-Bromophenyl-phenyl ether											
Hexachlorobenzene											
Pentachlorophenol											
Phenanthrene										530 J	
Anthracene										180 J	
Carbazole											
Di-n-butylphthalate											
Fluoranthene										460 J	
Pyrene									41 J	760 J	
Butylbenzylphthalate											
3,3'-Dichlorobenzidine											
Benzo(a)anthracene										350 J	
Chrysene										280 J	
bis(2-ethylhexyl)phthalate						2.8 J					
Di-n-octylphthalate											
Benzo(b)fluoranthene										360 J	
Benzo(k)fluoranthene											
Benzo(a)pyrene										300 J	
Indeno(1,2,3-cd)pyrene										180 J	
Dibenz(a,h)anthracene											
Benzo(g,h,i)perylene										180 J	

NOTES
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicated possible/probable blank contamination
E - estimated value

J - estimated value - compound present below CRQL but above IDL
analytes did not pass EPA QA/QC
presumptive evidence of the presence of the material

NR - analysis not required
Detection limits elevated if Dilution factor > 1 and/or percent moisture > 0%

401211

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

SEMI-VOLATILES										
Sample ID No.	CC-SB-DUP1-2-4	CC-SB-DUP-02	CC-MW-DUP01	CC-SB-FB-1	CC-SB-FB-3	CC-SB-FB-4	CC-SB-FB-5	CC-SB-FB-6	CC-SB-FB-07	CC-SB-FB-08
Lab No.	9804246-5	9805057-4	9805198-4	9804110-2	9804187-5	9804187-6	9804246-6	9805023-2	9805190-1	
Matrix	SOIL	SOIL	WATER	WATER	WATER	WATER	WATER	WATER	WATER	
Units	ug/kg	ug/kg	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Depth	2–4	0–2	-	-	-	-	-	-	-	
Dilution Factor	2	1	1	1	1	1	1	1	1	
Percent Moisture	10.6	8.9	-	-	-	-	-	-	-	
Phenol										
bis(2-chloroethyl)ether										
2-Chlorophenol										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
1,2-Dichlorobenzene										
2-Methylphenol										
2,2'-oxybis(1-Chloropropane)										
4-Methylphenol										
N-Nitroso-di-n-dipropylamine										
Hexachloroethane										
Nitrobenzene										
Isophorone										
2-Nitrophenol										
2,4-Dimethylphenol										
bis(2-Chloroethoxy)methane										
2,4-Dichlorophenol										
1,2,4-Trichlorobenzene										
Naphthalene	860									
4-Chloroaniline										
Hexachlorobutadiene										
4-Chloro-3-Methylphenol										
2-Methylnaphthalene	1100									
Hexachlorocyclopentadiene										
2,4,6-Trichlorophenol										
2,4,5-Trichlorophenol										
2-Chloronaphthalene										
2-Nitroaniline										
Dimethylphthalate										
Acenaphthylene										
2,6-Dinitrotoluene										
3-Nitroaniline										
Acenaphthene	2600									
2,4-Dinitrophenol										
4-Nitrophenol										
Dibenzofuran	1600									
2,4-Dinitrotoluene										
Diethylphthalate										
4-Chorophenyl-phenyl ether										
Fluorene	2300									
4-Nitroaniline										
4,6-Dinitro-2-methylphenol										
N-nitrosodiphenylamine										
4-Bromophenyl-phenyl ether										
Hexachlorobenzene										
Pentachlorophenol										
Phenanthrene	5300	62 J								
Anthracene	2500									
Carbazole	1100									
Di-n-butylphthalate	-									
Fluoranthene	5000	95 J								
Pyrene	5700	130 J								
Butylbenzylphthalate										
3,3'-Dichlorobenzidine										
Benzo(a)anthracene	2200	64 J								
Chrysene	2100	76 J								
bis(2-ethylhexyl)phthalate							1.1 J			
Di-n-octylphthalate										
Benzo(b)fluoranthene	1900	180 J								
Benzo(k)fluoranthene	570 J									
Benzo(a)pyrene	1100	92 J								
Indeno(1,2,3-cd)pyrene	400 J	78 J								
Dibenz(a,h)anthracene										
Benzo(g,h,i)perylene	370 J	69 J								

NOTES:
Blank space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicated possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor > 1 and/or percent moisture > 0%

401212

PESTICIDES/PCBS

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-TP-1-7-8	CC-TP-2-4-5	CC-TP-3-2-3	CC-TP-3-5-6	CC-TP-4-5-6	CC-TP-5-6-7	CC-TP-6-5-6	CC-SED-1
Lab No.	9804123-1	9804123-5	9804123-10	9804123-7	9804110-11	9804110-6	9804110-5	9804135-3
Matrix	SOIL	SOIL	WATER	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	ug/kg	mg/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Depth	7–8	4–5	2–3	5–6	5–6	6–7	5–6	0–1
Dilution Factor	1	5	1	1	2	1	100	1
Percent Moisture	32.9	29	TCLP / NA	26.8	37.1	13	25.1	18.1
alpha-BHC			Herbicide (2,4-D)					
beta-BHC			Herbicide (Silvex)					
delta-BHC			(Chlordane)					
gamma-BHC (Lindane)								
Heptachlor					4.1 J			
Aldrin			NR					
Heptachlor epoxide		34 E	NR		22 E			
Endosulfan I			NR				250 EN	
Dieldrin			NR					
4,4'-DDE		120 E	NR					
Endrin								
Endosulfan II			NR					
4,4'-DDD		180	NR		8.1 J			
Endosulfan sulfate			NR					
4,4'-DDT		19.0 J	NR			15 EN		
Methoxychlor								
Endrin ketone			NR			8.8 EN		
Endrin aldehyde			NR	8.4 E				
alpha-Chlordane		230 E	NR		92 EN			
gamma-Chlordane		200	NR		88	2.3 EN		
Toxaphene								
Aroclor-1016			NR					
Aroclor-1221			NR					
Aroclor-1232			NR					
Aroclor-1242			NR					
Aroclor-1248			NR				12000	
Aroclor-1254			NR			74		
Aroclor-1260	43 J		NR			78		

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401214

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-SED-3	CC-SW-1	CC-SW-2	CC-SW-3	CC-SB-04-2-4	CC-SB-04-4-6	CC-SB-05-2-4	CC-SB-07-0-2
Lab No.	9804135-1	9804135-6	9804135-7	9804135-8	9804263-3	9804263-4	9805023-1	9805057-8
Matrix	SOIL	WATER	WATER	WATER	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	ug/L	ug/L	ug/L	ug/kg	ug/kg	ug/kg	ug/kg
Depth	0–1	-	-	-	2–4	4–6	2–4	0–2
Dilution Factor	1	1	1	1	5	1	1	1
Percent Moisture	67.3	-	-	-	20.9	7.3	12	21.8
alpha-BHC								
beta-BHC								
delta-BHC								
gamma-BHC (Lindane)								
Heptachlor								
Aldrin								
Heptachlor epoxide	2.8 J							3.1
Endosulfan I								
Dieldrin								
4,4'-DDE								14
Endrin								
Endosulfan II								
4,4'-DDD	7.2 J				32 EN	3 J	11	17
Endosulfan sulfate								
4,4'-DDT	5.5 J				28 EN			6.9 E
Methoxychlor								
Endrin ketone					22 EN	13 EN		
Endrin aldehyde								
alpha-Chlordane	18 E				33 EN	1.3 J	4.3	13
gamma-Chlordane	14 E				26 EN	2	2.7 E	11
Toxaphene								
Aroclor-1016								
Aroclor-1221								
Aroclor-1232								
Aroclor-1242								
Aroclor-1248					230		21 J	
Aroclor-1254					220			
Aroclor-1260								

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401215

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-SB-08-0-2	CC-SB-09-0-2	CC-SB-12-4-6	CC-SB-13-4-6	CC-SB-14-2-4	CC-SB-15-2-4	CC-SB-16-6-8	CC-SB-16-8-10
Lab No.	9805072-1	9804216-5	9805057-7	9805013-4	9805013-6	9804187-4	9804216-6	9804216-3
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	SOIL
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/L	ug/kg
Depth	0–2	0–2	4–6	4–6	2–4	2–4	-	8–10
Dilution Factor	1	1	5	1	1	10	1	1
Percent Moisture	9.8	10.8	17.8	14.7	34.9	20	TCLP / NA	6.8
alpha-BHC				4.4			Herbicide (2,4-D)	
beta-BHC					8.4		Herbicide (Silvex)	
delta-BHC		3.6 E					(Chlordane)	
gamma-BHC (Lindane)								
Heptachlor								
Aldrin							NR	
Heptachlor epoxide							NR	
Endosulfan I							NR	
Dieldrin							NR	
4,4'-DDE				5.1	3.8 J	9.3	NR	
Endrin								
Endosulfan II							NR	
4,4'-DDD		2.2 J	50 E				NR	
Endosulfan sulfate							NR	
4,4'-DDT				12			NR	
Methoxychlor								
Endrin ketone							NR	
Endrin aldehyde							NR	
alpha-Chlordane		3.9 E		20	5.3		NR	
gamma-Chlordane		3.7		21	4.1		NR	
Toxaphene								
Aroclor-1016							NR	
Aroclor-1221							NR	
Aroclor-1232							NR	
Aroclor-1242							NR	
Aroclor-1248			2400 E				NR	
Aroclor-1254							NR	
Aroclor-1260				170.0			NR	

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401216

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-SB-17-2-4	CC-SB-18-4-6	CC-SB-19-0-2	CC-SB-20-4-6	CC-SB-21-0-2	CC-SB-21-2-4	CC-SB-22-2-4	CC-SB-23-4-6
Lab No.	9804167-1	9805013-1	9805013-7	9804187-3	9804187-4	9804187-5	9804246-3	9804246-11
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Depth	2–4	4–6	0–2	4–6	0–2	2–4	2–4	4–6
Dilution Factor	1	5	1	1	50	5	1	1
Percent Moisture	18.9	19.6	23.9	18.5	12.4	13.1	9.1	18.6
alpha-BHC								
beta-BHC								2.1 EN
delta-BHC			7.5			11.0 EN		
gamma-BHC (Lindane)								
Heptachlor								3.9 EN
Aldrin								
Heptachlor epoxide			2.2 J	2.8 EN		28.0 EN	2.4	
Endosulfan I					100 EN	13.0 EN	2.4	8.6 EN
Dieldrin				4.9 EN				12.0 EN
4,4'-DDE	9.3 EN		8.1	4.6 EN		19.0 EN	8.6 EN	14.0 EN
Endrin								
Endosulfan II								
4,4'-DDD	10 EN			4.7 EN		29.0 E	10.0 E	
Endosulfan sulfate								
4,4'-DDT			18	6.6 EN			9.0	
Methoxychlor								
Endrin ketone							11.0 E	6.8 EN
Endrin aldehyde								
alpha-Chlordane			12	16 EN	130 EN	52.0 EN	4.9	9.7 EN
gamma-Chlordane			10	12 EN		29.0 EN	7.9	
Toxaphene								
Aroclor-1016								
Aroclor-1221								
Aroclor-1232								
Aroclor-1242								
Aroclor-1248			81		5500	610.0		220
Aroclor-1254				130				310
Aroclor-1260	62							

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%

401217

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-SB-24-4-6	CC-SB-24-6-8	CC-SB-25-2-4	CC-SB-26-6-8	CC-SB-27-0-2	CC-SB-MW7-2-4	CC-SB-MW8-2-4	CC-TCLP-4
Lab No.	9804246-13	9804246-10	9805023-3	9804263	9805057-3	9804263-5	9805057-6	9805129-3
Matrix	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER
Units	mg/L	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/L
Depth	-	6–8	2–4	6–8	0–2	2–4	2–4	NA
Dilution Factor	1	1	1	1	1	5	5	1
Percent Moisture	TCLP / NA	21.5	12	24.6	7.1	8.8	10.5	TCLP / NA
alpha-BHC	Herbicide (2,4-D)							Herbicide (2,4-D)
beta-BHC	Herbicide (Silvex)							Herbicide (Silvex)
delta-BHC	(Chlordane)				17.0			(Chlordane)
gamma-BHC (Lindane)								
Heptachlor								
Aldrin	NR							NR
Heptachlor epoxide	NR					5.7 J		NR
Endosulfan I	NR	3.3 EN		2.5 EN				NR
Dieldrin	NR							NR
4,4'-DDE	NR		7.1 E		2 J		20 E	NR
Endrin								
Endosulfan II	NR							NR
4,4'-DDD	NR		11			61		NR
Endosulfan sulfate	NR							NR
4,4'-DDT	NR		9.9		14 E	12 J	100 E	NR
Methoxychlor								
Endrin ketone	NR					24 EN		NR
Endrin aldehyde	NR							NR
alpha-Chlordane	NR	3.5 EN	13		1.9 E	30 E		NR
gamma-Chlordane	NR		14	3.6 EN	1.4 J	35		NR
Toxaphene								
Aroclor-1016	NR							NR
Aroclor-1221	NR							NR
Aroclor-1232	NR							NR
Aroclor-1242	NR							NR
Aroclor-1248	NR	84	61	89				NR
Aroclor-1254	NR	78		64				NR
Aroclor-1260	NR							NR

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401218

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-TCLP-5	CC-MW-1	CC-MW-2	CC-MW-3	CC-MW-5	CC-MW-6	CC-MW-7	CC-MW-8
Lab No.	9805129-4	9805190-4	9805190-5	9805175-2	9805175-1	9805190-6	9805208-3	9805208-2
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Units	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Depth	NA	-	-	-	-	-	-	-
Dilution Factor	1	1	1	1	1	1	1	1
Percent Moisture	TCLP / NA	-	-	-	-	-	-	-
alpha-BHC	Herbicide (2,4-D)							
beta-BHC	Herbicide (Silvex)							
delta-BHC	(Chlordane)							
gamma-BHC (Lindane)								
Heptachlor								
Aldrin	NR							
Heptachlor epoxide	NR							
Endosulfan I	NR							
Dieldrin	NR							
4,4'-DDE	NR							
Endrin								
Endosulfan II	NR							
4,4'-DDD	NR							
Endosulfan sulfate	NR							
4,4'-DDT	NR							
Methoxychlor								
Endrin ketone	NR							
Endrin aldehyde	NR							
alpha-Chlordane	NR							
gamma-Chlordane	NR							
Toxaphene								
Aroclor-1016	NR							
Aroclor-1221	NR							
Aroclor-1232	NR							
Aroclor-1242	NR							
Aroclor-1248	NR							
Aroclor-1254	NR							
Aroclor-1260	NR							

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401219

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs								
Sample ID No.	CC-MW-CDM-1	CC-MW-CDM-2	CC-MW-CDM-3	CC-MW-CDM-4	CC-TP-DUP-01-6-7	CC-SED-DUP-01	CC-SW-DUP-01	CC-SB-DUP1-2-4
Lab No.	9805198-5	9805198-2	9805198-3	CC-MW-CDM-4	9804110-7	9804135-2	9804135-5	9804246-5
Matrix	WATER	WATER	WATER	9805190-7	SOIL	SIOL	WATER	SOIL
Units	ug/L	ug/L	ug/L	WATER	ug/kg	ug/kg	ug/L	ug/kg
Depth	-	-	-	ug/L	6–7	0–1	-	2–4
Dilution Factor	1	1	1	-	1	1	1	1
Percent Moisture	-	-	-	1	13	56.7	-	10.6
alpha-BHC								
beta-BHC								
delta-BHC								1.9 E
gamma-BHC (Lindane)								
Heptachlor								
Aldrin								
Heptachlor epoxide						2 J		
Endosulfan I								2.1
Dieldrin								6.8 EN
4,4'-DDE								7.1 EN
Endrin								
Endosulfan II								
4,4'-DDD						7.2 J		7.2 E
Endosulfan sulfate				0.17				5.2 EN
4,4'-DDT					11 EN	4.4 J		11.0
Methoxychlor								
Endrin ketone					5.8 EN			13.0 E
Endrin aldehyde								
alpha-Chlordane						13 E		
gamma-Chlordane					2.5 EN	9 E		7.4 E
Toxaphene								
Aroclor-1016								
Aroclor-1221								
Aroclor-1232								
Aroclor-1242								
Aroclor-1248								
Aroclor-1254					59			
Aroclor-1260					58			

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%.

401220

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

PESTICIDES/PCBs									
Sample ID No.	CC-SB-DUP-02	CC-MW-DUP01	CC-SB-FB-1	CC-SB-FB-3	CC-SB-FB-4	CC-SB-FB-5	CC-SB-FB-6	CC-SB-FB-07	
Lab No.	9805057-4	9805198-4	9804110-2	9804167-5	9804187-6	9804248-8	9805023-2	9805190-1	
Matrix	SOIL	WATER	WATER	WATER	WATER	WATER	WATER	WATER	
Units	ug/kg	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Depth	0–2	-	-	-	-	-	-	-	
Dilution Factor	1	1	1	1	1	1	1	1	
Percent Moisture	8.9	-	-	-	-	-	-	-	
alpha-BHC									
beta-BHC	15								
delta-BHC									
gamma-BHC (Lindane)									
Heptachlor									
Aldrin									
Heptachlor epoxide									
Endosulfan I									
Dieldrin									
4,4'-DDE									
Endrin									
Endosulfan II									
4,4'-DDD									
Endosulfan sulfate									
4,4'-DDT	13								
Methoxychlor									
Endrin ketone									
Endrin aldehyde									
alpha-Chlordane									
gamma-Chlordane									
Toxaphene									
Aroclor-1016									
Aroclor-1221									
Aroclor-1232									
Aroclor-1242									
Aroclor-1248									
Aroclor-1254									
Aroclor-1260									

NOTES:
Blank Space - compound analyzed for, but not detected
B - compound found in lab blank as well as sample, indicates possible/probable blank contamination
E - estimated value
J - estimated value, compound present below CRQL but above IDL
R - analysis did not pass EPA QA/QC
N - presumptive evidence of the presence of the material
NR - analysis not required
Detection limits elevated if Dilution Factor
> 1 and/or percent moisture > 0%

401221

INORGANICS

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

401223

INORGANICS							
Sample ID No.	CC-TP-1-7-8	CC-TP-2-4-5	CC-TP-3-2-3	CC-TP-3-5-6	CC-TP-4-5-6	CC-TP-5-6-7	CC-TP-6-5-6
Lab Number	9804123-1	9804123-5	9804123-10	9804123-7	9804110-11	9804110-6	9804110-5
Matrix	SOIL	SOIL	WATER	SOIL	SOIL	SOIL	SOIL
Depth	7--8	4--5	2--3	5--6	5--6	6--7	5--6
Units	mg/kg	mg/kg	ug/L	mg/kg	mg/kg	mg/kg	mg/kg
Percent Solids	67.1	71	TCLP	72.2	62.9	87	74.9
Aluminum	8470	13300	NR	10300	13700	7520	5050
Antimony	1030	65.6	NR	234	103 E		55.5 E
Arsenic	2760	249	772	1700	1470	8.0	262
Barium	193	289	124 J	662	354	54.2	741
Beryllium	2.9	2	NR	2.6	4.3	0.51 J	5.4
Cadmium	174	38.6	34.4 J	139	28.0	0.72 J	21.4
Calcium	38700	61900	NR	44000	66900	2000	191000
Chromium	23.3	25.2	11.7 J	91.2	40.1 E	16.8 E	9.1 E
Cobalt	331	100	NR	228	379 E	11.9 E	129 E
Copper	11300	556	NR	4170	2140	23.2	1740
Iron	200000	42100	NR	168000	115000	14200	88600
Lead	29500	4950	32.7	10000	3480	27.3	1130
Magnesium	27400	3520	NR	8110	39100	1600	1350
Manganese	2300	3070	NR	26100	7030	1120	30900
Mercury	0.37	0.52		1.0	0.49	0.10 J	4.1
Nickel	145	42	NR	81.1	112	14.1	37.0
Potassium	705 J	2500	NR	744 J	972 J	623 J	747 J
Selenium	72.0	33.3		57.3	43.1	2.3	65.1
Silver	245	37.7		63.5	46.7	0.71 J	72.2
Sodium	9990	1490	NR	6050	3960	113 J	5210
Thallium			NR		R	R	R
Vanadium	28.1	25.5	NR	34.3	22.2 E	18 E	21.2 E
Zinc	9630	5870	NR	9930	4620 E	52.6 E	1770 E
Cyanide	0.79		NR				

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SED-1	CC-SED-3	CC-SW-1	CC-SW-2	CC-SW-3	CC-SB-04-2-4	CC-SB-04-4-6
Lab Number	9804135-3	9804135-1	9804135-6	9804135-7	9804135-8	9804263-3	9804263-4
Matrix	SOIL	SOIL	WATER	WATER	WATER	SOIL	SOIL
Depth	0–1	0–1	-	-	-	2–4	4–6
Units	mg/kg	mg/kg	ug/L	ug/L	ug/L	mg/kg	mg/kg
Percent Solids	81.9	32.7	-	-	-	79.1	92.7
Aluminum	1550	11800 E			15000	8230	6770
Antimony	1.3 E	12.2 J			23.3 J		
Arsenic	0.96 J	17.8 E		3.5 J	39.9	19.6	3.9
Barium	5.8 J	126 E	11.4 J	140 J	444	113	41.2 J
Beryllium	0.18 J	0.81 J	0.24 J		0.57 J	0.08 J	0.16 J
Cadmium	0.26 J	2.8 J	0.47 J	1 J	8.6	1.6	0.33 J
Calcium	421 J	3760 E	11100	54800	74000	7190	988 J
Chromium	2.1 J	36.4 E			41.5	26.1	9.8
Cobalt	1.3 J	19.5 J		3.6 J	43.6 J	9.4 J	8.5 J
Copper	3.4 J	180 E	4.4 J	7 J	333	120	17.6
Iron	3200	29200 E	1900	19400	62000	43800	10500
Lead	3.9	271 E		2.1 J	418	145	21.9
Magnesium	332 J	2780 J	1680 J	12800 E	14400 E	2990	1500
Manganese	52.5	386 E	334	587	1840	444	316
Mercury		0.35 E		0.03 J	0.55	0.08 J	0.07 J
Nickel	2.3 J	41.2 E	0.76 J	3.4 J	63.6	56.8	10
Potassium	150 J	1420 J	1980 J	8100	9080	1310	729 J
Selenium		3.1 E			6.7	1.2 J	0.69 J
Silver		7.2 E			11.1	3.9	0.26 J
Sodium		121 J	2340 J	25300	5430	437 J	63.4 J
Thallium						3.9	
Vanadium	3.6 J	43.9 E		2.4 J	59.9	24.0	15.1
Zinc		364 E	12.2 J	14 J	772 E	212	33.8
Cyanide							

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401224

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SB-05-2-4	CC-SB-07-0-2	CC-SB-08-0-2	CC-SB-09-0-2	CC-SB-12-4-6	CC-SB-13-4-6	CC-SB-14-2-4
Lab Number	9805023-1	9805057-8	9805072-1	9804216-5	9805057-7	9805013-4	9805013-6
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Depth	2--4	0--2	0--2	0--2	4--6	4--6	2--4
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Percent Solids	88.0	78.2	90.2	89.2	82.2	85.3	65.1
Aluminum	6480	3320	6150	2760	5750	10500	19700
Antimony		2.3 J			8.3 J	175 E	1160 E
Arsenic	6.2	10.8	6.6	1.6 J	15.9	51.1	2030
Barium	166	91.8	52.5	16.1 J	394	119	1200
Beryllium	0.32 J	0.21 J	0.43 J		0.32 J	0.58 J	6.8
Cadmium	0.40 J	1.1 J	0.42 J	0.13 J	4.6	5	95.1
Calcium	1360 E	19900 E	1150	6030	10100 E	17300 E	87400 E
Chromium	17.8	18.2	10.9	6.5 E	26.7	44.1	91.2
Cobalt	9.9 J	5 J	7.5 J	2.1 J	6.9 J	31.4	162
Copper	42.1	180	24.7	11.5 E	416	305	4750
Iron	15000	18100	13800	4230	18600	38700	203000
Lead	59.3	297	31.1	15.8	801	735	6810
Magnesium	1230	10300	1460	582 J	3770	2030	4230
Manganese	247	217	372	70.2	424	1780	30900
Mercury	0.04 J	0.19	0.02 J		0.38	0.18	0.6
Nickel	14.9	19	10.5	3.7 J	57.3	27.9	121
Potassium	641 J	448 J	853 J	317 J	695 J	1250	893 J
Selenium	2.0	1.4			2	5.2	26.1
Silver	1.1	2.4 J	1.1 J		2.5	6.1	114
Sodium	79.8 J	140 J	30 J	67.3 J	172 J	394 J	14100
Thallium						2 J	
Vanadium	22.4	14.5	18.4	6.6 J	31.4	21.9	41.7
Zinc	87.9	301	52.9	25.9	826	451	17300
Cyanide							0.61 J

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401225

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SB-15-2-4	CC-SB-16-6-8	CC-SB-16-8-10	CC-SB-17-2-4	CC-SB-18-4-6	CC-SB-19-0-2	CC-SB-20-4-6
Lab Number	9804167-4	9804216-6	9804216-3	9804167-1	9805013-1	9805013-7	9804187-3
Matrix	SOIL	WATER	SOIL	SOIL	SOIL	SOIL	SOIL
Depth	2--4	6--8	8--10	2--4	4--6	0--2	4--6
Units	mg/kg	ug/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Percent Solids	80	TCLP	93.2	81.1	80.4	76.1	81.5
Aluminum	8120	NR	839	8750	12800	9140	7700
Antimony	34.7	NR	208	731	887 E	216 E	6.1 J
Arsenic	628	162	171	747	815	83.9	18.3
Barium	50.3	1310 J	6.5 J	442	535	176	99.2
Beryllium	1.0 J	NR		1.8	2.3	0.37 J	0.27 J
Cadmium	6.8	17.4 J	0.95 J	39.7	44.1	4	1.5
Calcium	80300	NR	1200	37000	69100 E	14400 E	5990
Chromium	16.3		5.7 E	22.7	29.1	22.5	17.5
Cobalt	11.4 J	NR	2.1 J	95.5	162	22.2	6.5 J
Copper	428	NR	200 E	2900	1640	253	99.8
Iron	28800	NR	5850	58400	59000	37300	17800
Lead	1150	19.5 J	57.5	3330	3990	398	163
Magnesium	2310	NR	248 J	2110	3520	2480	1700
Manganese	1720	NR	115	3310	8470	1850	359
Mercury	0.25		0.11	0.44	2.4	0.14	0.07 J
Nickel	14.2	NR	2.2 J	50.1	60.2	24.7	17.3
Potassium	1140 J	NR	105 J	1430	1600	805 J	725 J
Selenium	17.8	51	3.2	26.6	20.1	5.4	1.7
Silver	4.6		4.1 E	207	146	11.3	4.2
Sodium	885 J	NR	199 J	3650	2530	537 J	330 J
Thallium		NR				1.6 J	
Vanadium	23.2	NR	7.4 J	29.7	30.8	23.2	14.3
Zinc	214	NR	27.7	3910	2940	396	259
Cyanide		NR					

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401226

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SB-21-0-2	CC-SB-21-2-4	CC-SB-22-2-4	CC-SB-23-4-6	CC-SB-24-4-6	CC-SB-24-6-8	CC-SB-25-2-4
Lab Number	9804187-4	9804187-5	9804246-3	9804246-11	9804246-13	9804246-10	9805023-3
Matrix	SOIL	SOIL	SOIL	SOIL	WATER	SOIL	SOIL
Depth	0–2	2–4	2–4	4–6	4–6	6–8	2–4
Units	mg/kg	mg/kg	mg/kg	mg/kg	ug/L	mg/kg	mg/kg
Percent Solids	87.6	86.9	90.9	81.4	TCLP	78.5	88.0
Aluminum	6410	5900	4410	5350	NR	4040	5590
Antimony	23.0	5.6 J	4.7 J	15.1	NR	201	27.6 E
Arsenic	17.1	11.5	61.1	229		196	19.1
Barium	236	123	263	832	1770 J	855	109
Beryllium	0.22 J	0.18 J	0.37 J	2	NR	0.95 J	0.26 J
Cadmium	3.4	1.4	3.1	18.6	45.2 J	16.1	1.3
Calcium	9650	11300	5350	49300	NR	69900	5270 E
Chromium	28.4	39.6	25.6	102		244	15.0
Cobalt	7.6 J	5.5 J	100	103	NR	172	8.9 J
Copper	395	117	179	566	NR	714	116
Iron	63000	34300	15500	132000	NR	106000	18200
Lead	512	317	142	870		3000	199
Magnesium	2100	3180	1450	2000	NR	1060 J	1780
Manganese	635	286	3970	63700	NR	215000	436
Mercury	0.14	0.08 J	0.21	0.74		1.1	0.13
Nickel	36.7	19.3	75.6	46.3	NR	27.3	18.0
Potassium	631 J	491 J	496 J	789 J	NR	768 J	636 B
Selenium	3.8	1.3	6.9	42.5	139	133	1.6
Silver	4.1	1.8 J	7.8	17.1	13.6 J	51.6	3
Sodium	688 J	198 J	301 J	2120	NR	6130	235 J
Thallium	2.6 J				NR		
Vanadium	18.3	19.7	18.5	31.6	NR	19.3	15.6
Zinc	714	268	168	929	NR	586	335
Cyanide					NR		

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401227

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SB-26-6-8	CC-SB-27-0-2	CC-SB-MW7-2-4	CC-SB-MW8-2-4	CC-TCLP-4	CC-TCLP-5	CC-MW-1
Lab Number	9804263-2	9805057-3	9804263-5	9805057-6	9805129-3	9805129-4	9805190-4
Matrix	SOIL	SOIL	SOIL	SOIL	WATER	WATER	WATER
Depth	6-8	0--2	2--4	2--4	NA	NA	-
Units	mg/kg	mg/kg	mg/kg	mg/kg	ug/L	ug/L	ug/L
Percent Solids	75.4	92.9	91.2	89.5	TCLP	TCLP	-
Aluminum	3300	4260	5310	7180	NR	NR	13200
Antimony	43.3		2.1 J	1.9 J	NR	NR	
Arsenic	341	3	6.8	9.3			6690
Barium	524	52.1	117	163	81.9 J	66.9 J	446
Beryllium	2.4	0.35 J		0.42 J	NR	NR	0.78 J
Cadmium	37.2	0.26 J	1.4	0.78 J	14.1 J	81.7 E	
Calcium	204000	918 J	5670	2690 E	NR	NR	197000
Chromium	10.1	8.8	20.0	18.8		5 J	24.6 E
Cobalt	93.5	4.2 J	6.6 J	7.3 J	NR	NR	14.6 J
Copper	1850	16.5	115	62.3	NR	NR	60.6
Iron	96500	8620	15400	19100	NR	NR	158000
Lead	1200	93.9	166	243			98.1
Magnesium	887 J	1160	2660	1900	NR	NR	68400
Manganese	51700	194	269	278	NR	NR	6670
Mercury	0.75	0.06 J	0.14	0.11			0.83
Nickel	33.8	6.2 J	24.0	17.8	NR	NR	22.0 J
Potassium	339 J	712 J	713 J	947 J	NR	NR	33800
Selenium	57.4			1.4	61.2 E	52.5 E	32.1 E
Silver	53.2	0.28 J	4.2	0.45 J			
Sodium	9150	28.8 J	289 J	67.8 J	NR	NR	287000
Thallium					NR	NR	10.1
Vanadium	13.3 J	12.3	17.2	20.7	NR	NR	52.5
Zinc	1780	72.5	214	378	NR	NR	182 E
Cyanide					NR	NR	

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401228

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-MW-1	CC-MW-2	CC-MW-2	CC-MW-3	CC-MW-3	CC-MW-5	CC-MW-5
Lab Number	9805190-9	9805190-5	9805190-10	9805175-2	9805175-5	9805175-1	9805175-4
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Depth	-	-	-	-	-	-	-
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Percent Solids	dissolved	-	dissolved	-	dissolved	-	dissolved
Aluminum		467		33400		121000	25.6 J
Antimony							
Arsenic	648	49.1	2.3 J	22.2 E		325	106
Barium	42.5 J	342	62.1 J	448	209	356	104 J
Beryllium				1.8 J		6.6	
Cadmium				2.1 J			
Calcium	149000	195000	179000	129000	115000	203000	199000
Chromium		1.5 J		97.0 E	0.51 J	229 E	
Cobalt	3.2 J	2.8 J	1.5 J	34.1 J	0.84 J	185	2.9 J
Copper		9.1 J	2.7 J	247	1.0 J	770	0.92 J
Iron	25000	180000	1040	143000	21500	248000	4760
Lead		2.0 J		188		544	
Magnesium	57900	48000	48200	26000	19900	76500	64300
Manganese	4690	191	160	949	592	2190	1060
Mercury		0.04 J		0.50		0.69	
Nickel	2.1 J	4.6 J	2.6 J	52.4	1.4 J	224	11.6 J
Potassium	29200 E	22500	21500 E	15300	10200 E	57900	44900 E
Selenium	13.6 E	12.5 E		4.5 J		18.4 J	
Silver				9.5 J			
Sodium	273000	102000	97000	R	R	90200	76600
Thallium	7.9 J	17.7	9.2 J	8.7 J			
Vanadium	1.5 J	12.1 J	1.1 J	134	1.3 J	396	4.0 J
Zinc	30.9	42.5 E	20.4 E	308 E	16.0 J	2590	13.0 J
Cyanide	NR		NR	R	NR	R	NR

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401229

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-MW-6	CC-MW-6	CC-MW-7	CC-MW-7	CC-MW-8	CC-MW-8	CC-MW-CDM-1
Lab Number	9805190-6	9805190-11	9805208-3	9805208-5	9805208-2	980520-4	9805198-5
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Depth	-	-	-	-	-	-	-
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Percent Solids	-	dissolved	-	dissolved	-	dissolved	-
Aluminum	15000	80.0 J	1650	92.5 J	55500	254 E	15000
Antimony	56.6 J	15.7 J	15.5 J	14.0 J	40.5 J	41.4 J	
Arsenic	191	115	240	195	11400	10200	121
Barium	297	155 J	192 J	101 J	163 J	41.1 J	121 J
Beryllium	0.48 J	0.16 J			2.5 J		0.17 J
Cadmium	4.3 J				3.1 J		
Calcium	104000	68100	32400	27000	30200	16600	130000
Chromium	15.0 E		4.0 J		105 E		5.0 J
Cobalt	20.2 J	1.7 J	11.2 J		39.5 J	1.4 J	49.1 J
Copper	284	6.3 J	63.5	2.3 J	276	12.3 J	32.3
Iron	20300	474	4260	235	128000	649	28400
Lead	439		66.4		157		13.1
Magnesium	64200	60000	12700	12000	47500	23100	18400
Manganese	9050	5420	2270	543	1880	37.4	3420
Mercury	0.12 J		0.09 J		0.29	0.07 J	
Nickel	24.4 J	2.2 J	9.9 J	2.7 J	93.0	7.7 J	28.6 J
Potassium	93100	85200 E	8670	8370 E	60600	41900 E	8500
Selenium	142	120 E	68.6 E	69.4 E	93.3 E	105 E	6.4
Silver	14.6		2.2 J		6.3 J		
Sodium	1120000	1020000	40500	39700	987000	905000	138000
Thallium							
Vanadium	43.9 J	17.4 J	10.7 J	3.4 J	176	85.2	25.5 J
Zinc	378	23.2 E	124 E	12.3 J	589 E	97.2	45.4 E
Cyanide		NR		NR		NR	

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401230

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-MW-CDM-1	CC-MW-CDM-2	CC-MW-CDM-2	CC-MW-CDM-3	CC-MW-CDM-3	CC-MW-CDM-4	CC-MW-CDM-4
Lab Number	9805198-9	9805198-2	9805198-6	9805198-3	9805198-7	9805190-7	9805190-12
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Depth	-	-	-	-	-	-	-
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Percent Solids	dissolved	-	dissolved	-	dissolved	-	dissolved
Aluminum		33200		1730		6840	
Antimony							
Arsenic	15.9 E	10.5		1.8 J	2.6 J	26.4	
Barium	76.6 J	132 J	35.9 J	73.8 J	67.7 J	378	91.6 J
Beryllium		2.2 J					
Cadmium						0.71 J	
Calcium	137000	47200	44700	103000	99100	195000	202000
Chromium		47.5 E		3.0 J		19.8 E	0.57 J
Cobalt	30.8 J	44.3 J	7.4 J	2.2 J	1.6 J	12.0 J	3.4 J
Copper	3.2 J	67.2	1.9 J	27.8	R	106	3.1 J
Iron	1460	68200	37.6 J	2750	1740	79600	11200
Lead		48.9		5 E		178	
Magnesium	18200	6590	3520 J	19300	19200	38700	40100
Manganese	3040	1500	254	R	R	1010	728
Mercury		13.0	1.6			0.30	
Nickel	3.7 J	52.7	5.4 J	6.4 J	2.2 J	34.3 J	10.0 J
Potassium	7580 E	10200	7060 E	4460 J	4600 J	23400	23100 E
Selenium						5.4 E	
Silver							
Sodium	134000	165000	178000	R	18000 E	40100	42100
Thallium					8.3 J	9.1 J	
Vanadium		101		4.8 J	0.76 J	29.3 J	1.6 J
Zinc	16.8 J	148 E	23.1	103 E	31.7	495	63.5 E
Cyanide	NR		NR				NR

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401231

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-TP-DUP-01-6-7	CC-SED-DUP-01	CC-SB-DUP1-2-4	CC-MW-DUP-01	CC-MW-DUP-01	CC-SB-FB-1	CC-SB-FB-3
Lab Number	9804110-7	9804135-2	9804246-5	9805198-4	9805198-8	9804110-2	9804167-5
Matrix	SOIL	SOIL	SOIL	WATER	WATER	WATER	WATER
Depth	6--7	0--1	2--4	-	-	-	-
Units	mg/kg	mg/kg	mg/kg	ug/L	ug/L	ug/L	ug/L
Percent Solids	87	43.3	89.4	-	dissolved	-	-
Aluminum	7870	9810 E	5310	1400			
Antimony		10.6 J	6.2 J				
Arsenic	5.3	12.4 E	73.1				
Barium	50.0	101 E	403	71.1 J	67.4 J	0.45 J	1.8 J
Beryllium	0.51 J	0.67 J	0.88 J			0.14 J	0.19 J
Cadmium	0.6 J	2.1 J	4.2			0.42 J	
Calcium	1780	2660 E	9730	101000	106000	41.4 J	123 J
Chromium	13.1 E	28.7 E	33.3	2.4 J			
Cobalt	12.8 E	16.1 J	86.1	2.3 J	1.7 J		
Copper	18.4	132 E	154	17.4 J	2.5 J	2.3 J	2.6 J
Iron	13200	23100 E	20200	3140	790	11.9 J	84.9 J
Lead	19.4	200 E	205	2.9 J			
Magnesium	1640	2140 J	2140	19100	19300		
Manganese	683	284 E	4610	R	R		2.4 J
Mercury	0.08 J	0.32 E	0.24				
Nickel	13.8	33.3 E	82.2	5.4 J	3.4 J		
Potassium	594 J	1150 J	532 J	4450 J	4360 J		80.5 J
Selenium	1.9	2.2 J	6.6				
Silver		5.5 E	9				
Sodium	105 J	54.5 J	479 J	R	R		84.2 J
Thallium	R						
Vanadium	16.9 E	33 E	24.8	4.7 J	43.1		
Zinc	41.5 E	277 E	229	91.0 E	NR	3.7 J	3.2 J
Cyanide							

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401232

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics

INORGANICS							
Sample ID No.	CC-SB-FB-4	CC-SB-FB-5	CC-SB-FB-6	CC-SB-FB-07	CC-SB-FB-07	CC-SB-FB-08	CC-SW-DUP-01
Lab Number	9804187-6	9804246-8	9805023-2	98-5190-1	9805190-8	98-5190-2	9804135-5
Matrix	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Depth	-	-	-	-	-	-	-
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Percent Solids	-	-	-	-	dissolved	-	-
Aluminum			31.2 J				16800
Antimony							25.1 J
Arsenic							39.1
Barium	0.79 J	0.51 J	0.84 J	0.45 J	0.54 J	0.59 J	390
Beryllium							1.1 J
Cadmium	0.42 J						7.6
Calcium	84.8 J	149 J	208 J	286 J	358 J	259 J	65600
Chromium							43
Cobalt				1.6 J		0.82 J	48.7 J
Copper	2.8 J			2.5 J		0.76 J	291
Iron	32.6 J	27.4 J	93.4 J	35.9 J	49.0 J	17.6 J	61900
Lead							436
Magnesium		14.5 J	216 J	53.0 J	57.0 J	43.4 J	15200 E
Manganese	0.76 J	0.52 J	0.66 J	1.1 J	0.88 J		2770
Mercury							0.51
Nickel				2.0 J			65.2
Potassium			137 J	207 J	182 J	159 J	9950
Selenium							8.3
Silver							9.8 J
Sodium	208 J	135 J	52.1 J	276 J	309 J	5990	6900
Thallium					8.0 J	6.9 J	
Vanadium							60.5
Zinc	8.0 J	4 J	3.9 J	4.5 J	3.0 J	2.9 J	776 E
Cyanide							

NOTES:
Blank Space - analyte analyzed for, but not detected
E - estimated value
J - estimated value, analyte present below CRDL but above IDL
R - analysis did not pass EPA QA/QC
NR - analysis not required

401233

RADIONUCLIDES

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-TP-1-5-6	CC-TP-1-6-7	CC-TP-2-4-5	CC-TP-2-8-9	CC-TP-3-2-3	CC-TP-3-5-6
Lab Number	98041232	98041233	98041235	98041236	98041238	98041237
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/15/98	4/15/98	4/15/98	4/15/98	4/15/98	4/15/98
Sample Time	0915	0917	1030	1035	1210	1205
Beginning Depth	5	6	4	8	2	5
Ending Depth	6	7	5	9	3	6
Uranium 234	10.7 +/- 1.6	6.9 +/- 1.2	4.42 +/- 0.71	3.45 +/- 0.65	196 +/- 70	232 +/- 110
Uranium 235	0.41 +/- 0.21	0.39 +/- 0.23	0.129 +/- 0.087	0.18 +/- 0.12	< 40	< 74
Uranium 238	10.5 +/- 1.6	8.1 +/- 1.4	4.38 +/- 0.70	3.33 +/- 0.64	160 +/- 63	141 +/- 81
Radium 226	17.2 +/- 1.32	7.92 +/- 0.779	5.88 +/- 0.654	7.47 +/- 0.595	191 +/- 12.4	252 +/- 16.3
Radium 228	4.23 +/- 0.767	3.66 +/- 0.755	2.29 +/- 0.622	2.05 +/- 0.395	69.6 +/- 5.30	113 +/- 7.92
Thorium 228	2.99 +/- 0.58	3.27 +/- 0.61	1.40 +/- 0.28	1.58 +/- 0.37	< 83	< 160
Thorium 230	15.6 +/- 2.1	8.3 +/- 1.2	5.91 +/- 0.83	4.41 +/- 0.74	219 +/- 65	494 +/- 150
Thorium 232	3.40 +/- 0.62	3.35 +/- 0.60	1.63 +/- 0.31	1.67 +/- 0.38	56 +/- 32	70 +/- 52

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-TP-4-0-1	CC-TP-4-5-6	CC-TP-5-0-1	CC-TP-5-4-5	CC-TP-6-4-5	CC-TP-6-5-6
Lab Number	98041234	9804110-11	98041108	98041109	98041104	98041105
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/14/98	4/14/98	4/14/98	4/14/98	4/14/98	4/14/98
Sample Time	1655	1525	1340	1400	1140	1145
Beginning Depth	0	5	0	4	4	5
Ending Depth	1	6	1	5	5	6
Uranium 234	2.53 +/- 0.45	16.0 +/- 2.2 E	2.66 +/- 0.47	13.0 +/- 1.7	9.1 +/- 2.3	11.4 +/- 1.8
Uranium 235	0.179 +/- 0.094	0.59 +/- 0.25 E	0.118 +/- 0.076	0.62 +/- 0.20	< 0.70	0.63 +/- 0.31
Uranium 238	2.89 +/- 0.50	15.7 +/- 2.2 E	2.64 +/- 0.47	14.3 +/- 1.9	9.9 +/- 2.4	11.9 +/- 1.9
Radium 226	4.63 +/- 0.533	22.6 +/- 1.68	3.14 +/- 0.426	17.4 +/- 1.35	13.4 +/- 0.986	28.1 +/- 2.08
Radium 228	1.90 +/- 0.552	14.3 +/- 1.43	1.47 +/- 0.515	4.00 +/- 0.831	4.01 +/- 0.545	5.69 +/- 1.07
Thorium 228	1.83 +/- 0.33	9.7 +/-1.3	1.42 +/- 0.28	4.19 +/- 0.61 E	4.2 +/- 1.4	3.63 +/- 0.90
Thorium 230	4.47 +/- 0.65	15.3 +/- 2.0	2.18 +/- 0.36	17.0 +/- 2.1	13.0 +/- 2.6	17.1 +/- 2.6
Thorium 232	1.76 +/- 0.32	8.9 +/- 1.2	1.34 +/- 0.26	3.58 +/- 0.53	3.6 +/- 1.2	2.98 +/- 0.77

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401236

401237

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-TP-7-5-6	CC-WS-1	CC-WS-2	CC-WS-3	CC-WS-4	CC-WS-5
Lab Number	98041239	980413509	980413510	980413511	980413512	980413513
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/15/98	4/16/98	4/16/98	4/16/98	4/16/98	4/16/98
Sample Time	1317	0940	0950	1012	0957	1005
Beginning Depth	5	0	0	0	0	0
Ending Depth	6	1	1	1	1	1
Uranium 234	8.7 +/- 1.5	0.229 +/- 0.073	0.79 +/- 0.16	0.55 +/- 0.12	0.51 +/- 0.11	0.311 +/- 0.083
Uranium 235	0.48 +/- 0.26	< 0.030	< 0.036	< 0.032	< 0.033	< 0.028
Uranium 238	8.4 +/- 1.4	0.167 +/- 0.061	0.75 +/- 0.15	0.43 +/- 0.10	0.58 +/- 0.12	0.269 +/- 0.077
Radium 226	11.1 +/- 1.09	0.274 +/- 0.245	0.376 +/- 0.157	0.602 +/- 0.188	0.625 +/- 0.332	0.267 +/- 0.146
Radium 228	4.08 +/- 1.03	< 0.229	0.403 +/- 0.330	0.477 +/- 0.334	0.369 +/- 0.210	0.290 +/- 0.250
Thorium 228	4.42 +/- 0.76	0.113 +/- 0.047	0.401 +/- 0.100	0.50 +/- 0.11	0.44 +/- 0.10	0.087 +/- 0.051
Thorium 230	11.4 +/- 1.6	< 0.023	0.72 +/- 0.14	< 0.027	0.64 +/- 0.13	< 0.038
Thorium 232	4.24 +/- 0.74	0.099 +/- 0.044	0.48 +/- 0.11	0.47 +/- 0.11	0.386 +/- 0.094	0.140 +/- 0.053

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401238

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SED-1	CC-SED-3	CC-SW-1	CC-SW-2	CC-SW-3	CC-SB-01-6-8
Lab Number	980413503	980413501	98041356	98041357	98041358	9805057-1
Matrix	SOIL	SOIL	WATER	WATER	WATER	SOIL
Units	pCi/g	pCi/g	pCi/L	pCi/L	pCi/L	pCi/g
Sample Date	4/16/98	4/16/98	4/16/98	4/16/98	4/16/98	5/4/98
Sample Time	1255	1140	1300	1315	1115	1055
Beginning Depth	0	0	NA	NA	NA	6
Ending Depth	1	1	NA	NA	NA	8
Uranium 234	0.158 +/- 0.058	0.73 +/- 0.14	< 0.069	0.138 +/- 0.081	0.63 +/- 0.20	0.74 +/- 0.14
Uranium 235	< 0.025	0.043 +/- 0.030	< 0.059	0.034 +/- 0.038	< 0.068	0.037 +/- 0.025
Uranium 238	0.123 +/- 0.051	0.70 +/- 0.14	< 0.077	< 0.066	0.91 +/- 0.24	0.73 +/- 0.14
Radium 226	0.251 +/- 0.158	1.66 +/- 0.440	< 0.360	< 0.460	0.910 +/- 1.13	0.954 +/- 0.178
Radium 228	< 0.226	1.29 +/- 0.660	< 0.940	< 1.06	1.37 +/- 1.34	0.738 +/- 0.242
Thorium 228	0.087 +/- 0.047	0.69 +/- 0.14	< 0.12	< 0.17	< 0.15	0.85 +/- 0.14
Thorium 230	< 0.031	0.82 +/- 0.15	< 0.059	< 0.047	< 0.052	0.75 +/- 0.13
Thorium 232	0.158 +/- 0.056	0.77 +/- 0.14	< 0.059	< 0.047	< 0.052	0.78 +/- 0.13

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401239

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-02-2-4	CC-SB-03-0-2	CC-SB-04-2-4	CC-SB-05-2-4	CC-SB-06-0-2	CC-SB-06-4-6
Lab Number	9805057-2	9804246-1	9804263-3	9805023-1	9804187-1	9804187-2
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	5/4/98	4/24/98	4/28/98	5/1/98	4/22/98	4/22/98
Sample Time	1344	1002	1235	1025	0921	0930
Beginning Depth	2	0	2	2	0	4
Ending Depth	4	2	4	4	2	6
Uranium 234	0.59 +/- 0.12	0.68 +/- 0.16	0.70 +/- 0.16	0.72 +/- 0.14	0.62 +/- 0.12	0.54 +/- 0.11
Uranium 235	< 0.030	< 0.058	< 0.046	< 0.035	< 0.031	0.038 +/- 0.027
Uranium 238	0.61 +/- 0.12	0.45 +/- 0.13	0.68 +/- 0.16	0.59 +/- 0.13	0.66 +/- 0.13 E	0.59 +/- 0.12 E
Radium 226	0.737 +/- 0.160	0.501 +/- 0.264	1.01 +/- 0.198	0.957 +/- 0.209	0.502 +/- 0.124	0.814 +/- 0.164
Radium 228	0.517 +/- 0.215	0.825 +/- 0.539	0.739 +/- 0.316	0.915 +/- 0.332	0.518 +/- 0.165	0.684 +/- 0.272
Thorium 228	0.63 +/- 0.12	0.80 +/- 0.17	0.92 +/- 0.16	0.93 +/- 0.15	0.86 +/- 0.15	0.67 +/- 0.12
Thorium 230	0.74 +/- 0.13	0.72 +/- 0.15	< 0.032	0.81 +/- 0.14	0.78 +/- 0.14	0.70 +/- 0.12
Thorium 232	0.56 +/- 0.10	0.66 +/- 0.14	0.89 +/- 0.15	0.96 +/- 0.16	0.72 +/- 0.13	0.65 +/- 0.11

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401240

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-07-4-6	CC-SB-08-4-6	CC-SB-08-6-8	CC-SB-09-0-2	CC-SB-10-2-4	CC-SB-11-6-8
Lab Number	9805057-9	9805072-2	9805072-3	9804216-5	9804246-2	9804216-4
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	5/5/98	5/6/98	5/6/98	4/23/98	4/24/98	4/23/98
Sample Time	1553	1000	1010	1503	1312	1210
Beginning Depth	4	4	6	0	2	6
Ending Depth	6	6	8	2	4	8
Uranium 234	0.366 +/- 0.095	3.12 +/- 0.50	112 +/- 15	0.324 +/- 0.098	0.48 +/- 0.14	30.5 +/- 4.0
Uranium 235	< 0.034	0.139 +/- 0.078	11.4 +/- 2.8	< 0.019	< 0.059	1.61 +/- 0.47
Uranium 238	0.40 +/- 0.10	3.09 +/- 0.49	108 +/- 15	0.214 +/- 0.078	0.46 +/- 0.14	31.4 +/- 4.1
Radium 226	0.778 +/- 0.181	8.12 +/- 0.598 E	169 +/- 10.7 E	0.388 +/- 0.152	1.07 +/- 0.327	32.8 +/- 2.47
Radium 228	0.434 +/- 0.313	2.08 +/- 0.332	48.9 +/- 3.33	0.395 +/- 0.295	1.44 +/- 0.559	12.1 +/- 1.65
Thorium 228	0.54 +/- 0.11	1.50 +/- 0.30	47.7 +/- 7.0	0.323 +/- 0.068	0.95 +/- 0.19	14.0 +/- 1.8
Thorium 230	0.425 +/- 0.092	5.92 +/- 0.83	121 +/- 16	< 0.029	0.85 +/- 0.17	30.4 +/- 3.7
Thorium 232	0.53 +/- 0.11	1.66 +/- 0.32	47.8 +/- 7.0	0.341 +/- 0.068	0.88 +/- 0.17	13.2 +/- 1.7

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401241

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-12-4-6	CC-SB-13-4-6	CC-SB-13-6-7	CC-SB-14-2-4	CC-SB-14-5-5.5	CC-SB-15-2-4
Lab Number	9805057-7	9805013-4	9805013-3	9805013-6	9805013-5	9804167-4
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/L	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	5/5/98	4/30/98	4/30/98	4/30/98	4/30/98	4/21/98
Sample Time	1403	1120	1052	1337	1329	1030
Beginning Depth	4	4	6	2	5	2
Ending Depth	6	6	7	4	5.5	4
Uranium 234	0.55 +/- 0.11	2.34 +/- 0.31	164 +/- 21	23.7 +/- 2.9	8.3 +/- 1.4	117 +/- 14 E
Uranium 235	< 0.028	0.111 +/- 0.037	7.1 +/- 1.9	0.91 +/- 0.21	0.44 +/- 0.24	4.89 +/- 0.86 E
Uranium 238	0.422 +/- 0.093	2.65 +/- 0.35	162 +/- 21	23.8 +/- 2.9	8.0 +/- 1.3	113 +/- 14 E
Radium 226	0.808 +/- 0.197	3.50 +/- 0.430 E	211 +/- 13.7	43.1 +/- 2.92 E	12.8 +/- 1.15 E	101 +/- 6.71 E
Radium 228	1.19 +/- 0.286	1.44 +/- 0.471 E	70.2 +/- 5.59	16.7 +/- 1.50 E	4.25 +/- 0.883 E	32.7 +/- 2.98 E
Thorium 228	1.99 +/- 0.29	1.49 +/- 0.22	134 +/- 17	11.3 +/- 1.5	4.02 +/- 0.69	40.0 +/- 4.8
Thorium 230	0.93 +/- 0.16	4.38 +/- 0.56	273 +/- 33	24.2 +/- 3.0	10.4 +/- 1.4	96 +/- 11
Thorium 232	2.05 +/- 0.29	1.36 +/- 0.20	126 +/- 16	11.6 +/- 1.5	3.93 +/- 0.66	36.1 +/- 4.3

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401242

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-16-4-6	CC-SB-16-8-10	CC-SB-17-4-6	CC-SB-17-8-10	CC-SB-17-10-12	CC-SB-18-2-4
Lab Number	9804216-1	9804216-3	9805072-5	9804167-3	9804167-2	9805013-2
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/23/98	4/23/98	5/6/98	4/21/98	4/21/98	4/29/98
Sample Time	0928	0950	1519	1600	1520	1153
Beginning Depth	4	8	4	8	10	2
Ending Depth	6	10	6	10	12	4
Uranium 234	52.2 +/- 7.4	1.90 +/- 0.34	4.46 +/- 0.68	42.8 +/- 5.7	62.8 +/- 8.1	5.37 +/- 0.70
Uranium 235	1.05 +/- 0.64	0.134 +/- 0.071	0.29 +/- 0.12	1.44 +/- 0.57	2.33 +/- 0.73	0.179 +/- 0.063
Uranium 238	50.8 +/- 7.3	1.84 +/- 0.33	4.90 +/- 0.74	43.0 +/- 5.8	64.3 +/- 8.3	5.55 +/- 0.72
Radium 226	110 +/- 7.41	0.590 +/- 0.180	8.98 +/- 0.659 E	47.1 +/- 3.28 E	80.2 +/- 5.35 E	6.06 +/- 0.641 E
Radium 228	38.0 +/- 3.60	0.494 +/- 0.272	2.01 +/- 0.359	17.6 +/- 1.87 E	33.2 +/- 2.86 E	2.25 +/- 0.632 E
Thorium 228	24.7 +/- 3.5	0.46 +/- 0.11	< 0.19	28.4 +/- 4.2	36.3 +/- 5.1	2.90 +/- 0.43
Thorium 230	53.2 +/- 6.8	0.89 +/- 0.15	6.45 +/- 0.89	53.6 +/- 7.1	75.9 +/- 9.7	5.72 +/- 0.76
Thorium 232	24.1 +/- 3.4	0.343 +/- 0.082	< 0.080	24.3 +/- 3.7	40.1 +/- 5.5	2.65 +/- 0.39

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401243

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-18-4-6	CC-SB-19-2-4	CC-SB-20-4-6	CC-SB-21-0-2	CC-SB-21-2-4	CC-SB-22-0-2
Lab Number	9805013-1	9805013-8	9804187-3	9804187-4	9804187-5	9804246-7
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/29/98	4/30/98	4/22/98	4/22/98	4/22/98	4/27/98
Sample Time	1144	1455	1145	1506	1515	0913
Beginning Depth	4	2	4	0	2	0
Ending Depth	6	4	6	2	4	2
Uranium 234	29.9 +/- 3.8	3.27 +/- 0.49	1.01 +/- 0.18	0.54 +/- 0.12	0.58 +/- 0.12 E	1.92 +/- 0.35
Uranium 235	1.17 +/- 0.34	0.210 +/- 0.085	< 0.029	0.026 +/- 0.023	< 0.030	0.097 +/- 0.062
Uranium 238	29.9 +/- 3.8	3.46 +/- 0.52	1.01 +/- 0.18 E	0.45 +/- 0.10 E	0.349 +/- 0.089 E	1.90 +/- 0.34
Radium 226	19.9 +/- 1.42 E	3.94 +/- 0.464 E	1.21 +/- 0.168	0.483 +/- 0.146	0.608 +/- 0.132	2.45 +/- 0.432
Radium 228	6.47 +/- 0.795 E	1.36 +/- 0.460 E	0.563 +/- 0.241	0.314 +/- 0.311	< 0.291	1.50 +/- 0.656
Thorium 228	7.12 +/- 0.98	2.43 +/- 0.34	0.85 +/- 0.14	0.460 +/- 0.095	0.51 +/- 0.11	1.21 +/- 0.22
Thorium 230	14.3 +/- 1.8	4.61 +/- 0.59	1.16 +/- 0.18	0.511 +/- 0.097	0.59 +/- 0.11	1.86 +/- 0.30
Thorium 232	6.76 +/- 0.94	2.41 +/- 0.33	0.72 +/- 0.12	0.410 +/- 0.084	0.54 +/- 0.10	1.26 +/- 0.22

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401244

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES							
Sample ID No.	CC-SB-22-4-6		CC-SB-23-4-6	CC-SB-23-6-8	CC-SB-24-4-6	CC-SB-24-6-8	CC-SB-25-2-4
Lab Number	9804246-4		9804246-11	9804246-12	9804246-9	9804246-10	9805023-3
Matrix	SOIL		SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g		pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/27/98		4/27/98	4/27/98	4/27/98	4/27/98	5/1/98
Sample Time	0935		1509	1518	1204	1223	1225
Beginning Depth	4		4	6	4	6	2
Ending Depth	6		6	8	6	8	4
Uranium 234	5.37 +/- 0.75	E	678 +/- 83	1041 +/- 130	24.8 +/- 3.2	28.1 +/- 3.4	1.16 +/- 0.21
Uranium 235	0.253 +/- 0.098		25.3 +/- 5.6	43.8 +/- 8.5	1.35 +/- 0.34	1.38 +/- 0.28	0.064 +/- 0.038
Uranium 238	5.89 +/- 0.81		681 +/- 83	1031 +/- 120	25.7 +/- 3.3	28.9 +/- 3.5	1.13 +/- 0.20
Radium 226	9.23 +/- 0.875	E	120 +/- 7.92	141 +/- 9.24	32.4 +/- 2.19	41.6 +/- 2.97	1.39 +/- 0.199
Radium 228	2.32 +/- 0.761		35.7 +/- 3.18	42.6 +/- 3.72	8.57 +/- 0.896	9.34 +/- 1.39	0.816 +/- 0.231
Thorium 228	2.50 +/- 0.38		32 +/- 12	47 +/- 16	9.2 +/- 1.3	8.9 +/- 1.2	0.97 +/- 0.16
Thorium 230	8.5 +/- 1.1	E	97 +/- 21	142 +/- 28	29.6 +/- 3.6	40.2 +/- 4.8	1.17 +/- 0.18
Thorium 232	2.14 +/- 0.33	E	25.3 +/- 9.5	24 +/- 10	9.3 +/- 1.3	8.7 +/- 1.1	0.92 +/- 0.15

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401245

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SB-26-2-4	CC-SB-26-6-8	CC-SB-27-0-2	CC-SB-28-6-8	CC-SB-MW-7-2-4	CC-SB-MW-8-0-2
Lab Number	9804263-1	9804263-2	9805057-3	9805072-4	9804263-5	9805057-5
Matrix	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Sample Date	4/28/98	4/28/98	5/4/98	5/6/98	4/28/98	5/5/98
Sample Time	1019	1022	1535	1204	1545	1100
Beginning Depth	2	6	0	6	2	0
Ending Depth	4	8	2	8	4	2
Uranium 234	198 +/- 24	8.5 +/- 1.2	0.89 +/- 0.15 E	1.42 +/- 0.29	0.465 +/- 0.100	0.415 +/- 0.087
Uranium 235	9.3 +/- 2.0	0.39 +/- 0.16	< 0.028	0.102 +/- 0.067	0.035 +/- 0.025	0.027 +/- 0.020
Uranium 238	196 +/- 24	9.0 +/- 1.3	0.94 +/- 0.16 E	1.37 +/- 0.29	0.53 +/- 0.11	0.351 +/- 0.079
Radium 226	123 +/- 8.12	22.3 +/- 1.73	0.708 +/- 0.172	2.04 +/- 0.221 E	0.726 +/- 0.236	0.674 +/- 0.182
Radium 228	28.6 +/- 2.79	3.09 +/- 0.854	0.574 +/- 0.272	1.35 +/- 0.260	0.629 +/- 0.407	0.763 +/- 0.278
Thorium 228	45.8 +/- 5.9	2.87 +/- 0.46	0.94 +/- 0.15 E	1.62 +/- 0.37	0.528 +/- 0.087	0.435 +/- 0.91
Thorium 230	150 +/- 18	27.5 +/- 3.3	1.15 +/- 0.18 E	1.58 +/- 0.34	< 0.012	0.480 +/- 0.093
Thorium 232	46.9 +/- 6.0	2.91 +/- 0.45	0.91 +/- 0.15 E	1.89 +/- 0.39	0.442 +/- 0.074	0.485 +/- 0.093

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401246

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-MW-1	CC-MW-2	CC-MW-3	CC-MW-5	CC-MW-6	CC-MW-7
Lab Number	9805190-4	9805190-5	9805175-02	9805175-01	9805190-6	9805205-3
Matrix	WATER	WATER	WATER	WATER	WATER	WATER
Units	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
Sample Date	5/20/98	5/20/98	5/19/98	5/19/98	5/20/98	5/22/98
Sample Time	1015	1040	1506	1100	1159	1005
Beginning Depth	NA	NA	NA	NA	NA	NA
Ending Depth	NA	NA	NA	NA	NA	NA
Uranium 234	1.93 +/- 0.33	2.82 +/- 0.47	1.55 +/- 0.27 E	3.91 +/- 0.57 E	2.67 +/- 0.41	7.2 +/- 1.6 E
Uranium 235	0.113 +/- 0.061	0.158 +/- 0.082	0.053 +/- 0.040	0.177 +/- 0.076	0.137 +/- 0.065	0.78 +/- 0.50
Uranium 238	2.02 +/- 0.34	2.37 +/- 0.42	1.67 +/- 0.28 E	4.16 +/- 0.60 E	2.85 +/- 0.43	4.4 +/- 1.2
Radium 226	0.86 +/- 0.41	3.03 +/- 0.68	2.12 +/- 0.55	0.91 +/- 0.68	2.08 +/- 0.62	2.72 +/- 0.65
Radium 228	2.87 +/- 0.98	7.8 +/- 1.6	2.71 +/- 0.82	3.6 +/- 1.4	1.58 +/- 0.92	< 1.0
Thorium 228	0.48 +/- 0.15	0.95 +/- 0.081	0.091 +/- 0.088	0.29 +/- 0.13	0.27 +/- 0.13	0.86 +/- 0.44
Thorium 230	< 0.30	< 0.163	< 0.30	< 0.42	0.98 +/- 0.22	3.68 +/- 0.65 E
Thorium 232	0.151 +/- 0.076	< 0.066	0.076 +/- 0.054	0.33 +/- 0.11	0.44 +/- 0.14	0.57 +/- 0.26 E

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401247

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-MW-8	CC-MW-CDM-1	CC-MW-CDM-2	CC-MW-CDM-3	CC-MW-CDM-4	CC-TP-DUP-01-4-5
Lab Number	9805208-2	9805198-5	9805198-2	9805198-3	9805190-7	980411010
Matrix	WATER	WATER	WATER	WATER	WATER	SOIL
Units	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/g
Sample Date	5/22/98	5/21/98	5/21/98	5/21/98	5/20/98	4/14/98
Sample Time	1300	1520	1015	1230	1245	1405
Beginning Depth	NA	NA	NA	NA	NA	4
Ending Depth	NA	NA	NA	NA	NA	5
Uranium 234	3.60 +/- 0.51	3.39 +/- 0.51	0.85 +/- 0.19	0.55 +/- 0.15	1.85 +/- 0.32	12.1 +/- 1.6
Uranium 235	< 0.248	0.178 +/- 0.077	< 0.056	< 0.046	0.050 +/- 0.040	0.51 +/- 0.17
Uranium 238	2.93 +/- 0.43	3.38 +/- 0.51	0.58 +/- 0.15	0.47 +/- 0.14	1.67 +/- 0.29	12.3 +/- 1.6
Radium 226	0.86 +/- 0.42	1.24 +/- 0.56	0.99 +/- 0.43	< 0.56	0.80 +/- 0.38	15.3 +/- 1.23
Radium 228	2.09 +/- 0.77	< 0.88	< 0.8	< 0.80	0.95 +/- 0.67	4.90 +/- 0.833
Thorium 228	0.34 +/- 0.11	< 0.17	< 0.18	< 0.16	< 0.17	2.76 +/- 0.45 E
Thorium 230	<0.59 E	< 0.28	< 0.28	< 0.050	< 0.139	14.3 +/- 1.8
Thorium 232	0.255 +/- 0.083 E	0.078 +/- 0.055	< 0.068	< 0.067	0.132 +/- 0.070	3.09 +/- 0.49

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect

401248

SITE NAME: Captain's Cove
PROJECT #: 8001-202
EPA CASE NO.: NA
LAB NAME: Paragon Analytics, Inc.

RADIONUCLIDES						
Sample ID No.	CC-SED-DUP-01	CC-SW-DUP-01	CC-SB-DUP02		CC-MW-DUP01	CC-SB-DUP1-4-6
Lab Number	980413502	980141355	9805057-4		9805198-4	9804246-6
Matrix	SOIL	WATER	SOIL		WATER	SOIL
Units	pCi/g	pCi/L	pCi/g		pCi/L	pCi/g
Sample Date	4/16/98	4/16/98	5/4/98		5/21/98	5/14/98
Sample Time	1155	1125	1540		1300	
Beginning Depth	0	NA	0		NA	4
Ending Depth	1	NA	2		NA	6
Uranium 234	0.79 +/- 0.16	0.61 +/- 0.18	0.485 +/- 0.096	E	0.49 +/- 0.13	9.1+/- 1.2
Uranium 235	< 0.027	< 0.061	< 0.024		< 0.056	0.39+/-0.12
Uranium 238	0.86 +/- 0.17	< 0.086	0.487 +/- 0.096	E	0.38 +/- 0.12	8.6+/-1.1
Radium 226	1.40 +/- 0.340	< 0.400	0.587 +/- 0.240		< 0.48	12.8+/-1.10
Radium 228	1.31 +/- 0.674	< 0.980	0.495 +/- 0.387		< 0.76	2.43+/-0.791
Thorium 228	0.95 +/- 0.18	< 0.16	0.51 +/- 0.10	E	< 0.14	3.13+/-0.45
Thorium 230	0.89 +/- 0.17	< 0.072	0.58 +/- 0.11	E	< 0.085	13.4+/-1.7
Thorium 232	0.90 +/- 0.17	< 0.067	0.53 +/- 0.10	E	< 0.071	3.16+/-0.45

NOTES:
E - estimated value
R - analysis did not pass EPA QA/QC
NR - analysis not required
ND - Non-Detect