

**APPENDIX B – SOIL AND SEDIMENT SAMPLE SUMMARY**

**FINAL REMEDIAL INVESTIGATION REPORT  
CASMALIA RESOURCES SUPERFUND SITE  
CASMALIA, CALIFORNIA**

**Prepared By: URS Corporation**



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**Stormwater Ponds – Summary Analytical Results**

- B-19a Inorganics Detected above Screening Levels – Stormwater Ponds
- B-19b Summary Analytical Results and Field Observations – Stormwater Ponds

**Treated Liquid Impoundments – Summary Analytical Results**

- B-20a Inorganics Detected above Screening Levels – Treated Liquid Impoundments
- B-20b Summary Analytical Results and Field Observations – Treated Liquid Impoundments

**RISBON-59 Area**

- B-21a Soil Sampling Locations – RISBON-59 Area
- B-21b Inorganics Detected above Screening Levels – RISBON-59 Area
- B-21c Summary Analytical Results and Field Observations – RISBON-59 Area
- B-21d Cross Section A-A' – RISBON-59 Area
- B-21e Cross Section B-B' – RISBON-59 Area

## **LIST OF ATTACHMENTS**

ATTACHMENT B-1	FIELD RECORDS - SOIL BORING LOGS (COMPACT DISK)
ATTACHMENT B-2	SURVEY COORDINATES FOR SOIL AND SEDIMENT SAMPLING LOCATIONS (HARD COPY TABLE AND COMPACT DISK)
ATTACHMENT B-3	PHYSICAL TESTING LABORATORY REPORTS (COMPACT DISK)
ATTACHMENT B-4	EVALUATION OF UCL-RELATED DQOs
ATTACHMENT B-5	BOX PLOTS
ATTACHMENT B-6	EVALUATION OF BACKGROUND-RELATED DQOs

**LIST OF ACRONYMS**

ASTs	Aboveground Storage Tanks
bgs	below ground surface
CNS	Casmalia Neutralization System
COPC	chemical of potential concern
CPT	cone penetrometer testing
CSC	Casmalia Steering Committee
DDD	dichlorodiphenyldichloroethane
DDT	dichlorodiphenyltrichloroethane
DQO	data quality objective
ECD	electron capture detector
ELAP	California Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
EPC	exposure point concentration
FOD	frequency of detection
FS	Feasibility Study
g/cc	grams per cubic centimeter
GPS	global positioning system
HDPE	High Density Polyethylene
MCPP	2-(4-Chloro-2-methylphenoxy) propionic acid
mg/kg	milligrams per kilogram
MIP	Membrane Interface Probe
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene/tetrachloroethene
PCNB	pentachloronitrobenzene
pg/g	picograms per gram
PID	photoionization detector
ppmv	part(s) per million by volume
PPOs	Poor Purging Organics
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
REI	relative estimation interval
RFI	Request For Information form
RI	Remedial Investigation
RICH	RI Change Form
SL	Screening Level
SOP	Standard Operating Procedures
SVOC	semi-volatile organic compound
TBA	tert-butyl alcohol
TCE	trichloroethylene/trichloroethene
TEQ	toxic equivalent
TI	technical impracticability
TPH	total petroleum hydrocarbons
TPHd	total petroleum hydrocarbons (as diesel)
UCL	upper confidence limit
USCS	Unified Soil Classification System
UTL	upper tolerance limit

Vb	bulk volume
VOC	volatile organic compound
WAO	wet air oxidation



## 1.0 INTRODUCTION

The Casmalia Steering Committee (CSC) completed the soil and sediment investigation in accordance with the June 2004 *RI/FS Work Plan*, the Revision 4 – Fall 2005 Phase II RI Sampling Plan, dated November 2005, the Final Spring 2006 Phase II RI Sampling Plan, dated May 25, 2006 (Spring 2006 Sampling Plan), and the Revised Final Phase III Sampling Plan, dated March 27, 2007, which were prepared by the CSC and submitted to the U.S. EPA (EPA) (CSC 2004, 2005, 2006, 2007). The following sections describe the nature and findings of the work completed as part of this investigation.

### 1.1 Purpose of Investigation

In general accordance with the scope of work described in Section 5.1.1 of the *RI/FS Work Plan*, entitled “*Collect Soil and Sediment Samples*” and in conjunction with the approved Phase II and III Sampling Plans, the CSC performed field sampling and contracted laboratory chemical and physical analyses of soil and sediment samples collected from select on-site and off-site locations. Soil and sediment samples collected and analyzed as part of the Remedial Investigation (RI) supplement existing soil data, and will be used to assess the nature and extent of chemical impacts to these matrices, to evaluate potential on-site and off-site exposures to human and ecological receptors, and to assist in the evaluation of corrective measures, as appropriate based upon the findings of the Feasibility Study (FS).

### 1.2 Scope of Investigation

The CSC collected and analyzed a total of approximately 790 on-site and off-site soil samples, as well as approximately 81 on-site pond sediment and off-site drainage sediment samples, to further define the nature and extent of site-related contamination, evaluate potential health risks to human and ecological receptors, and assist in completing the FS. The locations of all soil and sediment samples collected during the RI are depicted on Figure B-1, and the subset of surface soil samples tested for the VOCs, as well as surface and subsurface soils tested for dioxins/furans, are depicted in Figure B-1a. In addition to soil sampling data from 0 to 6 inches and from approximately 5 feet below ground surface (bgs), deeper soil data (up to 10 feet bgs) were also collected to assess the inhalation pathway for on-site workers, and incidental ingestion pathways for burrowing animals. As discussed in more detail in the *RI/FS Work Plan*, the surface and shallow soil samples were collected using a stratified random sampling grid to ensure the statistical representativeness of the data used in the evaluations. Also as discussed in the *RI/FS Work Plan*, authoritative samples were locally collected from surface and subsurface soils in areas of suspected contamination. The sampling in these areas of the Site also extended to depths greater than 10 feet to satisfy the general RI data needs regarding the nature and extent of chemical impacts, and to provide data to aid in the evaluation of remedial options for the FS. The deeper soil borings typically extended to the groundwater table and/or into the unweathered claystone to assess whether contaminants in deep source area soils may pose a potential threat to groundwater quality.

In addition to the chemical analysis, selected soil and sediment samples were also tested for physical properties needed to support risk assessment, groundwater modeling, the Technical Impracticability (TI) evaluation, and/or the FS.

Soil/sediment sample collection and analysis was conducted in each of the following study areas:

- On-site Areas:
  - Capped Landfills Area
  - RCRA Canyon Area
  - West Canyon Spray Area
  - Burial Trench Area
  - Central Drainage Area
  - Liquids Treatment Area
  - Maintenance Shed Area
  - Administration Building Area
  - Roadways
  - Remaining On-site Areas (including the Former Ponds and Pads Subarea)
  - Stormwater Ponds (sediments)
  - Treated Liquid Impoundments (sediments)
- Off-site Areas
  - Off-site Soils
  - Off-site Drainage Sediments
  - Background Soils (see Appendix A)

Soils and sediments were collected from a variety of sample location “types,” which are categorized by matrix, total planned depth, and/or sample collection intervals as follows:

Location Type <sup>1</sup>	Matrix	Total Planned Boring Depth	Default Sample Collection Intervals <sup>4</sup>	Description
Type 2	Soil	0.5 feet	0 – 0.5 feet	Surface samples
Type 3	Soil	5 feet	0 – 0.5 feet 5 – 5.5 feet	Surface to shallow samples
Type 3 Modified	Soil	5 feet	0 – 0.5 feet 3 – 3.5 feet 5 – 5.5 feet	Surface to shallow samples
Type 4	Soil	10 feet	0 – 0.5 feet 5 – 5.5 feet 10 – 10.5 feet	Surface to medium depth
Type 5	Soil	20 feet	0 – 0.5 feet 5 – 5.5 feet 10 – 10.5 feet 20 – 20.5 feet	Surface to deep samples
Type 6	Soil	Greater than 20 feet	0 – 0.5 feet 5 – 5.5 feet 10 – 10.5 feet 20 – 20.5 feet Groundwater <sup>5</sup> Contact <sup>5</sup>	Surface to deep vadose zone and/or saturated zone samples
Type 7	NAPL/Soil	Total depth dependent on Type of collocated boring	Dependent upon Membrane Interface Probe (MIP) response	MIP-based samples
Type	Sediment	5 feet <sup>3</sup>	0 – 0.5 feet	Sediment samples <sup>3</sup>

Location Type <sup>1</sup>	Matrix	Total Planned Boring Depth	Default Sample Collection Intervals <sup>4</sup>	Description
8/8a <sup>2</sup>			3 – 3.5 feet <sup>3</sup> 5 – 5.5 feet <sup>3</sup>	

Note:

- <sup>1</sup> Type 1 and Type 9 locations are soil vapor and surface water samples, respectively, and are not discussed in this appendix.
- <sup>2</sup> Type 8a samples limited to depths of 0 - 0.5 feet.
- <sup>3</sup> Only sediment samples from on-site ponds/impoundments were collected at depths greater than 0 – 0.5 feet
- <sup>4</sup> Sampling intervals listed above are as stated in the RI/FS Work Plan. Actual field sampling intervals varied depending upon the sample analytical suite and QA/QC requirements for each location. In some cases the actual sample interval could be upwards of four feet in length.
- <sup>5</sup> Soil samples collected at groundwater and contact only if encountered within planned boring depth

All on-site soil and sediment sampling locations are depicted on Figures B-1 through B-5, and all off-site soil and sediment sampling locations, are shown on Figure B-6. The identity, collection depth, and chemical testing program for all on-site and off-site soil samples collected during the RI are summarized in Table B-1.

Results of the work completed as part of the soil and sediment investigation are discussed by study area in Section 3 of this appendix.

## 2.0 METHODOLOGY

### 2.1 Detailed Approach

Using coordinates derived from Figure 4-1(on-site) and 4-6 (off-site) of the RI/FS Work Plan, all soil and sediment sampling locations were first staked in the field by the surveying contractor. All staked sampling locations were then visited by URS personnel accompanied by agency oversight staff and reviewed for appropriateness. Adjustments to some of the staked sampling locations were made in consultation with oversight personnel, as necessary or appropriate based upon field conditions. All relocated sample points were re-surveyed in order to accurately record the actual sample location. Survey coordinates for all soil and sediment sample locations are presented in tabular and digital format in Attachment B-2 to this appendix.

Phase I field sampling was conducted between July 19 and December 28, 2004. Phase II sampling was conducted between July 17 and September 5, 2006. All sampling activities were conducted in accordance with procedures outlined in the Site Health & Safety Plan, which was reviewed and adhered to by all on-site workers. Field sampling began with collection of all Type 2 (surface samples) locations, generally followed by completion of progressively deeper sample collection locations. This approach provided field efficiency by sequencing sampling locations based upon the type of drilling and equipment needed (e.g., manual sampling versus direct-push versus hollow-stem auger). The sampling program concluded with collection of soil samples from Type 7 locations based upon membrane interface probe (MIP) responses.

#### 2.1.1 Soil Samples

A total of approximately 790 soil samples were collected from depths ranging from zero to 82 feet bgs throughout the Site and the surrounding off-site areas and tested for the potential presence of chemicals of potential concern (COPC). As described below in Section 2.1.5, samples were collected using a variety of sampling equipment, typically depending upon the depth of exploration. Type 2 samples were collected using a manual drive sampler, Type 3 and 4 samples were collected with either a direct-push or hollow-stem auger sampling rig, and Type 5, 6, and 7 locations were sampled with a hollow-stem auger rig. All soil sampling locations are shown on Figure B-1.

#### 2.1.2 Sediment Samples

The CSC collected pond-bottom sediment samples at 0 to 1 foot, 3 feet, and 5 feet bgs in each of the on-site storm water ponds (RCF Pond, Pond 13, A-Series Pond) and treated liquid impoundments (Pond A-5 and Pond 18). With the exception of the one sample location situated along northern edge of the RCF Pond (RISESP-06), all pond/impoundment sediment sampling was performed from a pontoon barge platform using either hand auger equipment (for soft sediment) or a vibratory or rotary drilling rig. All samples from location RISESP-06 were collected using hand auger equipment because this portion of the RCF Pond was dry at the time of the sampling. The pond/impoundment sediment sampling locations are shown on Figure B-1.

Sediment samples were also collected from select locations within off-site drainages, including the North Drainage, the A-Drainage, and the C-Drainage (Casmalia Creek). All drainage sediment samples were collected into laboratory-provided containers using clean hand tools. All off-site drainage sediment sampling locations are depicted in Figure B-6. In all, a total of 81

sediment samples, including 68 from on-site ponds/impoundments and 13 from off-site drainages were collected for chemical analysis. The identity, collection depth, and chemical testing program for all on-site and off-site sediment samples collected during the RI are summarized in Table B-1.

### **2.1.3 Physical Property Samples**

Representative samples of subsurface soils and pond/impoundment sediments were also collected to evaluate the physical properties of these materials. In all, a total of six soil samples and 63 pond/impoundment sediment samples were tested for physical properties. The identity, collection depth and physical properties testing program for all on-site soil and sediment samples collected during the RI are summarized in Table B-2.

### **2.1.4 Contractors and Subcontractors**

#### **2.1.4.1 Principal Contractor – URS Corporation**

The CSC contracted URS Corporation (URS) to complete the Soil and Sediment Investigation. URS subcontracted support services used to survey and stake planned sampling locations, perform drilling and sampling activities, and to perform chemical and physical testing of the samples collected. The specific work completed by each party is further described below.

#### **2.1.4.2 Surveying Subcontractor – Pacific Engineering/Cannon Associates**

Field surveying and demarcation of sampling locations was initially subcontracted to Pacific Engineering, Incorporated of Santa Maria, California (California contractors license No. A717253). In 2006 Pacific Engineering was purchased by Cannon Associates, who has been performing surveying activities at the site since that time. All surveying activities were conducted under the direct supervision of a California registered civil engineer (Leroy Cadena, California registered civil engineer No. C55373). Using northing-easting coordinates derived from Figure 4-1 and Figure 4-6 of the RI/FS Work Plan, Pacific Engineering located and staked all planned Phase I soil and sediment sampling locations on the ground surface. Similar procedures were used to locate subsequent Phase II and III sampling locations, using figures from the approved sampling plans.

#### **2.1.4.3 Drilling Subcontractor – Gregg Drilling**

All drilling and soil sample collection activities were subcontracted to Gregg Drilling & Testing, Incorporated of Signal Hill, California. Gregg Drilling is a licensed California drilling contractor (California C57HIC license No. 485165). Gregg Drilling used a variety of drilling equipment to collect soils from shallow, medium, and deep sampling intervals.

#### **2.1.4.4 Sediment Coring Subcontractors – TEG Oceanographic and Kinnetic Laboratories, Incorporated**

Coring activities related to collection of sediment samples from the on-site storm water ponds and treated liquid impoundments were conducted by two separate drilling subcontractors. Initial sediment coring activities were conducted on August 31, 2004 by TEG Oceanographic (TEG), of Santa Cruz, California. Due to equipment limitations, TEG was not successful in collecting

sediment core. None of the sediment samples reported in this investigation were collected by TEG.

Following discussions with EPA regarding sediment sampling, a second sediment coring subcontractor was selected to complete sampling program. Kinnetic Laboratories, Incorporated (Kinnetic) of Santa Cruz, California, completed the Phase I pond/impoundment sediment sampling program between October 27, 2004 and November 12, 2004. Phase II sediment samples were collected on August 8, 2006.

#### 2.1.4.5 Analytical Testing Subcontractors – Sequoia Analytical, Frontier Analytical, and Columbia Analytical

Laboratory chemical testing of soil and sediment samples collected during the RI was performed by a variety of analytical laboratories, depending upon the sample matrix to be tested and test method(s) to be used. The prime laboratory was Sequoia Analytical (Sequoia) of Petaluma, California (California Environmental Laboratory Accreditation Program certification [ELAP] No. 2374), which performed the majority of analytical testing. All solid matrix samples were first sent to Sequoia, where samples were logged-in and analytical assignments were made. Samples were then forwarded on to the appropriate analytical testing laboratory based upon the matrix and desired testing program.

Sequoia analyzed soil samples for all analyses with the exception of Dioxin/Furans (EPA Method 8290). EPA 8290 analyses were performed by Columbia Analytical Services, Incorporated in Houston, Texas (ELAP No. 2452) for the soil and sediment samples. In addition, Sequoia and Columbia Analytical Services, in Kelso, Washington (ELAP No. 2286) also analyzed the sediment samples.

#### 2.1.4.6 Physical Testing Subcontractor – PTS Labs

All physical testing of soil and sediment samples was conducted by PTS Laboratories of Santa Fe Springs, California. PTS is a specialty laboratory focused upon providing testing services for soil and rock physical properties, core analysis, bench scale testing and field sample handling services to the environmental, engineering, construction and petroleum industries.

### 2.1.5 **Equipment and Tools**

#### 2.1.5.1 Surveying Equipment

Surveying of all terrestrial soil and sampling locations was completed by the Pacific Engineering/Cannon Associates using Global Positioning System (GPS) equipment. Location coordinates provided by URS were loaded into a TDS Ranger 200C<sup>®</sup> data collector running SurveyPro<sup>®</sup> with robotic and GPS software. Coordinate locations were located and staked in the field using a Thales G-Max<sup>®</sup> real time kinematics dual frequency GPS rover and base system. Staked coordinate locations are reported to a lateral accuracy of 0.033 feet, and ground surface elevations are reported to a vertical accuracy of 0.065 feet. Control points used in field surveying were the same as those used to create the most recent Site topographic map (April 2004).

### 2.1.5.2 Drilling, Sampling, and Testing Equipment

The various drilling, sampling and testing equipment used during the soil and sediment investigation is briefly described below. The reader is referred to the task-specific Standard Operating Procedures (SOPs) presented in Appendix A of the RI/FS Work Plan for more detailed descriptions of the various field sampling procedures.

#### 2.1.5.2.1 *Manual Sampling*

Manual sampling equipment was used for sample collection at all Type 2 (surface soil) and some Type 8 (sediment) locations. Manual sampling activities included use of one of several sampling methods, either a manually operated drive sampler, a stainless steel hand auger (possibly in combination with a drive sampler), or a stainless steel trowel. Drainage sediment samples were typically collected directly into laboratory-provided jars using a clean stainless steel trowel. Please refer to SOP 1-4 in the RI/FS Work Plan for a more detailed description of manual sampling procedures

#### 2.1.5.2.2 *Direct Push Sampling*

Direct push sampling equipment was typically used for collection of shallow and medium depth subsurface soils from Type 3 and 4 locations. Direct push sampling equipment provided and operated by Gregg Drilling included the Marl<sup>®</sup> M5T track mounted combination hollow stem auger and direct push drill apparatus. Please refer to SOP 1-1 in the RI/FS Work Plan for a more detailed description of direct push sampling procedures.

#### 2.1.5.2.3 *Hollow Stem Auger Sampling*

Hollow-stem auger sampling equipment was typically used for collection of medium and deep subsurface soils from Type 5, 6 and 7 locations. Hollow-stem auger sampling equipment provided and operated by Gregg Drilling included the Marl<sup>®</sup> M5T track mounted combination hollow-stem auger and direct push drill apparatus. Please refer to SOP 1-1 in the RI/FS Work Plan for a more detailed description of hollow-stem auger sampling procedures.

#### 2.1.5.2.4 *Cone Penetrometer Testing Sampling*

Cone Penetrometer Testing (CPT) equipment was used to collect soil samples at some Type 6 and Type 7 locations. Gregg Insitu used a Marl<sup>®</sup> thirty-ton Cone Penetrometer Testing push rig that can produce up to 1,000 tons per square foot of reaction energy with a 15 square centimeter cone. The rig uses a twin ram hydraulic system that is linked to the data acquisition system to record the depth intervals and soil properties every five centimeters during each CPT push. The CPT drilling system used the piston sampling system as the primary soil sampling tool with this apparatus. The piston sampler uses a locking plunger system that allows the sampler to be advanced to the target depth then unlocked and advanced to collect the sample in a stainless steel liner.

#### 2.1.5.2.5 *Sediment Coring and Sampling*

Initial attempts at sediment core collection were performed by TEG using a barge-mounted 4-inch diameter continuous collection vibrocore system. This sampling technique was not able to

penetrate the claystone material underlying soft pond bottom sediments. After several unsuccessful attempts, this sampling technique was abandoned.

Sediment coring and sampling was successfully conducted using a system that was specifically adapted by Kinnetic Laboratories for this purpose. The soft pond bottom sediments were collected using a standard 6-inch diameter hand auger. The auger was advanced off of the side of the large pontoon barge that the contractor constructed and operated at the site. The dense sediments and underlying hard claystone materials were collected using a concrete coring tool and coring bits that were adapted for this purpose. Coring rods were adapted to allow the drill to be lowered through the center of the sampling barge and the water column, into the hard rock below the soft sediment layer. Plastic pipe casing was used to case off the soft sediments and allow for the reoccupation of the borehole after each core barrel run was advanced.

Sediment samples from off-site drainages were collected from the top 15 centimeters (0-6") using hand tools, typically a clean stainless steel trowel.

#### *2.1.5.2.6 Trenching Equipment*

Exploratory trenching and soil sample collection was conducted in two study areas, including one trench excavated within the limits of the former waste disposal area in RCRA Canyon, and two trenches situated between former Pond C and former Pond M in the Former Ponds and Pads Subarea. Trenching was conducted using a rubber tire backhoe with an extendable working arm length of approximately 12 feet. The backhoe was operated by Casmalia Site operations and maintenance staff experienced in operation of such equipment. Please refer to SOP 1-3 in the RI/FS Work Plan for a more detailed description of trenching and related soil sampling procedures.

#### *2.1.5.2.7 Analytical and Physical Testing Equipment*

All analytical (i.e., chemical) and physical testing of soils and sediments was performed by subcontract laboratories. Testing equipment is maintained and calibrated in accordance with manufacturer specifications, and operated in accordance with the individual laboratory's Quality Assurance Manuals.

Instruments, equipment and methods used to determine chemical properties of soil and sediment samples are common to all environmental testing laboratories, and included gas chromatography, gas chromatography/mass spectrometry, high-resolution gas chromatography/high-resolution mass spectrometry inductively coupled plasma-atomic emission spectrometry, inductively-coupled plasma-mass spectrometry, high performance liquid chromatography, ion chromatography, and wet chemical methods. Apparatus and analyzers used for the various chemical test methods, including inorganic analyses, were performed in accordance with EPA SW846, and Standard Methods guidelines.

Instruments, equipment and methods used to determine soil and sediment physical properties are common to all materials testing laboratories, and included ovens, scales, sieves, liquid limit devices with grooving tools, and plastic limit rolling plates. Apparatus used for the various physical test methods were performed in accordance with American Society for Testing and Materials, and/or American Petroleum Institute guidelines.

### 2.1.6 Sample Handling and Shipping

All soil and sediment sampling activities were conducted by URS geologists and/or field technicians working under the direct supervision of a California Registered Geologist. Sample collection and handling was performed in accordance with the methods described in the applicable SOP presented in Appendix A of the RI/FS Work Plan, including SOPs 1-1 (Mechanical Drilling and Soil Sample Collection), 1-3 (Trenching and Soil Sampling), 1-4 (Manual Soil Sampling), 1-5 (Sediment Sample Collection), 1-6 (EnCore<sup>®</sup> Soil Sample Collection), 1-7 (Soil Logging), and 1-8 (Sample Handling, Preservation, and Shipping).

Soil boring logs were prepared by URS geologists for all shallow, medium, and deep sampling locations (Types 3, 4, 5, 6, 7 and 8). Each log contains important information for each sampling location, including the following: boring number and location; sample identification numbers; date and time; sample depth; lithologic description in accordance with the Unified Soil Classification System (USCS) including soil type, particle size and distribution, color (using the Munsell soil color chart), and moisture content; description of any visible evidence of soil contamination (i.e., discoloration, unusual odors, etc.), and photo-ionization (PID) readings. The use of respirators prevented the field crews from documenting potential contaminant odors at several boring locations. Odor observations at these locations are labeled as “unknown” or “U” on applicable figures. Soil boring logs are presented in Compact Disk format in Attachment B-1 to this appendix. Those samples scheduled for volatile organic compound (VOC) analyses, including poor purging VOCs, were collected using En Core<sup>®</sup> samplers. At each sampling location, all soil sampling equipment was washed either in a non-phosphate cleaning solution and rinsed with deionized water, or steam-cleaned.

All samples were collected in appropriate containers, stored properly, and accompanied by chain-of-custody documents to the laboratory as described in the appropriate SOPs. Samples were picked-up at the Site on a daily basis by a dedicated courier, who was responsible for transferring soil and sediment samples into coolers chilled with ice, and arranging overnight shipment to the appropriate contract laboratory.

### 2.1.7 Data Validation

All laboratory chemical data developed during the RI was subjected to independent data validation by URS chemists. In accordance with the RI/FS Work Plan, 10% of all soil and sediment results were subjected to full validation, and the remaining 90% were subjected to limited data validation. The data were reviewed in accordance with URS Standard Operating Procedures and the principles presented in *USEPA National Functional Guidelines for Laboratory Data Review, Organics* (USEPA, 1999), *USEPA National Functional Guidelines for Laboratory Data Review, Inorganics* (USEPA, 2004b), *USEPA CLP National Functional Guidelines for Dioxin/Furan Data Validation* (USEPA, 2005). The methods and findings of the data validation process are summarized in Appendix R.

## 2.2 Deviations from RI/FS Work Plan

Significant deviations from the scope of soil and sediment sampling program as outlined in the RI/FS Work Plan are described in the RI Change Forms (RICH forms) and Request for Information forms (RFI forms) presented in Appendix Q. These deviations were typically prompted by the need to replace or adapt previously approved field sampling methods or planned sample collection locations to accommodate unanticipated changed conditions encountered during field

activities. Modifications in some analytical methods were also made. The need for, and nature of deviations were identified collaboratively with agency representatives and oversight personnel, and all changes to the RI program scope and procedures were discussed and approved prior to their implementation. Deviations documented in RICH and RFI forms relevant to the soil and sediment sampling and testing program are briefly summarized below. Deviations relevant to sampling and testing programs for other media are documented in their respective technical appendices.

<b>RICH Form</b>	<b>Subject</b>
RICH 001.2	Change in QAPP methodology, alternative extraction method for EPA 8270, 8081, 8082
RICH 004.2	Modify analytical procedures and reduce the number of soil samples being analyzed for Ethylene Glycol.
RICH 005.2	Collect trip blanks, equipment blanks and/or field blanks
RICH 009.3	Modifying sampling procedure for 8015 direct inject for soils
RICH 015	Change from EPA Method 680 to EPA Method 1668 Modified for analysis of PCB Congeners

<b>RFI Form</b>	<b>Subject</b>
RFI 002	Modify the EPA 8141 analysis for soil samples to include two additional organophosphorus pesticides.
RFI 003.2	Clarify the sample depths that will be collected for Type 6 Samples of the approved RI/FS Work Plan
RFI-2006-001	Three borings were drilled around Phase I boring location RISBON-59

While not truly a deviation, soil sample collection depths at joint Type 6/Type 7 locations or discrete Type 6 or Type 7 locations were not specifically identified in the RI/FS Work Plan, but were agreed upon with agency representatives and oversight personnel on a location by location basis, either based upon MIP response or subsurface conditions encountered. There were also several Type 6, Type 7, and Type 6/Type 7 locations where subsurface conditions did not merit any sample collection, as summarized below:

<b>Location ID</b>	<b>Location Type</b>	<b>Sample Depth</b>	<b>Reason for No Sample Collection</b>
RISBCD-01	Type 7	Unspecified	No MIP response recorded
RISBLT-05	Type 6/Type 7	Groundwater	No groundwater encountered
RISBLT-07	Type 6/Type 7	Groundwater	No groundwater encountered
RISBOF-01	Type 7	Unspecified	No MIP response recorded
RISBRC-03	Type 6/Type 7	10-10.5 ft./Contact	No contact encountered
RISBON-52	Type 6	20-20.5 ft.	Duplicative sample: Sample depth corresponded with depth to groundwater, which was also identified for sampling.

### 3.0 INVESTIGATION RESULTS

Presented in this section is a summary of laboratory test results from soil and sediment samples collected during Phases I and II of the RI from throughout the various Site study areas, including Off-Site Areas, other than background soil samples. The results of limited Phase III soil investigations conducted in the RISBON-59 area are discussed separately in Section 5.0. The results of soil background studies are discussed in detail in Appendix A of this report; however, the significance and applicability of the results of the background soils analyses, as they apply to interpreting on-site conditions, are briefly described below.

#### 3.1 *Significance and Applicability of Background Soil Conditions*

Background soil conditions provide a baseline in interpreting concentrations of inorganics (i.e., metals) primarily, and some organic compounds, as they are observed across the Site. When risk criteria are lower than the range of background concentrations, background comparison drives the determination of Chemicals of Potential Concern (COPC) status: exceedance of background generally implies exceedance of risk criteria as well. When risk criteria are higher than background, then comparison to risk criteria drives the determination of COPC status since exceedance of risk criteria implies exceedance of background as well. Predominantly it is inorganic compounds that are most likely to fall into the first case, where background comparison drives the determination of COPCs. However for this project area, background samples were also analyzed for dioxins and furans.

For metals and dioxins/furans, individual Site samples are compared to an upper tolerance limit (UTL) of levels expected for background as well as to the lowest risk criteria (ecological or human health) (Tables B-4 through B-17a). The UTL is defined as an upper-bound estimate (a 95 percent confidence level estimate) of the 95<sup>th</sup> percentile of the distribution, which is that concentration expected to be exceeded only 5 percent of the time in a random sample from true background conditions. Exceedance of the UTL is predicted to occur only 5 percent of the time or less among background concentrations. Therefore, for a given study area, comparison of each Site sample to the UTL provides a convenient and familiar comparison for identifying concentrations that may have resulted from a Site-impacted distribution.

Background levels for metals, dioxins, and polychlorinated biphenyls (PCBs), are observed using results from defined "background" soil samples taken off-site and up-gradient of the Site. In addition, it is reasonable to assume that background soil concentrations can also be observed among some of the over 600 samples obtained from 0 to 10 foot depths across the Site, specifically in a portion of the Site that is un-impacted for a given compound. When viewing the site-wide data set along with the defined background samples, an ambient distribution will appear as a normal or low-skewed lognormal distribution, with any spots of contamination appearing as distinctive subsets of samples, or as outliers dissimilar to the portion of samples that are ambient. This "site-wide ambient" approach for evaluating background (discussed in CalEPA, 1997) is effective for contamination that is not uniformly widespread. This approach of involving on-site ambient data as well as defined background data is an important consideration for a site that is as large and diverse as Casmalia.

There is some evidence for multiple background levels which may vary by depth, soil type, or geographically. For example, most Site study areas have significantly lower levels of cadmium than the RI background data set. These reported study area levels, which test as "lower than"

background, are not easily explained except by hypothesizing a depth and/or soil type relationship for background cadmium. Another example is tin, for which most study areas can be statistically differentiated as shifted slightly higher than the RI background samples, but has a sample distribution with characteristics typically associated with a naturally occurring, rather than site-impacted, population. A low skewness for these slightly higher study area data sets, and good fits to normal or lognormal distribution shapes, is additional evidence for background variation rather than contamination. Unless widespread over the entire study area, contamination would tend to result in the observation of distinct populations, outliers, or strong skewness among the samples. The site-ambient analysis approach was applied to estimate the UTL for tin, as discussed in Section 4 of Attachment A-1 for Appendix A.

### **3.2 Summary of Findings by Study Area**

The chemical analytical testing program performed for all soils and sediment samples collected as part of the RI is summarized in Table B-1. Soil and sediment physical testing program is summarized in Table B-2. COPCs detected in soil and sediment samples tested are tabulated in Table B-3.

Analytical results for each of the 14 study areas are individually discussed below by chemical class. Analytical results for each study area are summarized in a series of “prevalence tables” which present the number of samples tested for each detected analyte, the number of detections, the frequency of detection in percent (% FOD), the range of detected concentrations, and the average analyte concentration. To aid the understanding of the general vertical distribution of contaminants in each study area, this summary information is presented for several depth ranges, including surface soil (0-6 inches), shallow soil (0-10 feet), medium to deep soils (greater than 10 feet), and for all depths (Tables B-4 through B-17). These specific depth intervals were selected to facilitate evaluation of contaminant distribution relative to exceedance of ecological screening levels (0-5 feet), human health screening levels (0-10 feet), and general site characterization (0 to >10 feet).

Also presented in these prevalence tables are screening levels that are used to evaluate the significance of the concentrations detected. Screening levels included EPA Region 9 Industrial Preliminary Remediation Goals (PRGs) for human health, the lowest applicable ecological screening levels for ecological receptors, and for inorganic constituents in soil, UTLs calculated from background soil data (Appendix A). The human health and ecological screening levels discussed herein are used for preliminary data evaluation purposes only and are not meant to be used as final risk evaluation criteria.

For evaluating the significance of detected concentrations in this appendix, appropriate media-based screening levels were used as described below:

- For human health, industrial PRGs for soil presented in Table 3-10 of the Work Plan were used to evaluate Site soil and sediment data (Tables B-4 through B-17) for human health. Industrial PRGs were obtained from EPA’s Region 9 PRG Table (USEPA, 2004a).
- For ecological receptors, the lowest of the soil screening levels included in the project database (version 13 June 2007), and developed by the ecological risk assessment contractor were used to evaluate Site soil. Similarly, the lowest of the sediment screening levels included in the project database (version 13 June 2007), and developed by the ecological risk assessment contractor were used to evaluate Site sediment data.

Results for each study area are also summarized in a series of “totals” maps which present summed results by location and by depth for each chemical class tested (Figures B-7a through B-20b). Results for each chemical class are compared to a variety of screening levels, including industrial PRGs, residential PRGs, and ecological levels. These figures additionally summarize pertinent field observations associated with the samples collected.

Discussion of metals results in the following sections use a combination of screening levels to assess the significance of results. Metals concentrations are considered to exceed screening levels only when they exceed both the background UTL and at least one risk criteria, either ecological or human health. Because no screening levels exist for calcium, potassium and sodium, and they are considered as human and ecological receptor essential nutrients, these metals are not considered in the evaluation. Magnesium and iron are also not considered in the analysis because they are common soil nutrients and do not pose an ecological or human health risk. Background and risk-based screening levels (PRGs or ecological screening levels) used for evaluation and discussion of inorganic constituents in soil and sediment are summarized below. Organic constituent screening levels are presented in tables B-4 through B-17.

Inorganic Constituent	Soil Screening Levels (mg/kg)			
			Lowest Ecorisk Level	
	EPA Industrial Soil PRG	California Industrial Soil PRG	Soil	UTL
Aluminum	100000			18000
Antimony	408.80		0.27	4
Arsenic	1.59	0.25139632	18	22
Beryllium	1940.69		10	0.91
Barium	66577.35	5400	330	174
Cadmium	451.41		0.36	3.2
Chromium	448.32		0.4	47
Cobalt	1921.35		13	20
Copper	40876.66		28	19
Lead	800		11	11.9
Manganese	19458.11			330
Mercury	306.60		0.1	0.026
Molybdenum	5109.95		2	10
Nickel	20439.16		30	49
Selenium	5109.95		1	3.3
Silver	5109.95		4.2	
Thallium	67.45		1	0.64
Tin	100000		50	65
Vanadium	1022.00		2	81
Zinc	100000		50	104

**Notes:**

Lowest Ecorisk Level is based on the lowest available ecological soil screening level from USEPA's Ecological Soil Screening Level guidance (USEPA, 2007) and the Oakridge National Laboratory (ORNL) guidance for plants and invertebrates (Efroymsen et al., 1997a,b)

Highlighted cells indicate screening levels used for evaluation and discussions of inorganics data.

**Logic:** If the UTL is lower than risk-based (ecological or human health) screening levels, then compare the lowest of the risk-based screening levels against the UTL. Then use the most conservative (i.e., lower) risk-based value for screening purposes.

Inorganic Constituent	Sediment Screening Levels (mg/kg)			
			Lowest Ecorisk Level	
	EPA Industrial Soil PRG	California Industrial Soil PRG	Sediment	UTL
Aluminum	100000			18000
Antimony	408.80		2	4
Arsenic	1.59	0.25139632	8.2	22
Beryllium	1940.69		10	0.91
Barium	66577.35	5400	500	174
Cadmium	451.41		0.99	3.2
Chromium	448.32		0.4	47
Cobalt	1921.35		20	20
Copper	40876.66		31.6	19
Lead	800		35.8	11.9
Manganese	19458.11		500	330
Mercury	306.60		0.1	0.026
Molybdenum	5109.95		2	10
Nickel	20439.16		20.9	49
Selenium	5109.95		1	3.3
Silver	5109.95		1	
Thallium	67.45		1	0.64
Tin	100000		50	65
Vanadium	1022.00		2	81
Zinc	100000		50	104

**Notes:**

Lowest Ecorisk Level is based on the lowest available ecological sediment/soil screening level from Table 3-10 of the Work Plan (CSC, 2004).

Highlighted cells indicate screening levels used for evaluation and discussions of inorganics data.

**Logic:** If the UTL is lower than risk-based (ecological or human health) screening levels, then compare the lowest of the risk-based screening levels against the UTL. Then use the most conservative (i.e., lower) risk-base value for screening purposes.

Descriptions of the nature and findings of soil investigations conducted in each study area are presented in the following sections. For consistency, these descriptions are structured in a consistent format, with each including subsections describing: (1) drilling and subsurface conditions; (2) sample collection (Phase I and II, as appropriate); (3) analytical results (by chemical class); (4) findings relative to adjoining study areas; and, (5) conclusions regarding the nature and extent for soil impacts. Analytical results for each study area are presented with respect to the screening levels identified above, with discussions first describing the overall scope of the sampling and analytical program, and the nature and frequency of screening level exceedances regardless of depth interval. For those chemical classes where screening level exceedances were encountered, the following paragraphs in each analytical results subsection then proceed to describe exceedances relative to: (1) ecological screening levels (0-5 feet); (2) human health screening levels (0-10 feet); and, (3) general site characterization needs (greater than 10 feet).

Limited Phase III investigations were focused upon delineating soil impacts in a small area of the site, and are discussed separately in Section 5.0.

Additional supporting information is presented in attachments to this appendix, including:

- Attachment B-1: Soil boring logs, sediment sampling logs, trench logs, and CPT logs;
- Attachment B-2: Survey coordinates for soil and sediment sampling locations;
- Attachment B-3: Copies of currently available physical testing lab reports;
- Attachment B-4: Evaluation of UCL-Related DQOs;
- Attachment B-5: Box plots for selected constituents in soil; and
- Attachment B-6: Evaluation of Background-Related DQOs.

Detailed sample-by-sample analytical results are presented in the RI database, included as Appendix R to this report.

### **3.2.1 Capped Landfills Area**

Surface and subsurface soil samples were collected in order to characterize soil conditions in the Capped Landfills Area (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.2 of the RI/FS Work Plan.

#### **3.2.1.1 Drilling and Subsurface Conditions**

Four borings were completed in the Capped Landfills Study Area (RISSCL-01 through RISSCL-04). Lithologic conditions encountered included approximately 1 to 2 feet of sandy and silty gravel, underlain by engineered geofabric of the capped landfill. The geofabric was further underlain by silty clay with trace sand. Groundwater was not encountered in any of the borings. No evidence of odors or chemical staining was observed and organic vapors were not detected by the PID. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### **3.2.1.2 Sample Collection**

##### **3.2.1.2.1 *Phase I***

Ten soil samples from six former grout settlement locations (RISSCL-01 through RISSCL-06) were collected within and surrounding the Capped Landfills Area (Figure B-1). Soil samples collected from borings RISSCL-01 through RISSCL-04 were submitted for chemical analyses to characterize surface and shallow subsurface soil conditions. Soil samples were collected from these four boring locations at the surface and immediately above the high density polyethylene (HDPE) landfill liner (approximately 2 feet bgs) and analyzed for VOCs (Table B-1) to evaluate if settlement of grout used to abandon former boreholes may have allowed vapors from the landfill to contaminate vegetated fill material above the HDPE liner. In addition, a total of two surface soil samples were collected from RISSCL-05 and RISSCL-06. During further investigation, it was determined that the exact locations of the former grout settlement targeted by these two borings were uncertain due to a lack of original survey control. Based on this information, these two surface samples were not submitted for laboratory analyses. RICH Form 003 outlines the rationale and approval for the removal of RISSCL-05 and RISSCL-06 from the sampling program (Appendix Q).

One deep soil sample was collected from beneath the HDPE landfill liner in association with a MIP profile at RISBCL-01C, located directly adjacent to the gallery well, and analyzed for VOCs, semi-volatile organic compounds (SVOCs), and polycyclic aromatic hydrocarbons (PAHs). This sample was collected and analyzed for purposes of assessing the chemical character and corresponding MIP response of soils known to contain non-aqueous phase liquid (NAPL). Air purifying respirators (APRs) were worn by the drillers and sampling crew due to the presence of strong odors.

#### 3.2.1.2.2 *Phase II*

No additional samples were collected in the Capped Landfills Area during Phase II.

#### 3.2.1.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth range are presented in Table B-4. Sampling locations in the Capped Landfills Area are illustrated on Figure B-1. Summary analytical results with field observations for the Capped Landfills Area are presented in Figure B-7a.

##### 3.2.1.3.1 *Volatile Organic Compounds*

Eight soil samples were collected at surface and shallow depths from four locations and analyzed for VOCs. Detectable concentrations of VOCs were present in each sample. A total of 18 VOCs were detected in samples collected in the four locations however, concentrations did not exceed screening levels.

An additional soil sample at RISBCL-01C was collected from 74 feet bgs. 1,2-Dibromoethane, 1,2-dichloroethane, tetrahydrofuran, tetrachloroethylene (PCE), chloroform, trichloroethylene (TCE), 1,2-dibromo-3-chloropropane, and 1,1-dichloroethane were detected above PRGs in this single deep sample.

##### 3.2.1.3.2 *Semi Volatile Organic Compounds*

Detectable concentrations of SVOCs were present in the soil sample from RISBCL-01C; however, concentrations did not exceed screening levels.

##### 3.2.1.3.3 *Polycyclic Aromatic Hydrocarbons*

Detectable concentrations of PAHs were present in the soil sample from RISBCL-01C; however, concentrations did not exceed screening levels.

#### 3.2.1.4 Findings Relative to Adjoining Study Areas

There are no indications that low concentrations of VOCs detected in soils of P/S Landfill cap have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in the Capped Landfills Area.

### 3.2.1.5 Conclusions Regarding Nature and Extent of Soil Impacts

Volatile organic compounds are present in the surface and shallow subsurface of the fill above the HDPE liner, however only in extremely low concentrations. The settlement of grout used to abandon boreholes does not appear to have caused fugitive emissions from the landfill to significantly impact vegetated fill material above the HDPE liner. Elevated levels of VOCs detected in location RISBCL-01C are present at a depth of 74 feet bgs and reflect deep soil conditions in proximity to the gallery known to be affected by NAPL. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### 3.2.2 RCRA Canyon Area

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions in the RCRA Canyon Area (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks related primarily to potential surface soil exposure, and evaluate and develop response actions for this area as necessary. Additional soil data collected from throughout this study area during the RI augment considerable existing data, and together will serve to characterize conditions in this portion of the Site. Additional surface and subsurface soil samples were collected to (1) Confirm that landfill wastes were removed from the former landfill area, (2) Verify the absence or non-significant concentration of Appendix IX analytes not previously tested for, and (3) Verify that the previously collected data are representative of current site conditions. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.4 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### 3.2.2.1 Drilling and Subsurface Conditions

Lithology encountered in RCRA Canyon was primarily unconsolidated silty claystone with sand- and gravel-sized fragments of light yellowish-brown and pale brown claystone. Bedrock encountered in the study area was described as a fractured, weathered light yellowish-brown and light gray silty claystone. The contact between the weathered and the unweathered claystone was encountered in borings RISBRC-01, -02, -03, -04, and -06 between approximately 5.5 feet bgs (RISBRC-03 in the canyon bottom) to greater than 62 feet (RISBRC-06, upper north canyon). The anticipated depth of the weathered/unweathered contact was greater than the limitations of the equipment, and therefore the contact was not reached in RISBRC-06, drilled to 62 feet bgs. Odors and soil staining were observed in 10 of the 40 study area borings, including an oily sheen and greenish-gray to dark gray clayey materials in trench location RITRRC-01, completed in a portion of the former RCRA Landfill in the upper portion of the RCRA Canyon Area (Figure B-8c and Appendix B, Attachment B-1 - Log for trench RITRRC-01). Headspace readings ranged from 7.9 ppmv (RISBRC-13 at 5 feet) to 107 ppmv (RISBRC-06 at 14 feet bgs). Groundwater was encountered between 3 and 5 feet bgs in borings in the northern canyon bottom to approximately 9.5 feet in boring RISBRC-16, north of Pond A-5. Groundwater was not encountered in the remaining borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

### 3.2.2.2 Sample Collection

A total of approximately 123 soil samples from 42 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the RCRA Canyon Area (Figure B-1).

#### 3.2.2.2.1 *Phase I*

Soil samples were collected from surface and shallow surface borings (Type 3; RISSRC-01 through -18) located adjacent to historical samples collected by Brierley & Lyman. Soil samples were collected at 0 foot and 5 feet bgs and analyzed for metals, VOCs, SVOCs, PAHs, organochlorine pesticides (OCPs), and PCBs. Additionally, samples collected at 0 feet from borings RISSRC-06 and -13 were also analyzed for PCB Congeners.

Soil samples were collected from 18 medium depth borings (Type 4; RISBRC-05 and RISBRC-07 through -23) to achieve the confidence limits needed for the risk assessment. Eight of these borings (RISBRC-05, -09, -14, and -18 through -22) were located at former terraces and surface impoundment locations noted on historical aerial photographs. Three soil samples were collected from each boring at 0, 5, and 10 feet bgs. Samples collected from the borings were analyzed for metals, VOCs, SVOCs, PAHs, OCPs, and PCBs. Additionally, samples collected at 0 feet from borings RISBRC-08, -16, and -20, were also analyzed for PCB Congeners.

Soil samples were collected from five co-located Type 6/7 soil borings drilled to the top of the unweathered claystone. Borings RISBRC-01 and -02 were drilled in the former waste burial area. Boring RISBRC-03 was drilled in the canyon bottom downgradient of the former waste burial area. Boring RISBRC-04 was drilled within the former West Canyon Catch Basin. Boring RISBRC-06 was drilled at the head of the canyon to evaluate the potential presence of oil field wastes. Samples were selected for chemical analysis from the Type 6 borings on the basis of MIP and pore pressure readings from the adjacent Type 7 CPT boring. Sampling depths for each boring are included on Table B-1. Soil samples collected from each boring were analyzed for metals, VOCs, SVOCs, PAHs, OCPs, and PCBs. Soil samples collected at 0, 5, and 10 feet from borings RISBRC-02 and -04 were also analyzed for dioxins and furans. Additionally, samples collected at 0 feet from borings RISBRC-01 and -02 were analyzed for PCB Congeners.

Two soil samples were collected from a trench (RITRRC-01) excavated within the former RCRA Canyon waste burial area to assess whether wastes remain in the area. The trench was excavated to approximately 12 feet bgs and two samples were collected from the trench at 5 and 10 feet bgs. Soil samples were analyzed for metals, VOCs, SVOCs, PAHs, OCPs, and PCBs.

#### 3.2.2.2.2 *Phase II*

Soil samples from five additional Type 2 (RISSRC-2B, -16B, RISBRC-5B, -20B, -22B) and four additional Type 3 (RISSRC-1B, -6B, -9B, and RISBRC-16B) locations were collected in the RCRA Canyon Area and analyzed for dioxins and furans and PCB congeners at the request of the EPA. The locations were situated adjacent to Phase I borings that had elevated concentrations of COPCs.

### 3.2.2.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-5. RI/FS sampling locations, as well as historical sampling locations in the RCRA Canyon Area, are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the RCRA Canyon Area are presented in Figures B-8a and B-8b, respectively, and an interpretative cross section through the former RCRA disposal area is presented in Figure B-8c.

#### 3.2.2.3.1 *Metals*

One-hundred ten soil samples were collected from 40 borings and one trench location and analyzed for metals. A total of 24 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 41 locations. Barium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, tin, and zinc were detected above screening levels.

Concentrations exceeded screening levels in 38 locations throughout the entire study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSRC-01 through -15, -18, RISBRC-01 through -03, -05 through -12, -14, -15, -16, -18 through -23, and RITRRC-01. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRC-01, -04, -06, -08, -09, -10, -12, and -15, RISBRC-01, -02, -05, -06, -10, -18, -19, -20, and -23. In samples collected deeper than 10 feet bgs, metals were detected at concentrations exceeding PRGs at RISBRC-06. Locations and corresponding depths for inorganics detected above screening levels are illustrated on Figure B-8a.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, tin, and zinc were detected above ecological screening levels. In this depth range, 37 locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are barium (50 samples), cadmium (15 samples), copper (15 samples), lead (28 samples), mercury (7 samples), nickel (14 samples), and zinc (19 samples) out of a total of 82 samples analyzed. The sample collected from RISBRC-02 (5 feet bgs) was heavily stained and had a faint to moderate odor. The sample collected from RITRRC-01 was greenish-gray to very dark gray, and oily. The frequency of detection, range of detected concentrations, and average values are listed on Table B-5.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, barium and chromium were detected above PRGs. In this depth range, barium was detected in all of the samples at concentrations ranging from 19 to 12,000 mg/kg and exceeded PRGs in approximately 25 percent of the samples at 17 locations. In addition to the field observations noted above, a petroleum-like odor was observed RISSRC-09 (6 feet bgs). Chromium was detected in all of the samples at concentrations ranging from 16 to 470 mg/kg and exceeded PRGs at RISBRC-05 (0 feet bgs).

In samples collected greater than 10 feet bgs, barium was detected above PRGs. In this depth range, barium was detected in all of the samples at concentrations ranging from 18 to 6,300

mg/kg and exceeded PRGs at RISBRC-06 (12.5 and 24 feet bgs). The sample collected at 12.5 feet bgs was observed to be black, heavily stained, and containing a strong odor.

#### 3.2.2.3.2 *Volatile Organic Compounds*

One-hundred ten soil samples were collected from borings and one trench location and analyzed for VOCs. Detectable concentrations of VOCs were present in 55 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.2.3.3 *Semi Volatile Organic Compounds*

One-hundred ten soil samples were collected from 40 borings and one trench location and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 16 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.2.3.4 *Polycyclic Aromatic Hydrocarbons*

One-hundred eight soil samples were collected from 40 borings and one trench location and analyzed for PAHs. Detectable concentrations of PAHs were present in 35 percent of the samples. A total of 17 PAHs were detected. Naphthalene, n-nitrosodiethylamine, n-nitrosodimethylamine were detected above screening levels in one sample collected in deep soil in the northern portion of the study area.

In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding PRGs at RISBRC-06.

In samples collected greater than 10 feet bgs, naphthalene, n-nitrosodiethylamine, and n-nitrosodimethylamine were detected above PRGs. In this depth range, naphthalene was detected at in 38 percent of the samples at concentrations ranging from 0.013 to 8.2 mg/kg and exceeded PRGs at RISBRC-06 (12.5 feet bgs). N-Nitrosodiethylamine and n-nitrosodimethylamine were detected at concentrations of 0.16 and 0.079 mg/kg, respectively, in the same sample. The sample was observed to be black, heavily stained, and containing a strong odor.

#### 3.2.2.3.5 *Polychlorinated Biphenyls*

One-hundred ten soil samples were collected from 40 borings and one trench location and analyzed for PCBs. Detectable concentrations of PCBs were present in nine percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.2.3.6 *Pesticides and Herbicides*

One-hundred ten soil samples were collected from 40 borings and one trench location soil sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides and herbicides were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.2.3.7 *Dioxins and Furans*

Nineteen soil samples were collected from 11 shallow soil sampling locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in 95 percent of the samples; however, concentrations for the toxicity equivalent quotient (TEQ) did not exceed screening levels.

### 3.2.2.3.8 *PCB Congeners*

Twenty soil samples were collected from 16 soil sampling locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in all of the samples; however, concentrations for the TEQ did not exceed screening levels.

### 3.2.2.4 Findings Relative to Adjoining Study Areas

Available data, including analytical results of pond bottom sediments from Pond A-5 indicate that elevated metals concentrations encountered within the RCRA Canyon Area may have contributed to elevated concentrations of these constituents in downstream areas, including Pond A-5, and possibly the A-Series Pond. There are no indications that conditions in the neighboring study areas have influenced or created conditions encountered in the RCRA Canyon Area.

### 3.2.2.5 Conclusions Regarding Nature and Extent of Soil Impacts

A variety of inorganic constituents were detected in excess of screening levels in the majority of sampling locations in the RCRA Canyon Area, with barium being the most prevalent. Exceedances are most common in surface and shallow soils, with concentrations most typically diminishing with increased depth. Screening level exceedances are rarely present at depths in excess of five feet bgs, with only barium, nickel, and tin reported in excess of screening levels at a depth of 10 feet bgs. Barium is the only inorganic constituent detected in excess of screening levels at depths greater than 10 feet bgs.

Results indicate low concentrations of a variety of organic constituents are present in surface and medium depth soils across broad portions of the RCRA Canyon Area. However, with the exception of three PAHs, all organic constituents within this area were reported at concentrations below screening levels. Screening level exceedances for PAHs are limited to medium depth soil in one location near the head of the canyon, which coincides with the approximate alignment of a historical drainage through the area. Field observations in Trench RITRRC-01 indicate that residual waste materials may remain buried within a portion of the former RCRA Canyon waste burial area (Figure B-8c). However, the low concentrations of several organics detected within the limits of the former waste disposal area, were not reported above screening levels for the 11 samples collected from this historical feature. No exceedances were encountered for samples collected within former terraces and surface impoundments noted on historical aerial photographs. PAHs were detected in excess of screening levels in one location within the limits of the former oil field waste spreading area (RISBRC-06), but at a depth below 10 feet bgs, where human and/or ecological exposure is unlikely.

In summary, available data indicate surface to shallow soils across the majority of the RCRA Canyon Area have been impacted by a variety of inorganic constituents at concentrations in

excess of screening levels, and that exceedances of organic constituents are limited to a single location at depths in excess of excess 10 feet bgs. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### **3.2.3 West Canyon Spray Area**

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions surrounding the West Canyon Spray Area (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.5 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### **3.2.3.1 Drilling and Subsurface Conditions**

Lithologic conditions encountered in the West Canyon Spray Area were described as a fractured, weathered brownish-gray silty claystone overlain by inches to 9 feet of unconsolidated brown silty clay with claystone fragments. No evidence of odors, chemical staining, or detectable headspace readings were observed during soil sampling activities. Groundwater was not encountered in any of the borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### **3.2.3.2 Sample Collection**

Forty-one soil samples from 17 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the West Canyon Spray Area (Figures B-1). The sampling program at the West Canyon Spray Area included surface, shallow, and medium depth soil sampling to evaluate the presence of contaminants from historical spraying activities (Table B-1).

##### **3.2.3.2.1 *Phase I***

Three surface soil samples (Type 2; RISSSA-01 through -03) were collected from random locations within the West Canyon Spray Area to evaluate the presence of contaminants from past spraying practices. Sampling location selection methodology is described in Appendix F of the RI/FS Work Plan. All samples from this study area were analyzed for metals, VOCs, SVOCs, PAHs, OCPs, and PCBs.

Eighteen samples were collected from nine surface and shallow subsurface soil borings (Type 3; RISSSA-04 through -12) drilled adjacent to former Brierley and Lyman soil sampling locations. Samples collected at RISSSA-05 and -06 were also analyzed for PCB Congeners. Soil samples were also collected from five medium depth soil borings (Type 4; RISBSA-01 through -05). Based upon the widespread and relatively uniform use of this area for spraying, these five borings were randomly distributed throughout the West Canyon Spray Area. Three soil samples were collected from each boring at 0, 5, and 10 feet bgs. In addition to analysis of metals, VOCs, SVOCs, PAHs, OCPs, and PCBs, samples collected at 0, 5, and 10 feet from boring RISBSA-04 were also analyzed for dioxins and furans. The sample collected at 0 feet from RISBSA-03 was also analyzed for PCB Congeners

### 3.2.3.2.2 Phase II

Soil samples from one additional Type 2 (RISSSA-5B) and two additional Type 3 (RISSSA-4B and -6B) locations were collected in the West Canyon Spray Area and analyzed for dioxins and furans and PCB congeners at the request of the EPA. The locations were situated adjacent to Phase I borings that had elevated concentrations of COPCs.

### 3.2.3.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-6. Sampling locations in the West Canyon Spray Area are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the West Canyon Spray Area are presented in Figures B-9a and B-9b, respectively.

#### 3.2.3.3.1 Metals

Thirty-six soil samples were collected from 14 borings and three surface soil sampling locations and analyzed for metals. Detectable concentrations of metals were present in all of the samples. A total of 23 metals were detected in samples collected from surface, shallow, and medium soil in all 17 locations. Cadmium, chromium, cobalt, copper, iron, lead, nickel, tin, and zinc were detected above screening levels.

Concentrations exceeded screening levels in ten locations primarily in the southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSSA-03, -05, -06, -09, -10, -12, and RISBSA-02 through -05. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSSA-10 and RISBSA-05. In samples collected deeper than 10 feet bgs, metals were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, cadmium, chromium, cobalt, copper, lead, nickel, tin, and zinc were detected above ecological screening levels. In this depth range, ten locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels were cadmium (seven samples), chromium (eight samples), copper (seven samples), lead (five samples), nickel (eight samples), and zinc (five samples) out of a total of 31 samples analyzed. The frequency of detection, range of detected concentrations, and average values are listed on Table B-6.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, chromium and iron were detected above PRGs. In this depth range, chromium was detected in all of the samples at concentrations ranging from 21 to 670 mg/kg and exceeded PRGs at RISSSA-10 (0 feet bgs). Iron was also detected in all of the samples at concentrations ranging from 11,000 to 99,000,000 mg/kg and exceeded PRGs at RISBSA-05 (5 feet bgs).

### 3.2.3.3.2 *Volatile Organic Compounds*

Thirty-six soil samples were collected from 17 soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 78 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.3.3.3 *Semi Volatile Organic Compounds*

Thirty-six soil samples were collected from 17 soil sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 36 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.3.3.4 *Polycyclic Aromatic Hydrocarbons*

Thirty-six soil samples were collected from 17 soil sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 8 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.3.3.5 *Polychlorinated Biphenyls*

Thirty-six soil samples were collected from 17 soil sampling locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 3 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.3.3.6 *Organochlorine Pesticides*

Thirty-six soil samples were collected from 17 soil sampling locations and analyzed for organochlorine pesticides. Detectable concentrations of organochlorine pesticides were present in 14 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.3.3.7 *Dioxins and Furans*

Eight soil samples were collected from four soil sampling locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in all of the samples; however, concentrations for the TEQ did not exceed screening levels.

### 3.2.3.3.8 *PCB Congeners*

Eight soil samples were collected from six soil sampling locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in 75 percent of the samples; however, concentrations for the TEQ did not exceed screening levels.

### 3.2.3.4 Findings Relative to Adjoining Study Areas

Available data, including analytical results of pond bottom sediments from Pond A-5 indicate that elevated metals concentrations encountered within the West Canyon Spray Area may have contributed to elevated concentrations of these constituents in downstream areas, including Pond A-5, and possibly the A-Series Pond. There are no indications that conditions in the neighboring study areas have influenced or created conditions encountered in the West Canyon Spray Area.

### 3.2.3.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganics concentrations exceeded screening levels in ten locations, primarily in the southern half of the study area. Screening level exceedances are reported for cadmium, copper, chromium and nickel in roughly equal numbers of samples, followed closely by lead and zinc. With only few exceptions, inorganics exceedances are limited to surface soils, and concentrations typically diminish with increased depth. Screening level exceedances are rarely present at depths in excess of five feet bgs, with only nickel, and tin reported in excess of screening levels at a depth of 10 feet bgs.

Low concentrations of dioxins/furans, PCB Congeners, VOCs, and to a lesser extent SVOCs, are widely distributed across the West Canyon Spray Area; however, these compounds were not reported at concentrations in excess of screening levels. Other organic compounds are either not present, or only locally present at very low concentrations.

In summary, available data indicate that surface and shallow subsurface soils in the West Canyon Spray Area have been impacted by a variety of inorganic constituents at concentrations in excess of screening levels, and that the organic constituents are not present in excess of screening levels at any depth. Soil conditions in this study area have been adequately characterized and no additional data are necessary..

### 3.2.4 **Burial Trench Area**

Surface and subsurface soil samples, and residual organic seeps (tar) samples were collected in order to characterize surface and subsurface soil conditions surrounding the former disposal area (Figures B-1 and B-2). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from the Burial Trench Area is discussed in Section 4.7.6 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### 3.2.4.1 Drilling and Subsurface Conditions

Lithologic conditions encountered in the study area were described as a fractured, weathered brown silty claystone overlain by inches to several feet of unconsolidated brown silty clay with claystone fragments. The contact between the weathered and the unweathered claystone was encountered between approximately 40 to 80 feet bgs in the six borings located south and west of the former trenches (RISBBC-01, -02, -05, -06, -07, and -08). Due to equipment limitations, the contact was not reached in borings RISBBC-03 and -04, drilled to 82 and 69.5 feet bgs, respectively. Odors were observed in six of nine borings (exceptions being RISBBC-06, -07, and -08), and most commonly encountered between 20 and 58 feet bgs. The highest headspace reading as measured by the PID was 1,565 ppmv at 24.5 feet bgs in boring RISBBC-05A, located in the northwestern portion of the study area. Metal, plastic, and fibrous debris was observed at approximately 25 to 27 feet bgs in borings located between the burial trenches (RISBBC-03 and -04). Drilling and sampling at RISBBC-04 were completed with Level B protection including air supplied respirators due to the presence of landfill debris. Tar was observed mixed with sand sized claystone fragments at RISBBC-05 (5 feet bgs), at the tar seep. Groundwater was encountered in boring RISBBC-04, -06, and -07 at approximately 57.5, 55.9, and 50 feet bgs, respectively. Groundwater was not encountered in the remaining Burial Trench

Area borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### 3.2.4.2 Sample Collection

A total of 45 soil samples from 13 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Burial Trench area (Table B-1; Figure B-2).

##### 3.2.4.2.1 *Phase I*

Four surface soil samples (Type 2; RISSBC-01 through -04) were collected from locations overlying the former burial trenches to provide additional data for use in the risk assessment. Soil samples were analyzed for the Modified Appendix IX analytical suite (less dioxins and furans) and poor purging organic compounds (PPOs). The sample collected at 0 feet from RISSBC-01 was also analyzed for PCB Congeners.

Two samples from the residual organic seep were collected at 0 and 5 feet bgs from a shallow boring (RISSBC-05) drilled on the northwest portions of this area. These tar seep samples were analyzed for the full Appendix IX analytical suite with additional COPCs (including dioxins and furans).

Twenty additional samples were collected from five co-located Type 6 and 7 soil borings drilled and sampled in and around the perimeter of the Burial Trench Area. Four of these borings were advanced between the burial trenches (RISBBC-02 through RISBBC-05) and four to five samples were collected from each boring. Six soil samples were collected from one boring (RISBBC-01) completed downgradient of the trenches, along the southern margin of the Burial Trench Area, in order to evaluate potential migration of contaminants from the disposal trenches and wells.

The Type 6 and 7 co-located borings were drilled to the top of unweathered claystone surface at RISBBC-01, -02, and -05. This contact was not encountered at RISBBC-03 or -04 due to equipment limitations. In these cases, samples were collected at the terminus of the borings. Samples were selected for chemical analysis from the Type 6 borings on the basis of MIP response from the adjacent Type 7 CPT/MIP signature locations. Sampling depths for each boring are included on Table B-1. Soil samples collected from borings RISBBC-02 through -05 were analyzed for the Modified Appendix IX analyte suite with additional COPCs (less dioxins and furans) and PPOs. Samples collected from RISBBC-01 at 0, 5, and 10 feet were analyzed for the full Appendix IX analyte suite with additional COPCs (including dioxins and furans). Samples collected at 0 feet from RISBBC-03 and at 57.5 feet bgs from RISBBC-04 were also analyzed for PCB Congeners.

##### 3.2.4.2.2 *Phase II*

Soil samples from three additional Type 6 (RISBBC-06, -07, and -08) locations were collected in the Burial Trench Area and analyzed for the Modified Appendix IX analytical suite to further delineate the lateral extent of impacts to the west and southwest of the study area.

### 3.2.4.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-7. Sampling locations in the Burial Trench Area are illustrated on Figure B-2. Inorganics detected above screening levels and summary analytical results with field observations for the Burial Trench Area are presented in Figures B-10a and B-10b, respectively.

#### 3.2.4.3.1 *Metals and Cyanide*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for metals and cyanide. Detectable concentrations of metals were present in all of the samples. A total of 24 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the locations. Chromium, copper, lead, nickel, and selenium were detected above screening levels. Detectable concentrations of cyanide were present in seven percent of the samples, but not in excess of screening levels.

Metals concentrations exceeded screening levels in six locations. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSBC-01, -03, -04, -05, and RISBBC-01 and -03. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, metals and cyanide were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, chromium, copper, lead, nickel, and selenium were detected above ecological screening levels. In this depth range, six locations contained detections in excess of ecological screening levels. The most prevalent metal detected above screening levels samples was lead (four samples out of a total of 22 analyzed). The frequency of detection, range of detected concentrations, and average values are listed on Table B-7.

#### 3.2.4.3.2 *Volatile Organic Compounds*

Forty-five soil samples were collected from 13 soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 64 percent of the samples. A total of 45 VOCs were detected in samples collected from surface, shallow, medium, and deep soil in all 13 locations. 1,1-Dichloroethane, methylene chloride, PCE, TCE, vinyl chloride were detected above screening levels. One other VOC for which screening levels has not been developed was also detected.

Concentrations exceeded screening levels in 5 locations throughout the entire study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, human health screening levels were exceeded at location RISSBC-05. Furthermore, in samples collected deeper than 10 feet bgs, VOCs were detected at concentrations exceeding industrial PRGs at locations RISBBC-01, -03, -04, and -05.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, TCE was detected above PRGs. TCE was detected at concentrations ranging from 0.0031 to 24 mg/kg

and exceeded PRGs in two samples collected from RISSBC-05 (0 and 5 feet bgs). Black tar and a slight odor were observed at the 0 feet bgs sample. Black tar was also observed at the 5 feet bgs sample and strong odors and staining were noticed at 4 and 6 feet bgs.

In samples collected at depths greater than 10 feet bgs, 1,1-dichloroethane, methylene chloride, PCE, TCE, and vinyl chloride were detected above PRGs. In this depth range, 1,1-dichloroethane was detected at concentrations ranging from 0.002 to 8.1 mg/kg and exceeded PRGs at RISBBC-03 (77.5 feet bgs). Methylene chloride was detected at concentrations ranging from 0.0027 to 23 mg/kg and exceeded PRGs at RISBBC-05 (35 feet bgs). PCE was detected in 10 of the 19 samples at concentrations ranging from 0.00026 to 24 mg/kg and exceeded PRGs at RISBBC-03 (77.5 feet bgs) and RISBBC-05 (35 feet bgs). TCE was detected in 10 of the 19 samples at concentrations ranging from 0.0095 to 34 mg/kg and exceeded PRGs at RISBBC-01 (20, 37.25, and 44.75 feet bgs) RISBBC-03 (37 and 77.5 feet bgs) and RISBBC-05 (35 and 57 feet bgs). A slight odor was observed at the sample taken at 20 feet bgs from RISBBC-01. Vinyl chloride was detected at concentrations ranging from 0.0016 to 1.3 mg/kg and exceeded PRGs at RISBBC-04 (57.5 feet bgs) where oil, heavy staining, and a slight sheen were observed during sample collection.

Deep soil impacts by VOCs appear to extend from the area surrounding the former trenches and disposal wells toward the southern and western margins of the Burial Trench Area. Vertically, contamination is most apparent in the lower portion of the weathered claystone between approximately 20 to 78 feet bgs; however, the bottom of significantly impacted soil is also not defined for those borings completed in the central and southern portions of this study area.

#### 3.2.4.3.3 *Semi Volatile Organic Compounds*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 16 percent of the samples; however, concentrations did not exceed screening levels. One other SVOC for which screening levels have not been developed was also detected.

#### 3.2.4.3.4 *Polycyclic Aromatic Hydrocarbons*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 58 percent of the samples. A total of 18 PAHs were detected in samples collected from surface, shallow, medium, and deep soil in 12 of the 13 locations. Benzo(a)pyrene, n-nitrosodiethylamine, and n-nitrosodimethylamine were detected above screening levels.

Concentrations exceeded screening levels in three locations in the southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBBC-08. In samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding PRGs at RISBBC-02 and RISBBC-04.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitrosodimethylamine was detected above PRGs and was detected at a concentration of 0.089 mg/kg at RISBBC-08 (5 feet bgs).

In samples collected greater than 10 feet bgs, n-nitrosodiethylamine and benzo(a)pyrene were detected above PRGs. In this depth range, n-nitrosodiethylamine was detected at concentrations ranging from 0.086 to 0.14 mg/kg and exceeded PRGs at RISBBC-02 (52.5 feet bgs) and RISBBC-04 (57.5 feet bgs). Benzo(a)pyrene was detected at concentrations ranging from 0.004 to 0.28 and exceeded PRGs at RISBBC-04 (49 feet bgs) where oil, heavy staining, and a slight sheen were observed during sample collection.

#### *3.2.4.3.5 Polychlorinated Biphenyls*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 9 percent of the samples. A total of two PCBs were detected in samples collected from surface, shallow, and deep soil in four of the 13 locations. Aroclor 1254 was detected above screening levels.

Concentrations exceeded screening levels in one location in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, PCBs were detected at concentrations exceeding PRGs at RISBBC-04.

In samples collected greater than 10 feet bgs, Aroclor 1254 was detected above PRGs. Aroclor 1254 was detected at 150 mg/kg and exceeded PRGs at RISBBC-04 (57.5 feet bgs) where oil, heavy staining, and a slight sheen were observed during sample collection.

#### *3.2.4.3.6 Pesticides and Herbicides*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 64 percent of the samples. A total of 27 pesticides/herbicides were detected in samples collected from surface, shallow, medium, and deep soil in nine of the 13 locations. Aldrin and kepone were detected above screening levels.

Concentrations exceeded screening levels in one location in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, pesticides and herbicides were detected at concentrations exceeding PRGs at RISBBC-04.

In samples collected greater than 10 feet bgs, aldrin and kepone were detected above PRGs. In this depth range, Aldrin was detected in three of 19 samples at concentrations ranging from 0.0012 to 0.11 mg/kg and exceeded PRGs at RISBBC-04 (57.5 feet bgs). Kepone was detected at a concentration of 2.7 mg/kg and exceeded PRGs in the same sample where oil, heavy staining, and a slight sheen were observed during sample collection.

#### *3.2.4.3.7 Dioxins and Furans*

Five soil samples were collected from two borings and analyzed for dioxins and furans. Detectable concentrations of dioxins/furans were present in 80 percent of the samples; however, TEQ concentrations did not exceed screening levels.

### 3.2.4.3.8 *Poor Purging Compounds*

Forty-five soil samples were collected from nine borings and four surface soil sampling locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 71 percent of the samples. A total of 16 PPOs were detected in samples collected from surface, shallow, medium, and deep soil in 12 of the 13 locations. N-Nitroso-di-n-butylamine was detected above screening levels.

Concentrations exceeded screening levels in two locations in the northwest portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBBC-06. In samples collected deeper than 10 feet bgs, PPOs were detected at concentrations exceeding PRGs at RISBBC-05.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitroso-di-n-butylamine was detected above PRGs. In this depth range, n-nitroso-di-n-butylamine was detected in two of 35 samples at concentrations ranging from 0.061 to 0.081 mg/kg and exceeded PRGs at RISBBC-06 (5 and 10 feet bgs).

In samples collected greater than 10 feet bgs, n-nitroso-di-n-butylamine was detected above PRGs. In this depth range, n-nitroso-di-n-butylamine was detected in two of 29 samples at concentrations ranging from 0.054 to 0.11 mg/kg and exceeded PRGs at RISBBC-05 (35 feet bgs).

### 3.2.4.3.9 *PCB Congeners*

Three soil samples were collected from two borings and one surface soil sampling location and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in each of the samples. A total of 13 individual congeners were detected in samples collected from surface and deep soil in each of the three locations. The TEQ for PCB congeners was detected above screening levels.

Concentrations exceeded screening levels in one location in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded at any location. In samples collected deeper than 10 feet bgs, the TEQ for PCB congeners was detected at a concentration exceeding PRGs at RISBBC-04.

In samples collected greater than 10 feet bgs, the TEQ for PCB congeners exceeded PRGs. In this depth range, the PCB congener TEQ was detected at a concentration of 8455.32 picograms per gram (pg/g) and exceeded PRGs at RISBBC-04 (57.5 feet bgs) where oil, heavy staining, and a slight sheen were observed during sample collection.

### 3.2.4.4 Findings Relative to Adjoining Study Areas

There are no indications that chemical concentrations locally detected in soils within this area have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in the Burial Trench Area.

### 3.2.4.5 Conclusions Regarding Nature and Extent of Soil Impacts

Screening level exceedances for inorganic constituents were encountered in the majority sampling locations within the Burial Trench Area. Exceedances are present within surface to deep soils, principally within the central portion of the area. Inorganics impacts to surface soils are limited to lead, chromium, nickel, and selenium, principally in the southern portion of the area. Deep soils within the central portion of the area in proximity to the trenches locally exceed screening levels for a wider variety of inorganics at depths between 37 to 57.5 feet bgs. In contrast to conditions encountered in other study areas, maximum inorganics concentrations in a given location within the Burial Trench Area are present at depth as opposed to within surface or shallow soils.

Soils in the Burial Trench Area appear to be significantly impacted by a variety of organic constituents present above their respective screening levels, including VOCs, PAHs, PCBs, pesticides and herbicides, PPOs, and PCB congeners. Soil contamination by VOCs, most notably TCE, corresponds principally with borings completed in proximity to the trenches and disposal wells, and is most pronounced at depths in excess of 10 feet bgs, where often associated with exceedances for other organics. Deep soil impacts by VOCs apparently extend toward the southern margin of this study area. Contamination is most apparent in the weathered claystone at depths of approximately 20 to 78 feet bgs, and field observations of odor and staining generally correspond with elevated contaminant concentrations. Screening level exceedances for shallow soils are also reported for PAHs and PPOs in boring completed along the western margin of the study area. With only one exception, organics screening level exceedances are limited to soils at or below 5 feet bgs, with most present at depths in excess of 10 feet bgs. VOC screening level exceedances in the single surface soil sample correspond with an area where tarry materials are visible at the ground surface.

In summary, available data indicate that shallow to deep soils, principally within the central portion of the Burial Trench Area, have been significantly impacted by a variety of inorganic and organic constituents. Deep soil impacts by VOCs are also present along the southern margin of the area, as are lesser impacts to shallow soils by PPOs and PAHs along the western margin of the area. Field indications of soil impact, including visible tarry materials, staining, odors and elevated PID readings typically correspond with significantly elevated organics concentrations. One isolated sample collected in the central portion of the study area is reported to contain an anomalously high concentration of PCB Aroclor 1254 as well as PCB congener TEQ, indicating that deep soils in this study area have been locally impacted by PCBs and related compounds. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### **3.2.5 Central Drainage Area**

Surface soil samples, samples from soil borings, and physical properties data were collected in order to characterize surface and subsurface soil conditions in the Central Drainage Area (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.7 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

### 3.2.5.1 Drilling and Subsurface Conditions

Lithology encountered in the study area was described as unconsolidated brown, dark brown, and gray silty fragments of weathered claystone varying in size from sand- to cobble-size. Faint to strong odors with soil staining were observed in a majority of the borings, although organic vapors were not frequently detected with the PID. Drilling and sampling at borings RISBCD-09 and RISBCD-11 were completed with Level B protection including air supplied respirators due to the potential presence of NAPL. The maximum headspace reading was 277 ppmv, at 23.5 feet in boring RISBCD-07. Heaviest staining was observed in borings RISBCD-06 and RISBCD-09 at approximately 4 and 5 feet bgs, respectively. Groundwater was encountered in boring at RISBCD-06 and RISBCD-15 at approximately 4.7 and 44.9 feet bgs, respectively. Groundwater was not encountered in the remaining Central Drainage Area borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

### 3.2.5.2 Sample Collection

A total of approximately 61 soil samples from 18 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Central Drainage Area (Figure B-1). The sampling program at the Central Drainage Area included surface, shallow, medium, and deep soil sampling to evaluate the presence of contaminants in the former surface impoundments and between the existing landfills (Table B-1).

#### 3.2.5.2.1 *Phase I*

Three surface soil samples (Type 2; RISSCD-01 through -03) were collected to confirm adequate cleanup of an April 2001 break in the Gallery Well pipeline and a September 2002 "pinhole" leak at the Sump 9B extraction well. Samples from RISSCD-01 and -02 were analyzed for the full Appendix IX analytical suite with additional COPCs (including dioxins and furans) plus additional VOCs including alcohols. RISSCD-01 was also analyzed for PCB Congeners. RISSCD-03 was analyzed for the Modified Appendix IX list plus additional COPCs (less dioxins and furans) and additional VOCs including alcohols.

Soil samples were collected from three medium depth soil borings (Type 4; RISBCD-01 through -03). One boring (RISBCD-02) was located within the former footprint of Spreading Area S-1 and the other two borings (RISBCD-01 and -03) were located along the alignment of the former Metals Landfill drainage. Soil samples were collected from each boring at 0, 5, and 10 feet bgs. Soil samples collected from the borings were analyzed for the Modified Appendix IX analytical suite with additional COPCs (less dioxins and furans) plus additional VOCs including alcohols. Samples collected at 10 feet bgs from RISBCD-01 and -02 were also analyzed for the following physical parameters: pH, total organic carbon, moisture content, bulk density and total porosity, grain size distribution, and Atterberg limits. Additionally, samples collected at 0 feet from RISBCD-01, -02, and -03 were analyzed for PCB Congeners.

Soil samples were collected from nine medium and deep (Type 4 and Type 7) borings (RISBCD-04, -05, -06, -07, -08, -10, -11, -12, and -13). Four borings (RISBCD-06, -07, -10, and -11) were drilled along the former P/S Landfill drainage (south of the P/S Landfill, within former Pads 9A and 9B, and adjacent to PSCT-1). Three borings (RISBCD-04, -05, -12) were drilled along the former Metals Landfill drainage (within former Ponds 19 and 6). One boring (RISBCD-08) was drilled in former Pond R. The final boring (RISBCD-13) was drilled at the former landfill loading dock. Soil samples were collected from each boring at depths of 0, 5, and

10 feet bgs. Additional soil samples were collected based upon on MIP responses at associated Type 7 boring locations. Samples were analyzed for the modified Appendix IX analytical suite plus additional COPCs (no dioxins and furans) and additional VOCs including alcohols. Samples collected at 0, 5, and 10 feet bgs from RISBCD-06 and -13 and 0, 5, 10, 15, and 24 feet bgs from RISBCD-08 were also analyzed for dioxins and furans (full Appendix IX). Additionally, samples collected at 5 feet bgs from RISBCD-08, at 8 and 33 feet bgs from RISBCD-09, and at 0 and 5 feet bgs from RISBCD-10, were analyzed for PCB Congeners.

Because NAPL is known to be present in this area, one boring (RISBCD-09) was drilled near Sump 9B to calibrate MIP equipment sensitivity.

#### 3.2.5.2.2 *Phase II*

Soil samples were collected from two additional deep (Type 6) borings located east of Sump 9B road (RISBCD-14) and west of RISBCD-08 (RISBCD-15). Soil samples were collected from each boring at depths of 0, 5, and 10 feet bgs, just above groundwater at RISBCD-15 (44 feet bgs), and at the weathered/unweathered contact (37 and 48 feet bgs, respectively). Samples were analyzed for the Modified Appendix IX analytical suite to further delineate the lateral extent of impacts detected in Phase I borings completed in this area.

#### 3.2.5.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-8. Physical properties of soils are presented in Table B-19 and summarized in Section 3.3. Sampling locations in the Central Drainage Area are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the Central Drainage Area are illustrated in Figures B-11a and B-11b, respectively.

##### 3.2.5.3.1 *Metals and Cyanide*

Fifty-seven soil samples were collected from 15 borings and three surface soil sampling locations and analyzed for metals and cyanide. Detectable concentrations of metals were present in all of the samples. A total of 25 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 18 locations. Barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc were detected above screening levels. Detectable concentrations of cyanide were present in two percent of the samples, but not in excess of screening levels.

Concentrations exceeded screening levels in eight locations, primarily in the western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSCD-01, -03, and RISBCD-05 through -08, -12, and -15. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, metals were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc were detected above ecological screening levels. In this depth range, eight locations contained detections in excess of ecological

screening levels. The most prevalent metals detected above screening levels are barium (6 samples) and copper (3 samples) out of a total of 30 samples analyzed. Staining was observed in the sample collected at RISBCD-07 (5 feet bgs). Two of the five locations containing elevated barium concentrations were collected from borings in the vicinity of Sump 9B (RISSCD-03 and RISBCD-07). The frequency of detection, range of detected concentrations, and average values are listed on Table B-8.

#### 3.2.5.3.2 *Volatile Organic Compounds*

Fifty-eight soil samples were collected from 16 borings and three surface soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 93 percent of the samples. A total of 54 VOCs were detected in samples collected from surface, shallow, medium, and deep soil in each of the 19 locations. 1,1-Dichloroethane, 1,2-dibromo-3-chloropropane, 1,2-dichloroethane, benzene, chloroform, methylene chloride, PCE, TCE, and vinyl chloride were detected above screening levels. One other VOC for which screening levels have not been developed was also detected.

Concentrations exceeded screening levels in eight locations in the western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any locations in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBCD-07, -08, -09, -10, and -13. In samples collected deeper than 10 feet bgs, VOCs were detected at concentrations exceeding PRGs at RISBCD-06, -07, -08, -09, -10, -11, -11A, and -13.

1,1-Dichloroethane was detected at concentrations ranging from 0.00059 to 8.5 mg/kg in 38 of 58 samples analyzed for VOCs. Concentrations exceeded PRGs in five locations. In samples collected up to and including 10 feet bgs, 1,1-dichloroethane was detected in concentrations ranging from 0.00059 to 6.9 mg/kg and exceeded PRGs at RISBCD-09 and -13 (both at 8 feet bgs). In samples collected deeper than 10 feet bgs, 1,1-dichloroethane was detected at concentrations exceeding screening levels at RISBCD-07 (22 feet bgs), -08 (12 feet bgs), -09 (33 feet bgs), -11A (41 feet bgs), and -13 (30 feet bgs). Samples with elevated concentrations of 1,1-dichloroethane were all collected from the area south of the Pesticide/Solvent (P/S) Landfill clay barrier, including adjacent to Sump 9B (RISBCD-09), within the former limits of Pond R (RISBCD-08), at the former landfill loading dock (RISBCD-13), and along the western historical drainage channel (RISBCD-11 and -11A) in the western portion of the study area.

1,2-Dibromo-3-chloropropane was detected in one of the 58 samples analyzed for VOCs. It was detected at a concentration of 0.17 mg/kg at 41 feet bgs in boring RISBCD-11A.

1,2-Dichloroethane was detected at concentrations ranging from 0.0022 to 2.5 mg/kg in 22 of 58 samples analyzed for VOCs. Concentrations exceeded PRGs in four locations. In samples collected up to and including 10 feet bgs, 1,2-dichloroethane was detected at a maximum concentration of 0.57 mg/kg and exceeded PRGs at RISBCD-09 (8 feet bgs) and -13 (8 feet bgs). In samples collected deeper than 10 feet bgs, 1,2-dichloroethane was detected at a maximum concentration of 2.5 mg/kg and exceeded PRGs at RISBCD-09 (33 feet bgs), -11 (42 feet bgs), -11A (41 feet bgs), and -13 (30 feet bgs), south of the P/S Landfill buttress.

Benzene was detected at concentrations ranging from 0.00035 to 7.1 mg/kg in 32 of the 58 samples analyzed for VOCs. Concentrations exceeded PRGs in five locations. In samples collected up to and including 10 feet bgs, benzene was detected in concentrations ranging from

0.00035 to 2.7 mg/kg and exceeded PRGs in one sample: RISBCD-09 (8 feet bgs). In samples collected deeper than 10 feet bgs, benzene was detected in concentrations ranging from 0.00069 to 7.1 mg/kg and exceeded screening levels in six samples, including RISBCD-07 (22 feet bgs), -09 (33 feet bgs), -11 (42 feet bgs), and -11A (41 feet bgs) and -13 (20 and 30 feet bgs) south of the P/S Landfill buttress.

Chloroform was detected at concentrations ranging from 0.00048 to 9.8 mg/kg in 29 of 58 samples analyzed for VOCs. Concentrations exceeded PRGs in five locations. In samples collected up to and including 10 feet bgs, chloroform was detected in concentrations ranging from 0.00048 to 5.7 mg/kg and exceeded PRGs in samples from RISBCD-07 (5 and 10 feet bgs) and RISBCD-13 (8 feet bgs). In samples collected deeper than 10 feet bgs, chloroform was detected in concentrations ranging from 0.0024 to 9.8 mg/kg and exceeded PRGs in six samples, including RISBCD-07 (22 feet bgs), -08 (12 feet bgs), -09 (33 feet bgs), -11A (41 feet bgs), and -13 (20 and 30 feet bgs).

Methylene chloride was detected at concentrations ranging from 0.0012 to 110 mg/kg in 25 of 57 samples analyzed for VOCs. In samples collected deeper than 10 feet bgs, methylene chloride was detected in concentrations ranging from 0.0018 to 110 mg/kg, and exceeded PRGs in three samples, including RISBCD-08 (12 feet bgs) and -13 (20 and 30 feet bgs).

PCE was detected at concentrations ranging from 0.0003 to 220 mg/kg in 35 of 57 samples analyzed for VOCs. Concentrations exceeded PRGs in eight locations. In samples collected up to and including 10 feet bgs, PCE was detected in concentrations ranging from 0.0003 to 33 mg/kg and exceeded PRGs in six samples at RISBCD-07 (5 feet bgs), -08 (5 feet bgs), -09 (8 feet bgs), -10 (5 feet bgs), and -13 (0 and 8 feet bgs) in the western portion of the study area. In samples collected deeper than 10 feet bgs, PCE was detected in concentrations ranging from 0.0089 to 220 mg/kg and exceeded PRGs in nine samples, including RISBCD-06 (24 feet bgs), -07 (22 feet bgs), -08 (12 and 24 feet bgs), -11 (29 and 42 feet bgs), -11A (41 feet bgs), and -13 (20 and 30 feet bgs).

TCE was detected at concentrations ranging from 0.0011 to 20 mg/kg in 36 of 58 samples analyzed for VOCs. Concentrations exceeded PRGs in five locations. In samples collected up to and including 10 feet bgs, TCE was detected in concentrations ranging from 0.0024 to 6.3 mg/kg and exceeded PRGs in eight samples from RISBCD-07 (5 and 10 feet bgs), -08 (5 feet bgs), -09 (8 feet bgs), -10 (0 and 5 feet bgs), and -13 (0 and 8 feet bgs). In samples collected deeper than 10 feet bgs, TCE was detected in concentrations ranging from 0.0011 to 20 mg/kg and exceeded PRGs in 12 samples, including RISBCD-06 (24 feet bgs), -07 (22 feet bgs), -08 (12 and 24 feet bgs), -09 (33 feet bgs), -10 (12 feet bgs), -11 (12, 29, and 42 feet bgs), -11A (41 feet bgs), and -13 (20 and 30 feet bgs).

Vinyl chloride was detected at concentrations ranging from 0.004 to 1.2 mg/kg in eight of 58 samples analyzed for VOCs. Concentrations exceeded PRGs in two locations. In samples collected up to and including 10 feet bgs, vinyl chloride was detected at concentrations ranging from 0.0062 to 0.99 mg/kg and exceeded PRGs at RISBCD-09 (8 feet bgs). In samples collected deeper than 10 feet bgs, vinyl chloride was detected in concentrations ranging from 0.004 to 1.2 mg/kg and exceeded PRGs at RISBCD-11A (41 feet bgs).

The following field observations were noted in the samples described above: At RISBCD-07 (5 feet bgs), headspace was recorded at 77 ppmv and staining was observed. Headspace was recorded at 277 ppmv in the same boring at 22 feet bgs. At RISBCD-08 (12 feet bgs),

headspace was recorded at 66.7 ppmv. At RISBCD-09, headspace was recorded at 140 ppmv (5.5 feet bgs) and 271 (30 feet bgs); furthermore, heavy staining was observed at 8 feet bgs. A moderate to strong odor was observed at RISBCD-11 (29 and 42 feet bgs).

#### 3.2.5.3.3 *Semi Volatile Organic Compounds*

Fifty-eight soil samples were collected from 16 borings and three surface soil sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 26 percent of the samples. A total of 27 SVOCs were detected in samples collected from surface, shallow, and deep soil in 12 of the 19 locations. 1,4-Dichlorobenzene was detected above screening levels.

Concentrations exceeded screening levels in two locations in the western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, SVOCs were detected at concentrations exceeding PRGs at RISBCD-07 and RISBCD-11A.

In samples collected greater than 10 feet bgs, 1,4-dichlorobenzene was detected above PRGs. In this depth range, 1,4-dichlorobenzene was detected in 35 percent of the samples at concentrations ranging from 0.3 to 38 mg/kg and exceeded PRGs at RISBCD-07 (22 feet bgs) and -11A (41 feet bgs). Headspace readings were recorded at 277 ppmv in this sample.

#### 3.2.5.3.4 *Polycyclic Aromatic Hydrocarbons*

Fifty-eight soil samples were collected from 16 borings and three surface soil sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 57 percent of the samples. A total of 18 PAHs were detected in samples collected from surface, shallow, medium, and deep soil in 15 of the 19 locations. Benzo(a)pyrene, naphthalene, n-nitrosodiethylamine, and n-nitrosodimethylamine were detected above screening levels.

Concentrations exceeded screening levels in five locations primarily in the western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBCD-04, located in the eastern portion of the study area and the toe of the caustic/cyanide Landfill buttress. In samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding PRGs at RISBCD-07, -11, -13, and -15.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitrosodimethylamine was detected above PRGs. In this depth range, n-nitrosodimethylamine was detected in one sample at a concentration of 0.041 mg/kg and exceeded PRGs at RISBCD-04 (5 feet bgs). A moderate odor was observed in this sample.

In samples collected greater than 10 feet bgs, benzo(a)pyrene, naphthalene, n-nitrosodiethylamine, and n-nitrosodimethylamine were detected above PRGs. In this depth range, benzo(a)pyrene was detected in 12 percent of the samples at concentrations ranging from 0.72 to 0.79 mg/kg and exceeded PRGs at RISBCD-15 (44 and 48 feet bgs). Naphthalene was detected in 53 percent of the samples at concentrations ranging from 0.0062 to 24 mg/kg and exceeded PRGs at RISBCD-07 (22 feet bgs; Pad 9B). Headspace readings were recorded

at 277 ppmv in this sample. N-Nitrosodiethylamine was detected in one sample at a concentration of 0.81 mg/kg and exceeded PRGs at RISBCD-11 (42 feet bgs; historical natural drainage). A strong odor was observed in this sample. N-Nitrosodimethylamine was detected in one sample at a concentration of 0.16 mg/kg and exceeded PRGs at RISBCD-13 (30 feet bgs).

#### 3.2.5.3.5 *Polychlorinated Biphenyls*

Fifty-seven soil samples were collected from 15 borings and three surface soil sampling locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 26 percent of the samples. A total of three PCBs were detected in samples collected from surface, shallow, medium, and deep soil in 11 of the 18 locations. Aroclor 1260 was detected above screening levels.

Concentrations exceeded screening levels in two locations in the western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBCD-09 and -10. In samples collected deeper than 10 feet bgs, PCBs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, Aroclor 1260 was detected above PRGs. In this depth range, Aroclor 1260 was detected in 32 percent of the samples at concentrations ranging from 0.019 to 3.2 mg/kg and exceeded PRGs at RISBCD-09 (8 feet bgs) and -10 (0 feet bgs). At RISBCD-09 (8 feet bgs), headspace readings were recorded at 140 ppmv and heavy staining was observed.

#### 3.2.5.3.6 *Pesticides and Herbicides*

Fifty-seven soil samples were collected from 15 borings and three surface soil sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 67 percent of the samples. A total of 35 pesticides/herbicides were detected in samples collected from surface, shallow, medium, and deep soil in 13 of the 18 locations. Hexachlorobenzene and mirex were detected above screening levels.

Concentrations exceeded screening levels in two locations in the central western portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBCD-09. In samples collected deeper than 10 feet bgs, pesticides and herbicides were detected at concentrations exceeding PRGs at RISBCD-07.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, mirex was detected above PRGs. In this depth range, mirex was detected in 15 percent of the samples at concentrations ranging from 0.0021 to 0.96 mg/kg and exceeded PRGs at RISBCD-09 (8 feet bgs). Headspace readings were recorded at 140 ppmv and heavy staining were observed in this sample.

In samples collected greater than 10 feet bgs, hexachlorobenzene and mirex were detected above PRGs. In this depth range, hexachlorobenzene was detected in 31 percent of the samples at concentrations ranging from 0.0012 to 1.5 mg/kg. Mirex was detected in 25 percent

of the samples at concentrations ranging from 0.029 to 2.6 mg/kg. They exceeded PRGs in the same sample: RISBCD-07 (22 feet bgs). Headspace readings were recorded at 277 ppmv in this sample.

#### *3.2.5.3.7 Dioxins and Furans*

Fifteen soil samples were collected from four borings and two surface soil sampling locations and analyzed for dioxin and furans. Detectable concentrations of dioxin/furans were present in all of the samples. A total of 17 individual congeners were detected in samples collected from surface, shallow, medium, and deep soil in each of the six locations. Total TEQ was detected above screening levels.

Concentrations (TEQ) exceeded screening levels in one location. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded in any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSCD-01 in the northern portion of the study area, situated directly downslope from the Gallery Well at the toe of the P/S Landfill buttress, along the historical drainage pathways through this area. In samples collected deeper than 10 feet bgs, total TEQ was not detected at concentrations exceeding PRGs.

In samples collected up to and including 10 feet bgs, dioxins/furans were detected above PRGs. In this depth range, dioxins/furans were detected in 9 out of 10 samples at concentrations ranging from 0.000326 to 57.52022 pg/g and exceeded PRGs at RISSCD-01 (0 feet bgs).

#### *3.2.5.3.8 Poor Purging Compounds*

Fifty-eight soil samples were collected from 15 borings and three surface soil sampling locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 58 percent of the samples. A total of 14 PPOs were detected in samples collected from surface, shallow, medium, and deep soil in 16 of the 18 locations. N-Nitrosodi-n-butylamine was detected above screening levels.

Concentrations exceeded screening levels in one location in the southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBCD-06. In samples collected deeper than 10 feet bgs, PPOs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitrosodi-n-butylamine was detected above PRGs. In this depth range, it was detected at a concentration of 1.2 mg/kg and exceeded PRGs at RISBCD-06 (10 feet bgs). A strong odor and sheen were observed in the sample.

#### *3.2.5.3.9 PCB Congeners*

Nine soil samples were collected from six borings and one surface soil sampling location and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in 89 percent of the samples. A total of 14 individual congeners were detected in samples collected from surface, shallow, medium, and deep soil in six of the seven locations. The TEQ for PCB congeners was detected above screening levels.

Concentrations (TEQ) exceeded screening levels in one location in the central, southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at location RISBCD-10. In samples collected deeper than 10 feet bgs, the TEQ for PCB congeners was not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, the TEQ for PCB congeners exceeded PRGs. In this depth range, PCB congeners were detected in 88 percent of the samples at concentrations (TEQ) ranging from 0.0064317 to 32.35227 pg/g and exceeded PRGs at RISBCD-10 (0 feet bgs).

#### 3.2.5.4 Findings Relative to Adjoining Study Areas

Existing data from borings completed in the eastern portion of the Maintenance Shed Area indicate that high concentrations of organics, particularly VOCs, do not extend westerly from the Central Drainage Area into the Maintenance Shed Area. It is assumed that high VOC concentrations detected within this Central Drainage Area are at least in part related to sources within the P/S Landfill, and contaminated soil within this portion of the study area is assumed to extend from the P/S Landfill on the north to the PSCT on the south.

#### 3.2.5.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents are present above screening levels in slightly less than half the locations sampled, principally in the western half of the study area. The most prevalent constituents exceeding screening levels include barium, followed by copper. The widest variety and highest concentrations of inorganics detected above screening levels generally correspond with surface soil samples collected in proximity to and downslope of the gallery well and sump 9B along the former course of a historical surface drainage through this portion of the study area. With few exceptions inorganics screening level exceedances in the western portion of the study area are reported principally in surface and shallow soils, whereas exceedances in the eastern portion of the study area are reported principally at shallow to intermediate depths along the former course of a surface drainage once traversing this portion of the study area.

Many of the shallow to deep soil samples collected from borings completed in the western portion of the Central Drainage were reported to contain organic constituents in excess of screening levels. VOCs were the most prevalent organic constituent detected in this area, followed by pesticides/herbicides, PAHs, SVOCs, and PCBs, and to a lesser extent PPOs, dioxins/furans, and PCB Congeners. Screening level exceedances for PCBs and PCB congeners were limited to surface soil samples collected directly adjacent to extraction point PSTC-1. With the exception of low levels of PAHs at RISBCD-04, no organic constituents were detected in excess of screening levels in any borings completed within the northern or eastern portion of the Central Drainage Area, lying to the east of the Sump 9B road. Organics screening level exceedances were limited primarily to soil borings completed in the area below the P/S landfill. Not surprisingly, highest organics concentrations were reported in borings proximal to the toe of the P/S Landfill and Sump 9B.

In summary, available data indicate that principally surface to shallow soils across a broad area of the Central Drainage Area have been impacted by inorganic constituents at concentrations above screening levels. Exceedances for organic constituents are limited almost exclusively to

shallow to deep soils within the western portion of the study area, principally in proximity to the toe of the P/S Landfill, Sump 9B and locations situated down slope of these areas toward the PSCT. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### **3.2.6 Liquids Treatment Area**

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions surrounding the Liquids Treatment Area (Figure B-1 and B-3). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.8 of the RI/FS Work Plan.

#### **3.2.6.1 Drilling and Subsurface Conditions**

Lithologic conditions encountered in the study area were described as a fractured, weathered olive- and yellowish-brown silty claystone overlain by inches to several feet of unconsolidated pale and olive-brown silts and silty clay with claystone fragments. The contact between the weathered and the unweathered claystone was encountered between approximately 45.5 to 50.5 feet bgs in the four borings surrounding the six-pack tanks (RISBLT-05 through -08). Slight evidence of odors or chemical staining were observed in each of those borings and in shallow soil (approximately at 1 and 7 feet) of boring RISBLT-02, located northwest of the six-pack tank area. Headspace readings were generally non-detect, but ranged from 236 to 325 ppmv from near-surface soil at RISBLT-10, located beneath the concrete pad of the six-pack tanks. Groundwater was encountered in borings RISBLT-06 and RISBLT-08 at approximately 24 and 42 feet bgs, respectively. Groundwater was not encountered in the remaining Liquids Treatment Area borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### **3.2.6.2 Sample Collection**

A total of 60 soil samples from 19 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Liquids Treatment Area (Figure B-3). The sampling program included surface, shallow, medium, and deep soil sampling to evaluate the potential effects on soil from possible spills or leaks at the Liquids Treatment Area (Table B-1).

##### **3.2.6.2.1 *Phase I***

Five surface soil samples (Type 2) were collected in unpaved areas surrounding the liquid transfer areas and downslope of treatment facilities (RISSLT-01 through -05). One additional surface soil sample (RISSLT-06) was collected in the area formerly impacted by a leak in the Gallery Well liquids pipeline. Surface soil samples were limited to unpaved areas, as these are considered to represent the highest likelihood of chemical impact. Samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs (no dioxins and furans) and additional VOCs including alcohols. The sample collected at RISSLT-04 was also analyzed for PCB Congeners.

One boring Type 4 (RISBLT-11) was drilled and sampled southwest of the Casmalia Neutralization System (CNS) and west of Pond 14 and one boring (RISBLT-12) was drilled between the western Concrete Containment Area and the temporary PACT Unit in the location of former Pond 15. Soil samples were collected from these borings at 0, 5, and 10 feet bgs and analyzed for the Modified Appendix IX analytical suite with additional COPCs plus additional VOCs including alcohols. Additionally, the sample collected at 0 feet from RISBLT-12 was analyzed for PCB Congeners.

Four soil borings (Type 5) were drilled and sampled as follows: Boring RISBLT-01 was drilled immediately south (downgradient) of the CNS. Boring RISBLT-02 was drilled adjacent to the former temporary tanks north of the Operations Building. Boring RISBLT-03 was drilled west of the Operations Building near the sewer corridor. Boring RISBLT-04 was drilled immediately south (downgradient) of the Operations Building. Soil samples were collected from each boring at 0, 5, 10, and 20 feet bgs and analyzed for the Modified Appendix IX analytical suite with additional COPCs (no dioxins and furans) plus additional VOCs including alcohols. In addition, samples collected at 0, 5, and 10 feet bgs from RISBLT-04 were also analyzed for dioxins and furans (full Appendix IX list with additional COPCs). The two 10-foot samples from RISBLT-03 and -04 were also analyzed for the following physical properties: pH, total organic carbon, moisture content, bulk density and total porosity, grain size distribution, and Atterberg limits. Physical properties of soils are summarized in Section 3.3.

Soil samples were collected from one deep (Type 6) boring (RISBLT-06) drilled adjacent to BLS-1, a former shallow well located immediately next to the former wet air oxidation (WAO) footing near the northeast corner of the Operations Building. Two samples were collected from the boring at 15, 20 feet bgs, just above groundwater (24.5 feet bgs), and at the weathered/unweathered contact (44.5 feet bgs). Samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs (no dioxins and furans) plus additional VOCs including alcohols.

Soil samples were collected from three deep co-located Type 6/Type 7 borings (RISBLT-05, -07, and -08) surrounding the western, northern, and eastern boundaries of the 6-pack containment. The borings were drilled to the top of the unweathered bedrock contact (approximately 45 feet bgs). Samples were selected for chemical analysis on the basis of MIP response in the adjacent Type 7 CPT/MIP boring. Sampling depths for each boring are included on Table B-1. Borings RISBLT-05 had no associated elevated MIP readings, thus four samples were collected at default depths of 0, 5, 10, 20, and 43 feet bgs (contact). Sampling depths in borings RISBLT-07 and -08 were adjusted based on MIP readings. Samples were collected at depths of 0, 5, 9, 20, and 42 feet bgs at RISBLT-07 and 0, 5, 22, 42.5 (groundwater), and 48 (bedrock) at RISBLT-08. Samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs (no dioxins and furans) plus additional VOCs including alcohols.

Three soil samples were collected from a co-located Type 4/Type 7 boring (RISBLT-09) drilled south of the Operations Building near the concrete containment or "cement pond". Samples from this boring were selected for chemical analysis on the basis of MIP and pore pressure readings in the adjacent Type 7 CPT boring. Samples were collected at 0, 5, 19, and 36 feet bgs and analyzed for the full Appendix IX analytical suite with additional COPCs (including dioxins and furans – RISBLT-10 only) and additional VOCs including alcohols.

Soil samples (Type 5) were also collected from two borings completed within the 6-pack containment berm (RISBLT-10 and -13). Samples were collected at 0, 5, 10, and 20 feet bgs from RISBLT-10 and analyzed for the full Appendix IX analytical suite with additional COPCs (including dioxins and furans) and additional VOCs including alcohols. Samples collected from RISBLT-13 were analyzed for the Modified Appendix IX analytical suite.

#### 3.2.6.2.2 *Phase II*

No additional samples were collected in the Liquids Treatment Area during Phase II.

#### 3.2.6.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-9. Sampling locations in the Liquids Treatment Area are illustrated on Figure B-3. Inorganics detected above screening levels and summary analytical results with field observations for the Liquids Treatment Area are illustrated in Figures B-12a and B-12b, respectively.

##### 3.2.6.3.1 *Metals and Cyanide*

Sixty soil samples were collected from 13 borings and six surface soil sampling locations and analyzed for metals and cyanide. Detectable concentrations of metals were present in all of the samples. Detectable concentrations of cyanide were present in five percent of the samples. A total of 24 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 19 locations. Arsenic, cadmium, chromium, copper, lead, nickel, tin, vanadium, and zinc were detected above screening levels.

Concentrations exceeded screening levels in eight locations primarily in the southern half of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISBLT-01, -02, -04, -07, -10, -11, and -12. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, metals and cyanide were detected at concentrations exceeding PRGs at RISBLT-06.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, cadmium, chromium, copper, lead, nickel, tin, vanadium, and zinc were detected above ecological screening levels. In this depth range, seven locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are cadmium (3 samples), copper (3 samples), and lead (3 samples) out of a total of 30 samples analyzed. The frequency of detection, range of detected concentrations, and average values are listed on Table B-9.

In samples collected greater than 10 feet bgs, arsenic was detected above its PRG. In this depth range, arsenic was detected in 84 percent of the samples at concentrations ranging from 1.1 to 26 mg/kg and exceeded its PRG at RISBLT-06 (20 feet bgs).

### 3.2.6.3.2 *Volatile Organic Compounds*

Sixty soil samples were collected from 13 borings and six surface soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 62 percent of the samples. A total of 29 VOCs were detected in samples collected from surface, shallow, medium, and deep soil in 14 of the 19 locations. TCE was detected above screening levels. One other VOC for which screening levels have not been developed was also detected.

Concentrations exceeded screening levels in three locations in the central southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, VOCs were detected at concentrations exceeding PRGs at RISBLT-05, -06, and -07.

In samples collected at depths greater than 10 feet bgs, TCE was detected above PRGs. In this depth range, TCE was detected in 42 percent of the samples at concentrations ranging from 0.0037 to 1.1 mg/kg and exceeded PRGs in three samples collected from RISBLT-05 (43 feet bgs), -06 (44.5 feet bgs), and -07 (42 feet bgs). A slight odor was observed in the sample taken at 43 feet bgs from RISBLT-5.

### 3.2.6.3.3 *Semi Volatile Organic Compounds*

Sixty soil samples were collected from 13 borings and six surface soil sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 17 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.6.3.4 *Polycyclic Aromatic Hydrocarbons*

Sixty soil samples were collected from 13 borings and six surface soil sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 23 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.6.3.5 *Polychlorinated Biphenyls*

Sixty soil samples were collected from 13 borings and six surface sampling locations and analyzed for PCBs. PCBs were not detected in any of the samples.

### 3.2.6.3.6 *Pesticides and Herbicides*

Sixty soil samples were collected from 13 borings and six surface sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides and herbicides were present in 48 percent of the samples. A total of 21 pesticides/herbicides were detected in samples collected from surface, shallow, medium, and deep soil in 17 of the 19 locations. Hexachlorobenzene and MCPP were detected above screening levels.

Concentrations exceeded screening levels in one location in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISBLT-02. In samples collected up to and including 10 feet bgs, PRGs were also exceeded at RISBLT-02. In samples collected deeper than 10 feet bgs, pesticides and herbicides were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 and up to and including 5 feet bgs, MCPP was detected above ecological screening levels. In this depth range, MCPP was detected in 14 percent of the samples at concentrations ranging from 0.75 to 1400 mg/kg and exceeded ecological screening levels at RISBLT-02 (0 feet bgs).

In samples collected at depths ranging from 0 up to and including 10 feet bgs, hexachlorobenzene and MCPP were detected above PRGs. In this depth range, hexachlorobenzene was detected in 12 percent of the samples at concentrations ranging from 0.00093 to 3.1 mg/kg and exceeded PRGs in the surface soil sample collected from RISBLT-02, located adjacent to the temporary tanks north of the Operations Building. A slight odor was observed in the sample. MCPP was detected in 10 percent of the samples at concentrations ranging from 0.75 to 1,400 mg/kg and exceeded PRGs in the same sample.

#### *3.2.6.3.7 Dioxins and Furans*

Nine soil samples were collected from three borings and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in each of the nine samples; however, TEQ concentrations did not exceed screening levels.

#### *3.2.6.3.8 Poor Purging Compounds and Ethylene Glycol*

Sixty soil samples were collected from 13 borings and six surface sampling locations and analyzed for PPOs. Thirty-two of these samples were also analyzed for ethylene glycol. Detectable concentrations of ten PPOs were present in 35 of the 60 samples; however, not in concentrations that exceeded screening levels. Ethylene glycol was not detected in any of the samples.

#### 3.2.6.4 Findings Relative to Adjoining Study Areas

Available data indicate that elevated concentrations of pesticides/herbicides locally present in this area are spatially associated with former and existing liquids treatment facilities and equipment in the central and southern portion of this area, and there is no indication that these conditions may have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in Liquids Treatment Area.

#### 3.2.6.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents are present above screening levels in slightly less than half the locations sampled within the Liquids Treatment Area. Barium, copper, and lead were the most prevalent inorganic constituents exceeding screening levels, and were present at these levels in an equal number of samples. Over half of the inorganics exceedances were for surface soil samples collected in proximity to historical and existing process equipment and related facilities, with the remainder reported to be present in shallow or intermediate depth soils. No inorganic constituents were reported in samples collected from deeper than 10 feet bgs.

Results indicate soils within the Liquids Treatment Area have been locally impacted by organic constituents above screening levels, including select pesticides, herbicides, and VOCs. Other organic constituents were either not detected or were reported at concentrations below screening levels. Pesticides and herbicides are relatively widespread in the soils throughout the area. Highest concentrations of pesticides and herbicides are limited primarily to surface soils,

and to a lesser extent medium depth soils; however, these constituents are also locally detected in low concentrations at the maximum depth explored. Highest pesticide and herbicide levels are encountered in proximity to historical and existing process equipment and related facilities, most notably in surface soil at the temporary tanks situated north of the Operations Building, as well as in shallow soils surrounding the Operations Building and 6-pack tanks. No significantly elevated organics were reported for soils underlying the concrete containment structure for the 6-pack tanks. The presence of elevated herbicides in exposed surface soils in this area is not surprising, and may be attributable to the prior use of weed control chemicals in areas surrounding liquids conveyance piping and storage vessels. Low concentrations of VOCs, below screening levels, are pervasive in surface to intermediate depth soils throughout the area. Screening level exceedances for VOCs are restricted to deep soils beneath approximately 40 feet bgs. Maximum reported VOC concentrations were detected in samples collected from deep soils lying at or beneath the groundwater table, and are likely affected by groundwater contamination.

In summary, available data indicate that screening level exceedances are limited to variety of inorganic constituents present in surface to intermediate dept soils across the study area, and that organics exceedances are limited to pesticides and herbicides in surface soils at one location. These exceedances are spatially associated with historical and existing process equipment and related facilities. VOC exceedances are restricted to deep soils lying in at or below the groundwater table, and are likely affected by groundwater contamination. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### **3.2.7 Maintenance Shed Area**

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions at the Maintenance Shed Area (Figures B-1 and B-4). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.9 of the RI/FS Work Plan.

#### **3.2.7.1 Drilling and Subsurface Conditions**

Lithologic conditions encountered in the Maintenance Shed Area included fractured, weathered light yellowish-brown and gray silty claystone overlain by approximately 3.5 to 11 feet of unconsolidated pale and olive-brown silt and silty clay with abundant claystone fragments. RISBMS-04 was drilled inside the maintenance shed at the eastern end of the mechanics pit. This location had a concrete slab overlying approximately 6 feet of fill within the concrete-lined pit, which was overlying weathered bedrock. No evidence of odors or chemical staining was observed in the Maintenance Shed Area borings beyond surficial staining associated with historical facilities and features. Groundwater was not encountered in any of the Maintenance Shed Area borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### **3.2.7.2 Sample Collection**

Forty-seven soil samples from 15 locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Maintenance Shed Area

(Figures B-4). The sampling program at the Maintenance Shed Area included surface, shallow, medium, and deep soil sampling to evaluate the potential presence of contaminants from historical vehicle and construction equipment servicing and related support facilities (Table B-1).

#### 3.2.7.2.1 Phase I

Two surface soil samples (Type 2; RISSMS-01 and RISSMS-02) were collected at two locations in the general access area and analyzed for metals, VOCs, SVOCs, PAHs, and total petroleum hydrocarbons (TPH) as gasoline (TPHg) and diesel (TPHd).

One surface soil sample (Type 2; RISSMS-03) was collected north of the Maintenance Shed at the location of a July 2000 Gallery Well pipeline leak to evaluate if residual contaminants remain in shallow soil following earlier cleanup. This sample was analyzed for the Modified Appendix IX analytical suite with additional COPCs and PPOs, as well as for PCB Congeners.

Soil samples were collected from four medium depth borings (Type 4; RISBMS-05 through -07 and -12) located outside the Maintenance Shed. Three of these borings are located where apparent staining was identified on historical aerial photographs. Three soil samples were collected from each soil boring. Samples were to be selected for chemical analysis submittal based on PID measurements and any visible evidence of staining. However, no elevated PID readings or staining were observed; therefore, samples were collected at default depths of 0, 5, and 10 feet bgs. Samples were analyzed for metals, VOCs, SVOCs, PAHs, BTEX, TPHg, TPHd, and PPOs.

Soil samples were collected from four medium depth borings (Type 5; RISBMS-01, -04, -10, and -11). One boring, RISBMS-04, was drilled adjacent to the mechanic pit inside the Maintenance Shed. One boring, RISBMS-01, was drilled between the southeast corner of the Maintenance Building and the northwest corner of the decon pad. One boring, RISBMS-11, was drilled at the northeast side of the decon pad. One boring, RISBMS-10, was drilled at the former location of two temporary aboveground tanks in the south yard area. This fourth boring is located along the western end of the tanks, where potential staining was observed in aerial photographs. Four soil samples were collected from each Type 5 soil boring. Samples were collected at default depths of 0, 5, 10, and 20 feet bgs. The RI/FS Work Plan states that if contamination was present at 20 feet (e.g., there were elevated PID readings, stained soil, or odor), the boring was to be advanced to the top of the unweathered bedrock contact and samples were to be collected for chemical analysis just above the groundwater table and at the unweathered bedrock contact; however, no indicators of contamination were observed during sample collection. Soil samples were analyzed for metals, VOCs, SVOCs, PAHs, BTEX, TPHg and TPHd, and PPOs. In addition, samples collected at 10 feet bgs from RISBMS-01 and -04 were also analyzed for the following physical properties: pH, total organic carbon, moisture content, bulk density and total porosity, grain size distribution, and Atterberg limits.

Soil samples were collected from four co-located Type 6/7 borings, drilled to the top of the unweathered bedrock. Boring RISBMS-02 was drilled northeast of the Maintenance Building. Boring RISBMS-03 was drilled adjacent to the former decontamination tank. Boring RISBMS-08 was drilled adjacent to the septic tank. Boring RISBMS-09 was drilled southwest of the gasoline/diesel USTs. Four samples were selected for chemical analysis from each Type 6 boring based on MIP and pore pressure readings from the adjacent Type 7 CPT boring. Sampling depths in boring RISBMS-02 were adjusted based on MIP readings, and included sample collection at depth of 0, 5, 10, and 21 feet bgs. Sampling depths for each boring are

included in Table B-1. In the absence of elevated MIP readings, samples were collected at default depths 0, 5, 10, and 20 feet bgs and submitted for chemical analysis. Samples from RISBMS-02 and -03 were analyzed for metals, VOCs, SVOCs, PAHs, TPHg, and TPHd. and PPOs. Samples from RISBMS-02 and -03 collected at 0, 5, and 10 feet bgs were also analyzed for dioxins and furans. Additionally, all samples collected from RISBMS-02 were analyzed for PPOs. Samples from RISBMS-08 were analyzed for metals, VOCs, SVOCs, PAHs, and PPOs. Samples from RISBMS-09 were analyzed for metals, SVOCs, PAHs, BTEX, TPHg, and TPHd.

#### 3.2.7.2.2 *Phase II*

No additional samples were collected in the Maintenance Shed Area during Phase II.

#### 3.2.7.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-10. Physical properties of soils are summarized in Section 3.3 and Table B-19. Sampling locations in the Maintenance Shed Area are illustrated on Figure B-4. Inorganics detected above screening levels and summary analytical results with field observations for the Maintenance Shed Area are presented in Figures B-13a and B-13b, respectively.

##### 3.2.7.3.1 *Metals and Cyanide*

Forty-seven soil samples were collected from 12 borings and three surface soil sampling locations and analyzed for metals. One sample was also collected from a surface soil sampling location and analyzed for cyanide. Detectable concentrations of metals were present in all of the samples. Cyanide was detected in its respective sample. A total of 24 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 15 locations. Arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc were detected above screening levels.

Concentrations exceeded screening levels in nine locations throughout the entire study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSMS-01, -02, RISBMS-01, -03, -04, -07, and -11. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBMS-02, -04 and -11. In samples collected deeper than 10 feet bgs, metals and cyanide were detected at concentrations exceeding PRGs at RISBMS-10.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, cadmium, chromium, copper, lead, mercury, nickel, thallium, and zinc were detected above ecological screening levels. In this depth range, seven locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are copper (4 samples), lead (4 samples), and nickel (4 samples) out of a total of 26 samples analyzed. The frequency of detection, range of detected concentrations, and average values are listed on Table B-10.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, arsenic and lead were detected above PRGs. In this depth range, arsenic was detected in 97 percent of the

samples at concentrations ranging from 0.65 to 28 mg/kg and exceeded PRGs at RISBMS-04 (6.5 and 10 feet bgs). Lead was detected in 18 percent of the samples at concentrations ranging from 9.9 to 970 mg/kg and exceeded PRGs at RISBMS-11 (0 feet bgs).

In samples collected greater than 10 feet bgs, arsenic was detected above its PRG. In this depth range, arsenic was detected in all of the samples at concentrations ranging from 2.6 to 37 mg/kg and exceeded its PRG at RISBMS-10 (20 feet bgs).

#### *3.2.7.3.2 Volatile Organic Compounds*

Forty-three samples were collected from 11 borings and three surface soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 58 percent of the samples; however, concentrations did not exceed screening levels. Freon 113 was the most commonly detected VOC in the study area and was detected in 42 percent of the samples analyzed for VOCs.

#### *3.2.7.3.3 Semi Volatile Organic Compounds*

Forty-seven samples were collected from 12 borings and three surface sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 26 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.7.3.4 Polycyclic Aromatic Hydrocarbons*

Forty-seven samples were collected from 12 borings and three surface sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.7.3.5 Polychlorinated Biphenyls*

One surface soil sample (RISSMS-03) was collected and analyzed for PCBs. A detectable concentration of Aroclor 1260 was present in the sample; however, the concentration did not exceed screening levels.

#### *3.2.7.3.6 Pesticides and Herbicides*

One surface soil sample (RISSMS-03) was collected and analyzed for pesticides and herbicides. Detectable concentrations of pesticides were present in the sample; however, concentrations did not exceed screening levels.

#### *3.2.7.3.7 Dioxins and Furans*

Six soil samples were collected from two boring locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in each of the six samples. Sixteen individual congeners were detected in samples collected from the surface, shallow subsurface, and at depth. Concentrations for total TEQs exceeded the screening level in one sample. The total TEQ concentration was 19.052 pg/g in the surface soil sample collected from boring RISBMS-02. Results for deeper samples collected from this location did not exceed the screening levels for TEQs.

### 3.2.7.3.8 *Petroleum Hydrocarbons and BTEX*

Forty-three samples from 11 borings and two surface soil sampling locations were collected and analyzed for gasoline (C<sub>6</sub>–C<sub>10</sub>), diesel (C<sub>10</sub>–C<sub>28</sub>), and motor oil (C<sub>24</sub>–C<sub>36</sub>) range petroleum hydrocarbons. Detectable concentrations of petroleum hydrocarbons were present in 36 of the 43 samples. Petroleum hydrocarbons were detected in samples collected from surface soil, between 0 and 10 feet bgs, and greater than 10 feet bgs in all 13 locations. Diesel and motor oil range petroleum hydrocarbons were locally detected in concentrations exceeding 1,000 mg/kg. Gasoline range petroleum hydrocarbons were not detected in concentrations exceeding 100 mg/kg.

Diesel range petroleum hydrocarbons were detected at concentrations ranging from 8.5 to 2,400 mg/kg in 19 of 43 samples analyzed for TPH (diesel). In samples collected up to and including 10 feet bgs, diesel range petroleum hydrocarbons were detected in concentrations ranging from 8.5 to 2,400 mg/kg and exceeded 1,000 mg/kg at borings RISBMS-01, -03, and -11 in the southeastern portion of the study area, in proximity to historical facilities and areas of apparent historical surface staining. Diesel range petroleum hydrocarbons were not detected at concentrations exceeding 1,000 mg/kg in any samples other than surface soil samples.

Motor oil range petroleum hydrocarbons were detected at concentrations ranging from 3.6 to 4,900 mg/kg in 28 of 43 samples analyzed for TPH (motor oil). In samples collected up to and including 10 feet bgs, motor oil range petroleum hydrocarbons were detected in concentrations ranging from 3.6 to 4,900 mg/kg and exceeded 1,000 mg/kg at borings RISBMS-01, -02, -03, -11, and RISSMS-01 and -02 in the central and southeastern portion of the study area, in proximity to historical facilities and areas of apparent historical surface staining. Motor oil range petroleum hydrocarbons were not detected at concentrations exceeding 1,000 mg/kg in any samples other than surface soil samples.

Thirty-two samples from nine locations were collected and analyzed for BTEX. Detectable concentrations of BTEX were present in 2 locations; however, concentrations did not exceed screening levels.

### 3.2.7.3.9 *Poor Purging Compounds*

Thirty-seven samples were collected from ten borings and one surface soil sampling location and analyzed for PPOs. Eighteen of these samples were also analyzed for ethylene glycol. Detectable concentrations of PPOs were present in three percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.7.4 Findings Relative to Adjoining Study Areas

Soils containing locally elevated concentrations of petroleum hydrocarbons within the Maintenance Shed Area may possibly extend into adjoining study areas to the west and south. Petroleum hydrocarbon contaminated soils in the eastern portion of this area likely extend easterly beneath the P/S Landfill buttress within the northwestern portion of the neighboring Central Drainage Area. There are no indications that conditions in neighboring study areas have affected conditions in the Maintenance Shed Area.

### 3.2.7.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents are present above screening levels in slightly more than half the locations sampled within the Maintenance Shed Area. Copper, lead, and nickel were the most prevalent inorganic constituents exceeding screening levels, and were present at these levels in an equal number of samples. Approximately half of these exceedances were reported for surface soil samples, with the remaining half reported for shallow to deep samples. Inorganics exceedances were locally reported to a maximum depth of 20 feet bgs for locations at and slightly east of maintenance building, and typically displayed the widest variety, highest concentrations and most vertical persistence of inorganic constituents. While reported inorganics concentrations typically decreased with increasing depth, maximum constituent concentrations were reported in shallow to deep samples in some locations.

Soil in the Maintenance Shed Area appears to be moderately impacted by diesel and motor oil range petroleum hydrocarbons. Gasoline range petroleum hydrocarbons were not detected in concentrations in excess of 100 mg/kg. Petroleum contaminated soil is most apparent within surface soils in proximity to former facilities and areas of historical surface staining in the central and southern portion of the study area. Former facilities apparently associated with significantly elevated TPH include the storage area with secondary containment and the mechanic pit in the maintenance building in the central portion of the study area, as well as near the decon pad, shed, former decon tank, and temporary above-ground storage tanks (ASTs) in the southeastern and southern portions of the study area. Dioxin and Furan Total TEQs exceeded its screening level in surface soil at one location directly adjacent to the maintenance building. Total TEQs in this sample were reported in association with high TPH concentrations.

In summary, surface to deep soils across the Maintenance Shed Area were reported to contain a variety of inorganic constituents in excess of screening levels, and surface and shallow soils were reported to contain high levels of diesel to motor oil range TPH. Areas of maximum soil impact correspond with locations in proximity to former facilities or historical ground surface staining. Dioxin and furan Total TEQs in excess of screening levels were reported in surface soils only, in association with elevated TPH. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

### 3.2.8 **Administration Building Area**

Surface and subsurface soil samples were collected in order to characterize soil conditions surrounding the Administration Building Area (Figures B-1 and B-5). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.10 of the RI/FS Work Plan.

#### 3.2.8.1 Drilling and Subsurface Conditions

Lithologic conditions encountered in the Administration Building Area generally included approximately 6 inches of asphalt and sandy to gravelly road base underlain by up to 10 feet of organic-rich, clayey fill material. Fractured, weathered light olive- and yellowish-brown silty claystone bedrock was encountered between approximately 10.5 and 17 feet bgs. Organic odors were observed in most borings, and were locally associated with very dark gray to grayish-brown soils in some locations. With the exception of elevated PID readings

encountered at ~2.5 feet bgs in RISBON-49 (which was completed as part of the investigations of the Remaining On-site Area – see Section 3.2.10), no detectable headspace readings were observed in the area. Groundwater was not encountered in any of the borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

### 3.2.8.2 Sample Collection

A total of approximately 16 soil samples from four locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Administration Building Area (Table B-1; Figure B-5).

#### 3.2.8.2.1 *Phase I*

Surface and deep soil samples were collected from two Type 5 borings (RISBAB-02 and -03) located along plumbing lines from the Administration Building. Four samples were collected from these borings at 0, 5, 10, and 20 feet bgs. All of the samples from RISBAB-03 and the samples at 0.35 and 20 feet bgs from RISBAB-02 were analyzed for the Modified Appendix IX analytical suite with additional COPCs. The samples collected at 5 and 10 feet bgs from RISBAB-02 were analyzed for the Modified Appendix IX analytical suite, with the exception of the herbicide analysis.

Soil samples were collected from two Type 5/7 borings (RISBAB-01 and -04) drilled to the top of the unweathered bedrock contact. One boring (RISBAB-01) was drilled near the piping for the septic tanks. The second boring (RISBAB-04) was drilled and sampled near the former laboratory piping that historically discharged to Pond 12. Four samples were collected from each boring. Samples were selected for chemical analysis from the Type 5 borings on the basis of MIP and pore pressure readings from the adjacent Type 7 CPT boring. Sampling depths for each boring are included on Table B-1. Boring RISBAB-04 had no associated elevated MIP readings, thus four samples were collected at depths of 0, 5, 10, and 22 feet bgs. Sampling depths in boring RISBAB-01 were adjusted based on MIP readings, and included sample collection at depth of 0, 5, 14, and 29 feet bgs. All samples were analyzed for the Modified Appendix IX analyte suite with additional COPCs. In addition, the samples collected from RISBAB-04 at 0, 5, and 10 feet bgs were analyzed for dioxins and furans (full Appendix IX analytical suite with additional COPCs). Samples collected at 0 feet from RISBAB-01 (0 feet) and -04 (0.25 feet bgs) were also analyzed for PCB Congeners.

Three additional surface to medium depth soil samples were collected from a Type 4 soil boring completed in the eastern portion of the Administration Building Area (RISBON-49). Samples collected from depths of 0, 5 and 10 feet bgs in this boring were analyzed for metals, VOCs, SVOCs, PAHs, PCBs, and OCPs. As this boring was completed as part of the investigations for Remaining On-site Area, findings relating to this location are discussed in Section 3.2.10, and summary analytical results are presented in Table B-13 and in Figures B-16a and B-16B.

#### 3.2.8.2.2 *Phase II*

No additional samples were collected in the Administration Building Area during Phase II.

### 3.2.8.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-11. Sampling locations in the Administration Building Area are illustrated on Figure B-5. Inorganics detected above screening levels and summary analytical results with field observations for the Administration Building Area are illustrated in Figures B-14a and B-14b, respectively.

#### 3.2.8.3.1 *Metals and Cyanide*

Sixteen soil samples were collected from four borings and analyzed for metals and cyanide. Detectable concentrations of metals were present in all of the samples; however, concentrations did not exceed screening levels for samples collected at depths shallower than 20 feet bgs. Cyanide was not detected in any of the samples.

#### 3.2.8.3.2 *Volatile Organic Compounds*

Sixteen soil samples were collected from four borings and analyzed for VOCs. Detectable concentrations of VOCs were present in 94 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.8.3.3 *Semi Volatile Organic Compounds*

Sixteen soil samples were collected from four borings and analyzed for SVOCs. Detectable concentrations of SVOCs were present in only one of the samples collected; however, concentrations did not exceed screening levels.

#### 3.2.8.3.4 *Polycyclic Aromatic Hydrocarbons*

Sixteen soil samples were collected from four borings and analyzed for PAHs. Detectable concentrations of PAHs were present in 31 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.8.3.5 *Polychlorinated Biphenyls*

Sixteen soil samples were collected from four borings and analyzed for PCBs. PCBs were not detected in any of the samples.

#### 3.2.8.3.6 *Pesticides and Herbicides*

Sixteen soil samples were collected from four borings and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 75 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.8.3.7 *Dioxins and Furans*

Three soil samples were collected from one boring location (RISBAB-04) and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in two of the three samples; however, TEQ concentrations did not exceed screening levels.

### 3.2.8.3.8 *Poor Purging Compounds*

Sixteen soil samples were collected from four borings and analyzed for PPOs. Detectable concentrations of PPOs were present in each of the 16 samples; however, concentrations did not exceed screening levels.

### 3.2.8.4 Findings Relative to Adjoining Study Areas

There are currently no indications that chemical concentrations locally detected in soils within this area have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in the Administration Building Area.

### 3.2.8.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents were not reported at concentrations in excess of screening levels for any samples collected at less than 20 feet bgs within the Administration building area.

While organic compounds, principally VOCs and pesticides/herbicides, are present in shallow and medium depth soils in portions of this area, these compounds are not present at concentrations exceeding screening levels. Thus, it can be concluded that soils beneath building plumbing or at the discharge point to the septic system in the study area do not appear to be significantly impacted by historical activities in the Administration Building or former laboratory. Previous closure activities conducted for former Pond 12 indicate that contaminated materials once associated with this feature had been removed. Results of the current sampling activities completed at the former laboratory discharge piping confirm that earlier cleanup activities for Pond 12 were effective. Analytical results for surface to medium depth soil samples collected from the eastern portion of the Administration Building Area (location RISBON-49) are largely consistent with those for other borings completed within this study area, and indicate that low levels of organic constituents are present, but not at concentrations that exceed available screening levels. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

## 3.2.9 Roadways

Surface and subsurface samples were collected in order to characterize surface and shallow subsurface soil conditions on current and historical roadways across the Site (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this conceptual area is discussed in Section 4.7.11 of the RI/FS Work Plan.

### 3.2.9.1 Drilling and Subsurface Conditions

Lithologic conditions encountered in the Roadways typically included approximately 6 inches of asphalt and/or gravel and sand road base, underlain by unconsolidated to hard light yellowish-brown and olive-brown silty clay and claystone. Fill material with sand, organic-rich clay, and construction debris was encountered in borings RISSRS-15 and RISSRS-27 to their respective total depths. Sewer-like and organic odors were observed at boring RISSRS-02 from 2-6 feet bgs, a strong organic odor was observed at boring RISSRS-15 at 4.5 feet bgs, and an asphaltic odor was observed at boring RISSRS-27 at 1.5 feet bgs. Groundwater was not encountered in any of the roadway borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

### 3.2.9.2 Sample Collection

Sixty soil samples from 29 Type 3 borings were collected for chemical analyses to characterize surface and shallow subsurface soil conditions on current and historical roadways (Figures B-1). The sampling program included soil sampling to evaluate the presence of potential contaminants on or adjacent to roadways that were subjected to extensive water spraying or were extensively used for waste hauling, as well as to further evaluate the distribution of chemicals previously detected in historical sampling of roadways (Table B-1). These data are used in combination with samples from the specific study areas to characterize contaminants in shallow soil.

#### 3.2.9.2.1 *Phase I*

Surface and shallow subsurface soil samples were collected from 29 shallow borings (Type 3) on roadways. Seven borings (RISSRS-01 through -07) were located where previous sampling indicated elevated levels of metals or SVOCs. Eight borings (RISSRS-08 through -15) were located where roadway sampling was not previously performed along the primary traffic patterns, or at locations that were suggested during the agency review process. Fourteen borings (RISSRS-16 through -29) were located coincident with other historical sample locations as suggested by the agencies during the review process. For sample locations on paved roadways, the pavement was cored and samples were collected from soil immediately below the asphalt and base rock surface. Samples were analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. Samples collected at 0 and 5 feet bgs from RISSRS-02 and -10 were also analyzed for dioxins and furans. Additionally, samples collected at 0 feet bgs from RISSRS-07, -09, -11, -13, -14, -19, -21, and -26 were analyzed for PCB Congeners and samples from RISSRS-17 and -18 were analyzed for VOCs.

#### 3.2.9.2.2 *Phase II*

No additional samples were collected in the Roadways during Phase II.

### 3.2.9.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-12. Sampling locations on the roadways are illustrated on Figure B-1. Inorganics detected above screening

levels and summary analytical results with field observations for the Roadways are presented in Figures B-15a and B-15b, respectively.

#### 3.2.9.3.1 *Metals*

Sixty soil samples were collected from 29 borings and analyzed for metals. Detectable concentrations of metals were present in all of the samples. A total of 23 metals were detected in samples collected from surface, shallow, and medium soil in each of the 29 locations. Barium, cadmium, chromium, copper, lead, mercury, nickel, tin, and zinc were detected above screening levels.

Concentrations exceeded screening levels in 13 locations throughout the entire study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSRS-05, -08, -10 through -14, -17, -19, -20, and -24 through -26. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRS-11.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, cadmium, chromium, copper, lead, mercury, nickel, tin, and zinc were detected above ecological screening levels. In this depth range, 13 locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are mercury (4 samples), nickel (4 samples), and tin (4 samples) out of a total of 60 samples analyzed. The frequency of detection, range of detected concentrations, and average values are listed on Table B-12.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, chromium was detected above PRGs. In this depth range, chromium was detected in all of the samples at concentrations ranging from 3.5 to 470 mg/kg and exceeded PRGs at RISSRS-11 (0 feet bgs).

#### 3.2.9.3.2 *Semi Volatile Organic Compounds*

Sixty soil samples were collected from 29 shallow borings and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 18 percent of samples. A total of nine SVOCs were detected in samples collected from surface and shallow soil in nine of the 29 locations. Pentachloronitrobenzene (PCNB) was detected above screening levels.

Concentrations exceeded screening levels in one location in the northern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRS-16. In samples collected deeper than 10 feet bgs, SVOCs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, PCNB detected above PRGs. In this depth range, PCNB was detected in one of sixty samples at a concentration of 8 mg/kg and exceeded the PRG at RISSRS-16 (0 feet bgs).

#### 3.2.9.3.3 *Polycyclic Aromatic Hydrocarbons*

Sixty soil samples were collected from 29 shallow borings and analyzed for PAHs. Detectable concentrations of PAHs were present in 48 percent of the samples. A total of 14 PAHs were detected in surface and shallow soil in 20 of the 29 locations. Benzo(a)pyrene was detected above screening levels.

Concentrations exceeded screening levels in one location in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRS-06. In samples collected deeper than 10 feet bgs, PAHs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, benzo(a)pyrene was detected above PRGs. In this depth range, benzo(a)pyrene was detected in 33 percent of the samples at concentrations ranging from 0.004 to 0.22 mg/kg and exceeded PRGs at RISSRS-06 (0.2 feet bgs).

#### 3.2.9.3.4 *Polychlorinated Biphenyls*

Sixty soil samples were collected from 29 shallow borings and analyzed for PCBs. Detectable concentrations of PCBs were present in 7 percent of the samples. Only one PCB was detected in samples collected from surface soil in four of the 29 locations. Aroclor 1260 was detected above screening levels.

Concentrations exceeded screening levels in one location in the central southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRS-13.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, Aroclor 1260 was detected above PRGs. In this depth range, Aroclor 1260 was detected at concentrations ranging from 0.031 to 1.5 mg/kg and exceeded PRGs at RISSRS-13 (0 feet bgs), a location along a roadway remnant in the central portion of the Former Ponds and Pads Subarea. The headspace reading was recorded at 582 ppmv in shallow soils in the same boring.

#### 3.2.9.3.5 *Pesticides*

Sixty soil samples were collected from 29 shallow borings and analyzed for pesticides. Detectable concentrations of pesticides were present in 27 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.9.3.6 *Dioxins and Furans*

Five soil samples were collected from three shallow borings and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in 60 percent of the samples; however, total TEQ concentrations did not exceed screening levels.

#### 3.2.9.3.7 *PCB Congeners*

Eight soil samples were collected from eight shallow borings and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in 88 percent of the samples. A total of 14 individual congeners were detected in samples collected from surface soil in each of the eight locations. The TEQ for PCB congeners was detected above screening levels.

Concentrations exceeded screening levels in two locations, with one location in the central, northern portion of the study area and one in the central, southern portion of the study area. In

samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSRS-13 and -19.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, the TEQ for PCB congeners was detected above PRGs. In this depth range, PCB congeners were detected at concentrations (TEQ) ranging from 0.0048811 to 27.13436 pg/g and exceeded PRGs at RISSRS-13 (0 feet bgs) and -19 (0.25 feet bgs). A slight odor was observed in the sample collected from RISSRS-19.

#### 3.2.9.4 Findings Relative to Adjoining Study Areas

There are currently no indications that chemical concentrations locally detected in soils within this study area have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in the Roadways.

#### 3.2.9.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents are present above screening levels in slightly less than half the locations sampled within the Roadways Area. Mercury, nickel, and tin were the most prevalent inorganic constituents exceeding screening levels, and were present at these levels in an equal number of samples. With only one exception, inorganics exceedances in roadway samples within the southern portion of the Site were limited to shallow soils at a depth of 5 feet bgs, whereas exceedances detected in roadway samples within the central and northern portions of the Site were typically encountered in surface as well as shallow soils. The widest variety of inorganics exceedances were encountered in a Roadway Area sample collected in a portion of the Liquids Treatment area, where exceedances were limited principally to surface soils.

While organic compounds are locally present in the surface and shallow subsurface soils on and beneath current and historical roadways, they are typically reported only at very low concentrations. Screening levels for SVOCs, PAHs (benzo(a)pyrene), PCBs, and PCB congeners were exceeded only slightly in four of the sixty samples tested; however, these exceedances appear to be local isolated instances. In each of these instances, organics exceedances were restricted to surface soils, and were not reported for samples collected in underlying shallow soils. Findings indicate that historical waste hauling and disposal operations appear to have not significantly impacted roadway soils. Soil conditions in this study area are sufficiently characterized, and no further data are necessary.

#### **3.2.10 Remaining On-site Areas**

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions in the interstitial areas of the site not associated with prior waste management activities (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The risks are primarily related to potential exposure to surface soils. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.12 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

### 3.2.10.1 Drilling and Subsurface Conditions

Lithology encountered during drilling in portions of the study area near Stormwater Ponds (RCF Pond, Pond 13, and A-Series Pond) and the southeastern portion of the Site (head of A-Drainage, and vicinity of former Pad 8A) was generally characterized by very dark gray clayey fill material with varying amounts of sand, gravel, organic material, and claystone fragments to 48 feet bgs (RISBON-54, east of Pond 13), underlain by weathered olive-brown and gray silty claystone. Odors and staining were observed in some of these borings in the upper 2 to 16 feet of fill material. Detectable headspace readings ranged from 1.7 ppmv to 2,415 ppmv (RISBON-49, located at the head of the A-Drainage, east of the Administration Building). Groundwater was encountered at approximately 15 feet bgs in boring RISBON-54 and 38 feet bgs at boring RISBON-83. At the same time, groundwater was also encountered at 30.34 feet bgs in a piezometer (RIPZ-37) adjacent to RISBON-83. The weathered/unweathered claystone contact was encountered in the Type 6 borings (RISBON-51, RISBON-54, and RISBON-57) between 38.5 and 51 feet bgs.

Lithology encountered in the remaining borings completed in other portions of this study area was generally grayish-brown, unconsolidated and highly fragmented weathered claystone. Odors and chemical staining, or detectable headspace readings were not observed in these borings. Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

### 3.2.10.2 Sample Collection

Eighty-one soil samples from 21 borings and seven surface soil sampling locations were collected for chemical analyses to characterize surface and subsurface soil conditions within the Remaining On-site Areas (Figures B-1). The sampling program for the Remaining On-site Areas included surface, shallow, medium, and deep soil sampling to evaluate the potential presence of residual contamination from past operations (Table B-1).

#### 3.2.10.2.1 *Phase I*

##### Statistical Sampling Locations

To meet statistical sampling objectives presented in the RI/FS Work Plan, six locations in the Remaining On-site Areas were sampled. The methodology for choosing random locations is described in Appendix F of the RI/FS Work Plan.

Soil samples were collected from six (Type 4 and Type 5) borings (RISBON-12 through -15 and -77 and -78), drilled at randomly selected locations throughout the study area. Three soil samples were collected from each of the borings at default depths of 0, 5, and 10 feet bgs. Soil samples were analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. All samples collected from 5 and 10 feet bgs and surface soil samples from RISBON-15 and -78 were also analyzed for VOCs. In addition, samples collected at 0, 5, and 10 feet from RISBON-77 and -78 were also analyzed for dioxins and furans and the sample collected at 0 feet from RISSRC-13 was analyzed for PCB Congeners.

### Other Areas of Concern

One surface soil sample (Type 2; RISSON-30) was collected at the location of former spills and seeps associated with previous breaks in pipelines that historically conveyed contaminated liquids. The sample was analyzed for the Modified Appendix IX analytical suite with additional COPCs.

Soil samples were collected from a (Type 4) soil boring (RISBON-76) drilled at the location of a former AST. Samples at this location were initially proposed for collection at default depths of 0, 5, and 10 feet bgs; however, elevated electron capture detector (ECD) readings recorded at 8 feet bgs in the collocated Type 7 NAPL survey boring (Appendix M, Attachment M-3) prompted collection of a soil sample at this depth in lieu of the proposed 10 foot sample. Samples were analyzed for metals, VOCs, SVOCs, PAHs, PCBs, and OCPs.

Soil samples were collected from one co-located (Type 4/7; RISBON-75) boring drilled to the top of the unweathered bedrock south of former Ponds P and 14. Samples were selected for chemical analysis from this Type 4 boring based on MIP and pore pressure readings from the adjacent Type 7 CPT boring. Sampling depths for the boring are included in Table B-1. In the absence of elevated MIP readings, samples were collected at depths 0, 5, and 8 feet bgs and submitted for chemical analysis. Samples collected from RISBON-75 were analyzed for the full Appendix IX analytical suite with additional COPCs.

Soil samples were collected from six (Type 4) borings (RISBON-45 through -50) drilled in the interstitial areas of the Site that did not fall within defined conceptual study areas. Samples were collected at 0, 5, and 10 feet bgs and analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. In addition, all Type 4 samples were analyzed for VOCs except for samples collected at 0 feet bgs from RISBON-46, -47, -48, and -50.

### Historical Drainages

Historical drainages were investigated to identify whether NAPL may be present within former drainage channels. Two borings (Type 7; RISBON-59 and -62) were drilled to the top of the unweathered bedrock in historical drainage channels. Type 6 samples were proposed to be collected adjacent to the CPT borings (Type 7) where evidence of NAPL was suspected based on MIPS responses. However, no such evidence was observed in boring RISBON-62; therefore, samples were not collected from this location. RISBON-62 was drilled south of the confluence of the P/S and Metals Landfill drainages, where the drainage crosses NTU Road. RISBON-59 was drilled in the western portion of the study area along the trunk of a former drainage where it crosses NTU Road. A single soil sample was collected from this location at a depth of 29 feet bgs (corresponding with maximum MIP response) and tested for the Modified Appendix IX analytical suite with additional COPCs.

Three deep Type 6 borings were drilled to the top of unweathered bedrock in areas along NTU Road where residual wastes or contamination were thought to potentially be present based on previous sampling data. The purpose of these data is to assess the distribution of chemicals at the southern boundary of the Site as necessary for remedial planning. RISBON-51 was drilled adjacent to and south of former Pond A-1, at the former diesel fuel pump site. RISBON-54 was drilled adjacent to Pond 13. RISBON-57 was drilled along former NTU road just south of former Pond 11. Six samples were collected from each boring at depths of 0, 5, 10, 20, just above groundwater, and at the unweathered bedrock contact. Samples were analyzed for the

Modified Appendix IX analytical suite with additional COPCs. In addition, samples collected at 0, 5, and 10 feet from RISBON-51 and -54 were also analyzed for dioxins and furans (full Appendix IX with additional COPCs) and the sample collected at 0 feet from RISBON-57 was analyzed for PCB Congeners. Sample depths for each boring are included on Table B-1.

### *3.2.10.2 Phase II*

Soil samples from two additional Type 2 (RISSON-41 and -42) locations, four modified Type 3 (RISSON-43 through -46) locations, and three Type 6 (RISBON-83 through -85) locations were collected in the Remaining On-site Areas during the Phase II investigation. Type 2 samples were analyzed for pesticides and herbicides, PCBs, PPOs, dioxins and furans, and PCB Congeners. Soil samples collected from modified Type 3 locations were analyzed for total organic carbon (TOC) and fractional organic carbon (FOC). The locations were situated adjacent to Phase I borings that had elevated concentrations of COPCs. Data from the Type 6 locations are intended to further delineate the extent of impact to soil from the NAPL identified in the vicinity of RISBON-59. Soil samples collected from the Type 6 borings were analyzed for the Modified Appendix IX analytical suite with additional COPCs (with the exception of RISBON-84 (30 feet), for which cyanide and herbicides were not analyzed).

### 3.2.10.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-13. Sampling locations in the Remaining On-site Areas are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the Remaining On-site Areas are presented in Figures B-16a and B-16b, respectively.

#### *3.2.10.3.1 Metals*

Seventy-nine soil samples were collected from 21 borings and one surface soil sampling location and analyzed for metals. Detectable concentrations of metals were present in all of the samples. A total of 24 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 22 locations. Barium, chromium, copper, lead, molybdenum, nickel, selenium, and thallium were detected above screening levels. Detectable concentrations of cyanide were present in three percent of the samples, but not in excess of screening levels.

Concentrations exceeded screening levels in eight locations throughout the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISBON-13, -14, -45, -50, 75, -77, -78, and -84. No samples contained concentrations of metals in excess of PRGs at any depth.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, chromium, copper, lead, molybdenum, nickel, selenium, and thallium were detected above ecological screening levels. In this depth range, eight locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are chromium (2 samples), and nickel (2 samples) out of a total of 39 samples analyzed. The

frequency of detection, range of detected concentrations, and average values are listed on Table B-13.

#### *3.2.10.3.2 Volatile Organic Compounds*

Seventy-one soil samples were collected from 21 borings and one surface soil sampling location and analyzed for VOCs. Detectable concentrations of VOCs were present in 67 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.10.3.3 Semi Volatile Organic Compounds*

Seventy-nine soil samples were collected from 21 borings and one surface soil sampling location and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 5 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.10.3.4 Polycyclic Aromatic Hydrocarbons*

Seventy-nine soil samples were collected from 21 borings and one surface soil sampling location and analyzed for PAHs. Detectable concentrations of PAHs were present in 45 percent of the samples. A total of 18 PAHs were detected in samples collected from surface, shallow, medium, and deep soil in 16 of the 22 locations. Benzo(a)pyrene was detected above screening levels.

Concentrations exceeded screening levels in two locations in the central southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding PRGs at RISBON-83 and -85.

In samples collected greater than 10 feet bgs, benzo(a)pyrene was detected above PRGs. In this depth range, benzo(a)pyrene was detected in 11 percent of the samples at concentrations ranging from 0.39 to 0.43 mg/kg and exceeded PRGs at RISBON-83 (55 feet bgs) and -85 (51 feet bgs).

#### *3.2.10.3.5 Polychlorinated Biphenyls*

Eighty-one soil samples were collected from 21 borings and three surface soil sampling locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 8 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.10.3.6 Pesticides and Herbicides*

Eighty-one soil samples were collected from 21 borings and three surface soil sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

### *3.2.10.3.7 Dioxins and Furans*

Seventeen soil samples were collected from five borings and two surface soil sampling locations and analyzed for dioxins and furans. Detectable concentrations of dioxins/furans were present in all of the samples; however, concentrations did not exceed screening levels.

### *3.2.10.3.8 Poor Purging Compounds*

Forty-two soil samples were collected from eight borings and three surface soil sampling locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 60 percent of the samples. A total of six PPOs were detected in samples collected from surface, shallow, medium, and deep soil in 10 of the 11 locations. N-Nitrosodi-n-butylamine was detected above screening levels.

Concentrations exceeded screening levels in three locations in the central southern portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBON-51. In samples collected deeper than 10 feet bgs, PPOs were detected at concentrations exceeding PRGs at RISBON-59 and -83.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitrosodi-n-butylamine was detected above PRGs. In this depth range, n-nitrosodi-n-butylamine was detected in 9 percent of the samples at concentrations ranging from 0.024 to 0.33 mg/kg and exceeded PRGs at RISBON-51 (0 feet bgs). A faint to moderate petroleum odor and staining were observed in the sample.

N-Nitrosodi-n-butylamine was also detected above PRGs in samples collected greater than 10 feet bgs. In this depth range, n-nitrosodi-n-butylamine was detected in 5 percent of the samples at concentrations ranging from 0.13 to 0.79 mg/kg and exceeded PRGs at RISBON-59 (29 feet bgs) and -83 (30 feet bgs). The sample collected from RISBON-59 (29 feet bgs) was observed as black, oily with moderate to strong petroleum-like odor. The sample collected from RISBON-83 (30 feet bgs) was observed as having a slight chemical odor.

### *3.2.10.3.9 PCB Congeners*

Four soil samples were collected from two borings and two surface soil sampling locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in all of the samples. A total of 13 individual PCB congeners were detected in samples collected from surface and shallow soil in each of the four locations. The TEQ for PCB congeners was detected above screening levels.

Concentrations (TEQ) exceeded screening levels in one location in the southern portion of the study area. In samples collected up to and including 5 feet bgs, the ecological screening level was not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBON-57. In samples collected deeper than 10 feet bgs, the TEQ for PCB congeners was not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, the TEQ for PCB congeners was detected above PRGs. In this depth range, PCB congeners were detected in all of the samples at concentrations ranging from 0.0005869 to 16.40863 pg/g and exceeded

PRGs at RISBON-57 (5 feet bgs). Black fertilizer and a manure-type odor were observed in the sample.

#### 3.2.10.4 Findings Relative to Adjoining Study Areas

Available data indicate deep soil contamination is present in several locations clustered along the southern Site boundary between Pond 13 and the western end of the RCF Pond. As discussed in Section 5.0, Phase III investigations were completed in this area to further assess the nature and distribution of contaminants present in deep soils in this area. There are currently no indications that chemical concentrations locally detected in soils within the neighboring study areas have influenced or created conditions encountered in the Remaining On-site Area.

#### 3.2.10.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents exceeded screening levels in surface to shallow soils broadly across the Remaining On-site Areas. The most prevalent inorganics exceedances included chromium and nickel in surface to shallow soils, and nickel and zinc in deep soils. Inorganics exceedances throughout the northern portion of the Site were limited to surface soils and directly underlying shallow soils, with no exceedances encountered at depths of 10 feet bgs. Conversely, a variety of inorganic constituents were detected in excess of screening levels in deep soil samples collected from several locations along the southern Site boundary, where exceedances were encountered at depths of between 20 and 44.5 feet bgs.

With only limited exception, available data indicate that organic constituents were rarely encountered at concentrations in excess of screening levels within the Remaining On-site Areas. Exceedances of organics screening levels were limited to five locations within this study, all situated along the southern Site boundary. Organics exceedances included PPOs and PAHs detected in surface and deep soil in four separate locations along the southern Site boundary. One location is associated with the former diesel fuel pump area south of former Pond A-1, and the others are in proximity to a former waste impoundment once located near the western end of the present RCF Pond that is visible on the 1974 and 1975 historical aerial photographs. Exceedances in these latter locations are limited to soils lying at depths of between 29 to 55 feet bgs, at or below the groundwater table in this area. PCB Congeners were also detected in exceedance of PRGs in a single, apparently isolated, shallow soil sample in one location along NTU road at the southern Site boundary near the southeast corner of the RCF pond. No screening level exceedances were reported for randomly distributed statistical soil sample locations, or those collected to assess specific areas of concern, including pipeline leaks. These data indicate that prior cleanup efforts conducted throughout the Remaining On-site Areas were very effective in removing the majority of contaminated soils formerly associated with historical features once present in this area.

Deep soil contamination detected in proximity to a former waste impoundment once present along the southern Site boundary (RISBON-59 area) was the subject of focused Phase III investigations conducted during 2007. The findings of these Phase III investigations are presented separately in Section 5.0.

### **3.2.11 Former Ponds and Pads Subarea**

Surface soil samples and samples from soil borings were collected in order to characterize surface and subsurface soil conditions within areas of the Site not associated with prior waste management activities, specifically, the area south of the PSCT delineated as the Former Ponds and Pads Subarea (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The risks are primarily related to potential exposure to surface soils. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.12 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### **3.2.11.1 Drilling and Subsurface Conditions**

Lithologic material encountered in the western portion of the study area near Pond 18, the A-Series Pond, and Pond A-5 was approximately 1 to 12 feet of silty clay alluvium and/or fill material, underlain by weathered olive-brown and light brownish-gray silty claystone. Odors or chemical staining were generally not observed in borings completed in this area, although headspace readings of 175 ppmv and 518 ppmv were detected at locations RISSON-05 and RISBON-40 at 0.5 feet and 5 feet bgs respectively. Groundwater was encountered at approximately 20 feet bgs in boring RISBON-52, but not encountered in the remainder of these borings.

The central portion of the study area between NTU road and the PSCT Trench was characterized by thin (6 inches to 2 feet) alluvial material covering weathered yellowish-brown and light brownish-gray silty claystone. Odors and dark gray or black chemical staining were observed in several borings completed in this area, with heaviest odors and staining occurring in borings proximal to historical drainages, former Ponds A and B, and just south of the PSCT. The highest PID reading for borings completed in this area was 2563 ppmv at 5 feet bgs in boring RISBON-22. Groundwater was encountered at approximately 6.5 feet bgs in boring RISBON-28, but not encountered in the remainder of these borings.

Lithologic material encountered in borings along NTU Road and along the southern boundary of the study area, was approximately 26 to 55 feet of dark gray to grayish-brown clayey fill with organic material, debris, and claystone fragments, underlain by weathered yellowish-brown and light olive-brown silty claystone. The weathered/unweathered claystone contact was encountered between approximately 43.5 and 60 feet bgs. Slight odors and lightly stained soil was encountered in boring RISBON-55 at approximately 10 feet bgs and elevated headspace readings (250 ppmv) were encountered in a surface soil sample in boring RISSON-25. Groundwater was encountered between 31 and 34 feet bgs in two borings completed south of the RCF Pond along NTU road (RISBON-55 and -56). Headspace readings are included in Table B-18 and boring logs are included in Attachment B-1.

#### **3.2.11.2 Sample Collection**

Two-hundred and seventeen soil samples from 59 boring, 33 surface soil, and two trench sampling locations were collected for chemical analyses to characterize surface and subsurface soil conditions within and surrounding the Former Ponds and Pads Subarea (Figure B-1). The sampling program at the Former Ponds and Pads Subarea included surface, shallow, medium,

and deep soil sampling to evaluate the potential presence of residual contamination from past operations (Table B-1).

### 3.2.11.2.1 Phase I

#### Statistical Sampling Locations

To meet statistical sampling objectives presented in the RI/FS Work Plan, 57 locations in the Former Ponds and Pads Subarea were sampled. Twenty-seven surface soil samples (Type 2; RISSON-01 through -27) were collected from random locations distributed throughout the subarea. The methodology for choosing random locations is described in Appendix F of the RI/FS Work Plan. Samples were analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. Additionally, samples from RISSON-05, -10, -15, -20, and -25 were analyzed for VOCs and samples collected from RISSON-04, -17, -18, -20, -22, and -27 were analyzed for PCB Congeners.

Soil samples were collected from 40 borings (RISBON-01 through -11 and -16 through -44) drilled at randomly selected locations throughout the subarea. Three soil samples were collected from each of the borings. Samples were collected at default depths of 0, 5, and 10 feet bgs. Soil samples were analyzed for metals, SVOCs, PAHs, PCBs, OCPs, and herbicides. All samples collected from 5 and 10 feet bgs and surface soil samples from RISBON-05, -20, -25, -26, -30, -35, and -40 were also analyzed for VOCs. In addition, samples collected at 0, 5, and 10 feet from RISBON-07, -16, -28, and -29 were also analyzed for dioxins and furans and samples collected at 0 feet from RISBON-06, -08, -09, -30, -34, -38, -40, -41, and -44 were analyzed for PCB Congeners.

#### Other Areas of Concern

Six surface soil samples (Type 2; RISSON-28, -29, and -31 through -34) were collected at the location of former spills and seeps associated with previous breaks in pipelines that historically conveyed contaminated liquids. Samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs. In addition, surface soil samples RISSON-28 and -29 associated with the April 2001 Gallery Well pipeline leak were analyzed for dioxins and furans (the full Appendix IX analytical suite with additional COPCs). Samples collected from RISSON-29 and -31 were also analyzed for PCB Congeners.

Soil samples were collected from thirteen co-located Type 4/ 7 borings, drilled to the top of the unweathered bedrock. The following borings were drilled in ponds which historically contained oil field waste: RISBON-63 (Pond A), RISBON-66 and -70 (Pond C), RISBON-67 and -71 (Pond M), RISBON-64 and -65 (Pond S), RISBON-72 (Pond V), and RISBON-74 (Pond B). Borings RISBON-68 and -69 (Pond D) and RISBON-73 (Pond 16) were drilled in ponds which historically contained wet air oxidation (WAO) unit effluent, RCRA liquids and truck washout liquids.

Samples were selected for chemical analysis from each Type 4 boring based on MIP and pore pressure readings from the adjacent Type 7 CPT boring. Sampling depths for each boring are included in Table B-1. In the absence of elevated MIP readings, samples were collected at default depths 0, 5, and 10 feet bgs and submitted for chemical analysis. Samples collected from RISBON-63, -64, -66, -67, -68, -72, -73, and -74 were analyzed for the full Appendix IX analytical suite with additional COPCs. Samples from RISBON-65, -69, -70, and -71 were

analyzed for the Modified Appendix IX analytical suite with additional COPCs (no dioxins and furans). Selected samples collected from RISBON-64 through -66 were also analyzed for PCB Congeners.

### Historical Drainages

Historical drainages were investigated to evaluate if pooled NAPL is present within former drainage channels. Three borings (Type 7; RISBON-58, -60, and -61) were drilled to the top of the unweathered bedrock in historical drainage channels within the subarea. Type 6 samples were planned to be collected from adjacent to the CPT borings (Type 7) where there was evidence of NAPL, as indicated by MIP response. However, evidence of NAPL was not observed; therefore, samples were not collected in these three locations. RISBON-58 was drilled at the confluence of two former drainages (Pad 4A) in the western portion of the study area. Two borings were drilled in the eastern part of the study area, including RISBON-60 at the confluence of the former P/S and Metals Landfill drainages (Pond 8), and RISBON-61 south of the former drainage intersection, but also within Pond 8.

Four deep Type 6 borings were drilled to the top of unweathered bedrock in areas along NTU Road where residual wastes or contamination were thought to potentially be present based on previous sampling data. These data will be used to assess the distribution of chemicals at the southern boundary of the Site and will assist in remedial planning. Boring RISBON-52 was drilled south of Pond 1, and three borings (RISBON-53, -55, -56) were drilled along former NTU road near Ponds 3, 4, 10, and 11. Six samples were collected from each boring at depths of 0, 5, 10, 20, just above groundwater, and at the unweathered bedrock contact. All Type 6 samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs. In addition, samples collected at 0, 5, and 10 feet from RISBON-55 and -56 were also analyzed for dioxins and furans (full Appendix IX with additional COPCs) and the sample collected at 0 feet from RISBON-55 was also analyzed for PCB Congeners.

Two trenches (RITRON-01 and -02) were excavated on both sides of the former roadway between Ponds C and M to locate the former drainage swale once connecting the two ponds. The trenches were excavated to approximately 10 feet bgs. Two samples were collected from each trench at locations and depths where there was visual evidence of contamination, elevated PID readings, or at 5 and 10 feet bgs. Samples were analyzed for the Modified Appendix IX analytical suite with additional COPCs. Trench logs are included in Attachment B-1.

#### *3.2.11.2 Phase II*

Soil samples were collected from six additional shallow soil sampling locations (Type 3; RISSON-35 through -40) and four additional borings (Type 5; RISBON-79 through -82). The locations were situated adjacent to a Phase I locations that had elevated concentrations of COPCs. Soil samples collected from the shallow soil sampling locations were intended to further delineate the lateral extent of impacts to soils detected in Phase I borings south of the PSCT near former Ponds S and V, as well as near former Pond 3 and were analyzed for PCBs and pesticides and herbicides. Soil samples collected from the borings intended to further assess the lateral and vertical extent of the soil impacts encountered in Phase I borings near former Ponds A and B, and were analyzed for the Modified Appendix IX analytical suite with additional COPCs.

### 3.2.11.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-14. Sampling locations in the Former Ponds and Pads Subarea are illustrated on Figure B-1. Inorganics detected above screening levels are presented in Figure B-17a. Summary analytical results with field observations are presented in Figures B-17b, B-17c, and B-17d.

#### 3.2.11.3.1 *Metals and Cyanide*

Two-hundred and thirty one soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for metals. Eighty-four soil samples were collected from 22 borings and five surface soil sampling locations and analyzed for cyanide. Detectable concentrations of metals were present in all of the samples and detectable concentrations of cyanide were present in 5 percent of the samples. A total of 23 metals were detected in samples collected from surface, shallow, medium, and deep soil in each of the 94 locations. Cyanide was detected in samples collected from deep soil in four of the 27 locations. Barium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, thallium, and zinc were detected above screening levels. Cyanide was not detected above screening levels.

Concentrations of metals exceeded screening levels in 36 locations throughout the entire study area. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISSON-01, -02, -05, -06, -09, -14, -18, -20, -27, -29, -31, -32, -33, and RISBON-03, -04, -06, -18, -19, -22, -24 through -27, -30, -31, -40, -44, -53, -69, -71, -72, -79 through -82, and RITRON-02. With the exception of arsenic, PRGs were not exceeded in the samples collected.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, barium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, thallium, and zinc were detected above ecological screening levels. In this depth range, 36 locations contained detections in excess of ecological screening levels. The most prevalent metals detected above screening levels are barium (13 samples), cadmium (8 samples), chromium (6 samples), copper (9 samples), lead (13 samples), nickel (11 samples), and zinc (6 samples) out of a total of 156 samples analyzed. The frequency of detection, range of detected concentrations, and average values are listed on Table B-14.

#### 3.2.11.3.2 *Volatile Organic Compounds*

One-hundred and seventy-seven soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 58 percent of the samples. A total of 43 VOCs were detected in samples collected from surface, shallow, medium, and deep soil in 55 of the 72 locations. PCE and TCE were detected above screening levels.

Concentrations exceeded screening levels in four locations in the central portion of the study area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBON-37, -41, -63, and -82 (vicinity of Ponds A and B). In

samples collected deeper than 10 feet bgs, VOCs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, PCE and TCE were detected above PRGs. In this depth range, PCE was detected in 9 percent of the samples at concentrations ranging from 0.00029 to 1600 mg/kg and exceeded PRGs at RISBON-37 (5 and 10 feet bgs) and RISBON-41 (5 feet bgs). TCE was detected in 18 percent of the samples at concentrations ranging from 0.00053 to 120 mg/kg and exceeded PRGs at RISBON-37 (5 and 10 feet bgs), -41 (5 feet bgs), -63 (5 feet bgs), and -82 (5 feet bgs). Slight hydrocarbon odors were observed in RISBON-63, and moderate staining and a moderate petroleum odor were observed in both RISBON-37 and -41.

#### *3.2.11.3.3 Semi Volatile Organic Compounds*

Two-hundred and thirty one soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 21 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.11.3.4 Polycyclic Aromatic Hydrocarbons*

Two-hundred and thirty one soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 38 percent of the samples. A total of 18 PAHs were detected in samples collected from surface, shallow, medium, and deep soil in 51 of the 94 locations. Benzo(a)pyrene, n-nitrosodimethylamine, and n-nitrosopyrrolidine were detected above screening levels.

Concentrations exceeded screening levels in four locations in the central eastern portion of the study area just south of the PSCT in proximity to former Ponds A, B, and S. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSON-18, RISBON-80, and RISBON-82. In samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding PRGs at RISBON-81 and RISBON-82.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, benzo(a)pyrene, n-nitrosodimethylamine, and n-nitrosopyrrolidine were detected above PRGs. In this depth range, n-nitrosodimethylamine was detected in 6 percent of the samples at concentrations ranging from 0.0058 to 0.067 mg/kg and exceeded PRGs at RISSON-18 (0 feet bgs). Benzo(a)pyrene was detected in 11 percent of the samples at concentrations ranging from 0.0056 to 0.6 mg/kg and exceeded PRGs at RISBON-80 (0.5 feet bgs) and -82 (10 feet bgs). N-Nitrosopyrrolidine was detected in 4 percent of the samples at concentrations ranging from 0.0058 to 1.3 mg/kg and exceeded PRGs at RISBON-80 (0.5 feet bgs). In samples collected greater than 10 feet bgs, benzo(a)pyrene was detected above PRGs. In this depth range, benzo(a)pyrene was detected in 20 percent of the samples at concentrations ranging from 0.0059 to 0.69 mg/kg and exceeded PRGs at RISBON-81 (20 feet bgs) and RISBON-82 (20 feet bgs).

### 3.2.11.3.5 Polychlorinated Biphenyls

Two-hundred and forty-five soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 15 percent of the samples. A total of three PCBs were detected in samples collected from surface, shallow, and medium soil in 31 of the 100 locations. Aroclor 1260 was detected above screening levels.

Concentrations exceeded screening levels in seven locations in two clusters within the central portion of the study area, including three borings along the north margin of former Pond 3 and four borings completed south of the PSCT near former Ponds S and V. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSON-20, -27, -31, -35, -36, -39, and -40. In samples collected deeper than 10 feet bgs, PCBs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, Aroclor 1260 was detected above PRGs. In this depth range, Aroclor 1260 was detected in 15 percent of the samples at concentrations ranging from 0.02 to 8 mg/kg and exceeded PRGs at RISSON-20 (0 feet bgs), -27 (0 feet bgs), -31 (0 feet bgs), -35 (0.5 and 5 feet bgs), -36 (0.5 and 5 feet bgs), -39 (0.5 feet bgs), and -40 (0.5, 5 feet bgs). A moderate petroleum odor was noted at RISSON-35 (5 ft bgs).

### 3.2.11.3.6 Pesticides and Herbicides

Two-hundred and forty-five soil samples were collected from 60 borings, 32 surface soil sampling locations, and two trench locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 30 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.11.3.7 Dioxins and Furans

Forty-seven soil samples were collected from 15 borings and two surface soil sampling locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in 96 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.11.3.8 Poor Purging Compounds

Eighty-six soil samples were collected from 20 borings, five surface soil sampling locations, and two trench locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 79 percent of the samples. A total of ten PPOs were detected in samples collected from surface, shallow, medium, and deep soil in 26 of the 27 locations. N-Nitrosodi-n-butylamine was detected above screening levels.

Concentrations exceeded screening levels in one location in the central northern portion of the study area within the limits of former Pond B. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISBON-74. In

samples collected deeper than 10 feet bgs, PPOs were not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, n-nitrosodi-n-butylamine was detected above PRGs. In this depth range, n-nitrosodi-n-butylamine was detected in one out of 104 samples at a concentration of 0.072 mg/kg and exceeded PRGs at RISBON-74 (10 feet bgs). An oily residue, moderate to strong odor, and staining were observed in this sample.

#### 3.2.11.3.9 PCB Congeners

Twenty-two soil samples were collected from 13 borings and 8 surface soil sampling locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in all of the samples. A total of 14 individual congeners were detected in samples collected from surface, shallow, medium, and deep soil in all of the 21 locations. The TEQ for PCB congeners was detected above screening levels.

Concentrations exceeded screening levels in for locations primarily in the north central portion of the study area proximal to the PSCT. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded at any location in the study area. In samples collected up to and including 10 feet bgs, PRGs were exceeded at RISSON-04, -20, -27, and -31. In samples collected deeper than 10 feet bgs, the TEQ for PCB congeners was not detected at concentrations exceeding PRGs.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, the TEQ for PCB congeners was detected above PRGs. In this depth range, PCB congeners were detected in at concentrations (TEQ) ranging from 0.0000714 to 321.2599 pg/g and exceeded PRGs at RISSON-04 (0 ft bgs), -20 (0 ft bgs), -27 (0 ft bgs), and -31 (0 ft bgs).

#### 3.2.11.4 Findings Relative to Adjoining Study Areas

Available data for this study area indicate several apparently isolated locations where organic constituents exceed screening levels. High concentrations of VOCs were detected shallow soils in former Ponds A and B. Elevated levels of PAHs and PPOs were also locally present in proximity to these former ponds. PCBs were detected in a cluster of surface soil samples collected near the RCF Pond, in proximity to former Pond 3 as well as in a cluster of shallow samples near former Pond S, south of the PSCT. Impacted soils in these locations may possibly extend into adjoining study areas including the Remaining On-site Area, the Central Drainage Area, and the Stormwater Ponds (RCF Pond).

#### 3.2.11.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents are present above screening levels in approximately one-third of the locations sampled within the Former Ponds and Pads Subarea. Barium, lead and nickel were the most prevalent inorganic constituents exceeding screening levels, and were present at these levels in approximately an equal number of samples, followed by copper, cadmium and chromium. The majority of exceedances were reported for surface soil samples, although exceedances are locally present in shallow and intermediate depth samples as well. While reported inorganics concentrations typically decrease with increasing depth, maximum

constituent concentrations were reported in shallow to intermediate depth samples in some locations.

Available data for organic constituents indicate few significant soil impacts exist within the Former Ponds and Pads Subarea, and that these impacts are limited in extent. While results indicate that a variety of organics are widely present within this study area, with only few exceptions, reported concentrations are below screening levels.

VOC concentrations in excess of screening levels (both TCE and PCE) are detected only in shallow to medium depth soils in borings completed within the limits of former Pond A and Pond B, located in the north central portion of this area just below the PSCT. A sample from Pond B with elevated VOCs was also reported to contain one PAH and one PPO above screening levels. Significantly, the other borings completed within former Ponds A and B did not encounter similarly elevated organics, indicating that significant soil impacts related to these two former ponds are of limited lateral extent. The only other organics exceedances were for PCB Aroclor 1260 and PCB Congeners TEQ, encountered above screening levels in surface soils at four isolated locations in the east central portion of this study area.

No indications of significant soil impacts were encountered in deep borings and MIP investigations completed along historical drainage paths. Available field observations and analytical data indicate that residual impacts to shallow to medium depth soils are present in the area of exploratory trench locations RITRON-01 and RITRON-02, indicating that localized impacts may remain beneath the road remnant that now overlies the drainage swale that once connected former Ponds C and M. Results from the randomly distributed surface soil samples collected throughout the area further support the finding that significant soil impacts are limited in extent. Together these findings indicate that prior soil cleanup activities conducted within the Former Ponds and Pads Subarea were very effective. Moreover, no indications of significant impact were reported for samples collected from surface to deep soils along the southern Site boundary, indicating that soil contamination does not extend into off-site areas. With the exception of one location with PCBs above screening levels, it appears that no significant soil impacts are associated with post-owner pipeline leaks and spills that were targeted for sampling. Available data indicate that soil conditions in this study area have been adequately characterized and that no additional data are necessary.

### **3.2.12 Off-site Areas**

Sediment samples, surface soil samples, and samples from soil borings were collected in order to characterize surface and subsurface soil conditions in the Off-Site Areas (Figure B-6). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.13 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### **3.2.12.1 Drilling and Subsurface Conditions**

Surficial soil in the Off-Site Areas ranged from dry, light brown silt and silty clay in the North, B-, and A-Drainages, to wet, very dark brown and black organic-rich silt in the C-Drainage. Decomposing organic odors was observed in sediments collected from Casmalia Creek, in the C-Drainage. Available boring logs are included in Attachment B-1.

### 3.2.12.2 Sample Collection

Three surface soil and 13 sediment samples from 16 locations were collected for chemical analyses to characterize surface and subsurface soil conditions in the Off-Site Areas (Figures B-1 and B-6). The sampling program in the Off-Site Areas included surface soil and sediment sampling to evaluate the potential presence of contaminants off-site (Table B-1). Background samples were also collected in Off-Site Areas to supplement existing background data. Findings from background samples are discussed independently in Appendix A.

#### 3.2.12.2.1 *Phase I*

Three surface soil samples (Type 2; RISSOF-01 through RISSOF -03) were collected along the B-drainage, south of Pond 13 and downgradient of the Site boundary to evaluate the presence of potential contaminants in off-site soils. Samples were spaced approximately 1,200 feet apart. These samples were analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. One surface soil sample (RISSOF-01) was also analyzed for the full Appendix IX list plus additional COPCs.

Sediment samples (Type 8a) were collected from the drainages just below flowing water, or in the absence of water, at the lowest point within the drainage at the locations shown on Figure B-6. Six sediment samples were collected along the C-Drainage spaced approximately 1,800 feet apart. One of the samples (RISEOF-01) was collected at the location of a historical stormwater discharge point. Three sediment samples were collected downstream of the discharge point (RISEOF-02 through -04) and two samples (RISEOF-05 and -06) were collected upstream of the discharge point. Three sediment samples, spaced approximately 300 feet apart, were collected along the A-Drainage in the drainage bottom along NTU Road (RISEOF-07 through -09). Four sediment samples, spaced approximately 1,200 feet apart, were collected along the North Drainage (RISEOF-10 through -13). All sediment samples were analyzed for metals, SVOCs, PAHs, PCBs, and OCPs. In addition, a sediment sample closest to the Site boundary within each drainage (from RISEOF-02, -07, and -12) was analyzed for the full Appendix IX list plus additional COPCs (with the exception of RISEOF-12, which did not have a SVOC analysis).

#### 3.2.12.2.2 *Phase II*

Soil samples from two additional modified Type 3 locations (RISSOF-04 and -05) were collected and analyzed for dioxins and furans, as well as TOC and FOC at the request of the EPA. The locations were situated adjacent to Phase I off-site sample locations considered to be representative of background conditions that had no detected elevated concentrations of COPCs. Results for these TOC and FOC analyses were used to assist in performing NAPL partitioning calculations, which are documented in Appendix M.

### 3.2.12.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-15. Sampling locations in the Off-Site Area are illustrated on Figure B-6. Inorganics detected above screening levels and summary analytical results with field observations for the Off-Site Area are presented in Figures B-18a and B-18b, respectively.

### *3.2.12.3.1 Metals and Cyanide*

Three soil samples were collected from three surface soil sampling locations and analyzed for metals. Detectable concentrations of metals were present in each of the soil samples; however, concentrations did not exceed screening levels.

Thirteen sediment samples were collected and analyzed for metals. Detectable concentrations of metals were present in each of the sediment samples. A total of 22 metals were detected in samples collected in all 13 sediment locations. Cadmium, manganese, and/or selenium were detected above ecological screening levels at RISEOF-06, -09, -11, and -13 (all at 0 feet bgs). Metals concentrations in sediment samples did not exceed PRGs.

### *3.2.12.3.2 Volatile Organic Compounds*

A total of four samples were collected from three sediment and one surface soil sampling locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 67 percent of the sediment samples and none of the soil samples; however, concentrations did not exceed screening levels in any of the samples.

### *3.2.12.3.3 Semi Volatile Organic Compounds*

A total of 15 samples were collected from 12 sediment and three surface soil sampling locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 33 percent of the sediment samples and all of the soil samples. A total of four SVOCs were detected in sediment samples in four of the 12 sediment locations and one SVOC was detected in each of the three soil locations. Bis(2-ethylhexyl)phthalate was detected above screening levels in sediment samples. Detectable concentrations of SVOCs were present in soil; however, concentrations did not exceed screening levels.

Concentrations exceeded screening levels in one sediment sampling location in the A-drainage. In sediment samples collected less than 5 feet bgs, bis(2-ethylhexyl)phthalate was detected above ecological screening levels. In this depth range, bis(2-ethylhexyl)phthalate was detected in one of the 12 samples collected at a concentration of 0.24 mg/kg and exceeded ecological screening levels at RISEOF-09 (0 feet bgs).

### *3.2.12.3.4 Polycyclic Aromatic Hydrocarbons*

A total of 16 samples were collected from 13 sediment and 3 surface soil sampling locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 69 percent of the sediment samples and 33 percent of the soil samples; however, concentrations did not exceed screening levels in any of the samples. Three PAHs for which no screening levels have been developed were also detected.

### *3.2.12.3.5 Polychlorinated Biphenyls*

A total of 16 samples were collected from 13 sediment and three surface soil sampling locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 8 percent of the sediment samples and none of the soil samples. PCB concentrations did not exceed screening levels in any of the samples.

### 3.2.12.3.6 *Pesticides and Herbicides*

A total of 16 samples were collected from 13 sediment and three soil sampling locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 92 percent of the sediment samples and none of the soil samples. A total of 19 pesticides and herbicides were detected in sediment samples in 12 of the 13 locations. Pesticides/herbicides were not detected in soil samples in any of the three locations. DDD and DDT were detected above screening levels in one sediment sample.

Concentrations of DDD and DDT exceeded ecological screening levels in one sediment sample located in the upstream portion of the C-Drainage: RISEOF-05 (0 feet bgs). DDD was detected in 46 percent of the samples at concentrations ranging from 0.0008 to 0.0025 mg/kg. DDT was detected in 23 percent of the samples at concentrations ranging from 0.00027 to 0.0011 mg/kg.

### 3.2.12.3.7 *Dioxins and Furans*

A total of four samples were collected from three sediment and one surface soil sampling locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in each sample; however, concentrations did not exceed screening levels in any of the samples.

### 3.2.12.3.8 *Poor Purging Compounds*

A total of four samples were collected from three sediment and one surface soil sampling locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 67 percent of the sediment samples and none of the soil samples; however, concentrations did not exceed screening levels in any of the samples.

### 3.2.12.4 Findings Relative to Adjoining Study Areas

There are currently no indications that chemical concentrations locally detected in soils within this area have affected neighboring study areas, nor that conditions in the neighboring study areas have influenced or created conditions encountered in the Off-Site Area.

### 3.2.12.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents were not detected above screening levels in surface soil samples collected from the B-Drainage within the Off-site Areas. Off-site sediments locally contain inorganics in excess of screening levels, including manganese and selenium in the North Drainage, manganese in lower reaches of the A-drainage, and cadmium in the C-Drainage upstream from the site. The positions of these exceedances, either upstream or distal from the Site, suggest they are unrelated to Site activities.

Low concentrations of pesticides and herbicides detected in sediment in the upper C-Drainage are upstream of the site and likely unrelated to former Site activities. Elevated SVOCs encountered in sediment within the A-Drainage are distal from the site and not present in proximal samples, thus are likely unrelated to former Site activities. These data indicate that off-site areas have not been significantly affected by historical Site activities or present on-site conditions. Soil and sediment conditions in this study area have been adequately characterized, and no additional data are necessary.

### 3.2.13 Stormwater Ponds

Sediment samples were collected in order to characterize surface and subsurface conditions at the on-site Stormwater Ponds, including the RCF Pond, the A-Series Pond, and Pond 13 (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.14 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### 3.2.13.1 Drilling and Subsurface Conditions

Surficial sediment in the Stormwater Ponds Area was comprised of wet, black organic-rich silt and silty clay ranging from 6 inches to 4 feet thick. The thickest sediment was encountered in Pond 13 (3 to 4 feet). The sediment was underlain by moderately lithified to very hard gray and olive-brown silt and claystone bedrock. The contact between the weathered and unweathered claystone was encountered at approximately 3 feet below the sediment-claystone interface in boring RISESP-12, located in the A-Series Pond. Decomposing organic odors were observed in the pond-bottom sediments. Chemical staining was not observed. Available boring logs are included in Attachment B-1.

#### 3.2.13.2 Sample Collection

Sediment samples were collected for chemical analyses to characterize surface and subsurface soil conditions within existing surface impoundments (Figures B-1). The sampling program at the Stormwater Ponds included surface and shallow subsurface sediment sampling to evaluate the pond sediments for residual contamination from past operations (Table B-1).

##### 3.2.13.2.1 *Phase I*

Thirty-nine sediment samples (Type 8b) were collected from 13 locations at 0, 3, and 5 feet bgs using hand auger and continuous core sample collection methods. Six borings (RISESP-01 through -06) were located within the RCF Pond; four borings (RISESP-10 through -13) were located within the A-Series Pond; and three borings (RISESP-07 through -09) were located within Pond 13. Samples were analyzed for metals, VOCs, SVOCs, PAHs, PCBs, and OCPs.

Two sediment samples from 0 and 3 feet bgs at one location in each of the ponds (RISESP-01, -07, -10) were also analyzed for the full Appendix IX analyte list with additional COPCs. This included additional analyses for dioxins and furans, cyanide, sulfide, pesticides, and herbicides. Two samples from each stormwater pond were also analyzed for PCB Congeners, including the RCF Pond (RISESP-03 and -04), Pond 13 (RISESP-07 and -09), and the A-Series Pond (RISESP-10 and -13). In addition, physical parameters including TOC and grain size analysis were performed on all sediment samples. Physical properties of sediments are summarized in Section 3.3 and Table B-19.

##### 3.2.13.2.2 *Phase II*

In the Stormwater Ponds Area, sediment samples from ten additional Type 8a locations were collected from the RCF Pond, A-Series Pond, and Pond 13 and analyzed for Acid Volatile Sulfides (AVS) to assess the metals availability in pond sediments. In the RCF Pond, two

samples were collected in the northern portion of the pond (RISESP-15 and -18) and three in the southern portion of the pond (RISESP-14, -16, and -17). In the A-Series Pond, four samples were collected in the pond (RISESP-19 through -22). One sample was collected in Pond 13 (RISESP-23). In addition, two samples were collected in the RCF Pond for analysis of PCB Congeners (RISESP-17 and -18).

### 3.2.13.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study area and their concentration ranges by depth class are presented in Table B-16. Sampling locations at the Stormwater Ponds are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the Stormwater Ponds are presented in Figures B-19a and B-19b, respectively.

#### 3.2.13.3.1 *Metals and Cyanide*

Fifty sediment samples were collected and analyzed for metals. Detectable concentrations of metals were present in each of the samples. A total of 23 metals were detected in samples collected at each location. Metal concentrations exceeded screening levels in 15 locations throughout the entire study area. Barium, cadmium, chromium, copper, manganese, molybdenum, nickel, selenium, tin, and zinc were detected above ecological screening levels. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISESP-03, -04, -06, -07, -09, -10, -11, -13, -14, -16, and -19 through -23. The most prevalent metals detected above ecological screening levels were barium (6 samples), cadmium (8 samples), and nickel (11 samples). Metals concentrations in sediment samples did not exceed PRGs.

#### 3.2.13.3.2 *Volatile Organic Compounds*

Thirty-nine sediment samples were collected from 13 locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 56 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.13.3.3 *Semi Volatile Organic Compounds*

Thirty-nine sediment samples were collected from 13 locations and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 5 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.13.3.4 *Polycyclic Aromatic Hydrocarbons*

Thirty-nine sediment samples were collected from 13 locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.13.3.5 Polychlorinated Biphenyls

Thirty-nine sediment samples were collected from 13 locations and analyzed for PCBs. Detectable concentrations of PCBs were present in 33 percent of the samples. A total of two PCBs were detected in samples collected from the surface and shallow subsurface in eight of the 13 locations. Aroclor 1248 and Aroclor 1260 were detected above screening levels.

Concentrations exceeded screening levels in eight locations primarily in the RCF Pond. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISESP-01 through -06 (RCF Pond), -07 (Pond-13), and -13 (A-Series Pond). In samples collected up to and including 10 feet bgs, PRGs were not exceeded at any location.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, Aroclor 1248 and 1260 were detected above ecological screening levels. In this depth range, Aroclor 1248 was detected in one of 39 samples at a concentration of 0.16 mg/kg and exceeded ecological screening levels at RISESP-03 (3 feet bgs). Aroclor 1260 was detected in 33 percent of the samples at concentrations ranging from 0.024 to 0.13 mg/kg and exceeded ecological screening levels at RISESP-01 (0 feet bgs), -02 (0 feet bgs), -03 (0 and 3 feet bgs), -04 (0, 2.5, and 5 feet bgs), -05 (0 feet bgs), -06 (0, 3, and 5 feet bgs), -07 (3 feet bgs), and -13 (2 feet bgs). A strong sulfide odor was observed at RISESP-02 (0 feet bgs).

### 3.2.13.3.6 Pesticides and Herbicides

Thirty-nine sediment samples were collected from 13 locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides and herbicides were present in 36 percent of the samples. A total of 13 pesticides and herbicides were detected in samples collected from the surface and shallow subsurface seven of the 13 locations. Alpha chlordane, DDD, DDT, dieldrin, and endrin were detected above screening levels.

Concentrations exceeded screening levels in five locations in the RCF Pond. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at locations RISESP-02 through -06. In samples collected up to and including 10 feet bgs, PRGs were not exceeded at any location.

In samples collected at depths ranging from 0 up to and including 5 feet bgs, alpha chlordane, DDD, DDT, dieldrin, and endrin were detected above ecological screening levels. In this depth range, alpha chlordane was detected in 5 percent of the samples at concentrations ranging from 0.0029 to 0.0032 mg/kg and exceeded ecological screening levels at RISESP-03 (3 feet bgs) and -04 (2.5 feet bgs). DDD was detected in 8 percent of the samples at concentrations ranging from 0.0053 to 0.012 mg/kg and exceeded ecological screening levels at RISESP-02 (0 feet bgs) and -06 (0 and 3 feet bgs). DDT was detected in 13 percent of the samples at concentrations ranging from 0.004 to 0.0081 mg/kg and exceeded ecological screening levels at RISESP-02 (0 feet bgs), -05 (0 feet bgs), and -06 (0, 3, and 5 feet bgs). Dieldrin was detected in one of 39 samples at a concentration of 0.005 mg/kg and exceeded ecological screening levels at RISESP-06 (3 feet bgs). Endrin was detected in 10 percent of the samples at concentrations ranging from 0.00093 to 0.0031 mg/kg and exceeded ecological screening levels at RISESP-03 (3 and 5 feet bgs) and -04 (2.5 and 5 feet bgs). As previously noted, a strong sulfide odor was observed at RISESP-02 (0 feet bgs).

### 3.2.13.3.7 *Dioxins and Furans*

Six sediment samples were collected from three locations and analyzed for dioxins and furans. Detectable concentrations of dioxins and furans were present in all of the samples; however, total TEQ concentrations did not exceed screening levels.

### 3.2.13.3.8 *Poor Purging Compounds*

Six sediment samples were collected from three locations and analyzed for PPOs. Detectable concentrations of PPOs were present in 33 percent of the samples; however, concentrations did not exceed screening levels.

### 3.2.13.3.9 *PCB Congeners*

Eight sediment samples were collected from eight locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in each of the samples; however, TEQ concentrations did not exceed screening levels.

## 3.2.13.4 Findings Relative to Adjoining Study Areas

There are currently no indications that chemical concentrations locally detected in sediments and soils within the Stormwater Ponds have affected neighboring study areas. Conditions in isolated locations within the Former Ponds and Pads Area, however, may possibly have contributed to elevated contaminants present in shallow sediments and soils in the RCF Pond.

## 3.2.13.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents were found to exceed ecological screening levels in the majority of sediment samples collected from each of the three stormwater ponds. The most prevalent inorganics detected included barium, cadmium, and nickel. Exceedances are primarily limited to surface sediment samples, but are also locally present in sediments at depths of 2.5 to 5 feet bgs.

Organic constituents were reported above screening levels in the majority of sediment samples from the RCF, and in a single sample from each Pond 13 and the A-Series Pond. Exceedances include PCB Aroclors 1260 and 1248 in over half the sediment samples from the RCF, and Aroclor 1260 in single isolated samples in each the A-Series Pond and Pond 13. In addition, alpha chlordane, DDD, DDT, dieldrin, and/or endrin were detected above screening levels in five of the six sampling locations in the RCF Pond. Exceedances were locally reported for samples collected at depths of up to 5 feet bgs in the RCF Pond, up to 2 feet bgs in the A-Series Pond, and up to 3 feet bgs in Pond 13. No other organics were reported to exceed screening levels at the Stormwater Ponds. Sediment conditions the Stormwater Ponds have been adequately characterized, and no further data are necessary.

## 3.2.14 **Treated Liquid Impoundments**

Sediment samples were collected in order to characterize surface and subsurface conditions at the Treated Liquid Impoundments (Figure B-1). The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary. The rationale and

strategy guiding the collection and analysis of samples from this area is discussed in Section 4.7.15 of the RI/FS Work Plan and the Spring 2006 Sampling Plan.

#### 3.2.14.1 Drilling and Subsurface Conditions

Pond bottom sediment in this study area comprised wet, black organic-rich silt and silty clay ranging from 6-inches to 5 feet thick (Pond A-5), underlain by moderately-lithified to very hard olive-brown and dark yellowish-brown silt and claystone bedrock. Decomposing organic odors were observed in the surficial sediments. Chemical staining was not observed. Available boring logs are included in Attachment B-1.

#### 3.2.14.2 Sample Collection

Sediment samples were collected for chemical analyses to characterize surface and subsurface soil conditions within existing surface impoundments (Figures B-1). The sampling program at the Treated Liquid Impoundments included surface and shallow subsurface sampling to evaluate the pond sediments and underlying claystone for residual contamination from past operations (Table B-1).

##### 3.2.14.2.1 *Phase I*

Sediment samples (Type 8b) were collected from the bottom of two former treated liquid impoundments (Pond A-5 and Pond 18) to evaluate the presence and concentrations of chemical contaminants in sediment in these areas. Sediment samples were collected at depths of 0, 3, and 5 feet below the top of the sediment using hand auger and continuous core sampling methods from three locations in Pond A-5 (RISETL-01 through -03) and three locations in Pond 18 (RISETL-04 through -06). Samples were analyzed for metals, VOCs, SVOCs, PAHs, PCBs, and OCPs.

Two sediment samples from 0 and 3 feet bgs from one location in each of the ponds (RISETL-01 and -04) were also analyzed for the full Appendix IX analyte list with additional COPCs. This included additional analyses for dioxins and furans, cyanide, sulfide, organophosphorus pesticides, and herbicides. Two locations from Pond 18 (RISETL-05 and -06) and one location from Pond A-5 (RISETL-03) were also analyzed for PCB Congeners. Samples collected at 0 feet from RISETL-03, -05, and -06 were also analyzed for PCB Congeners. In addition, physical parameters including total organic carbon and grain size analysis were performed on all sediment samples collected. Physical properties of sediments are summarized in Section 3.3 and Table B-19.

##### 3.2.14.2.2 *Phase II*

One sediment sample from an additional Type 8a (RISETL-07) location was collected from the north end of Pond A5 and analyzed for PCB congeners at the request of the EPA. The location was situated adjacent to a Phase I location that had elevated concentrations of COPCs.

#### 3.2.14.3 Analytical Results

Summaries of the analytical program and detected compounds are provided in Tables B-1 and B-3, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific compounds in the study

area and their concentration ranges by depth class are presented in Table B-17. The sampling program and results for physical properties of sediments are listed in Tables B-2 and B-19, respectively. Sampling locations at the Treated Liquid Impoundments are illustrated on Figure B-1. Inorganics detected above screening levels and summary analytical results with field observations for the Treated Liquid Impoundments are presented in Figures B-20a and B-20b, respectively.

#### *3.2.14.3.1 Metals and Cyanide*

Eighteen sediment samples were collected and analyzed for metals. Detectable concentrations of metals were present in each of the samples. A total of 24 metals were detected in samples collected at each location. Metal concentrations exceeded screening levels in six locations throughout the entire study area. Barium, cadmium, chromium, copper, manganese, molybdenum, nickel, selenium, and zinc were detected above ecological screening levels. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at RISETL-01 through -06. The most prevalent metals detected above ecological screening levels were barium cadmium (7 samples), copper (5 samples), nickel (11 samples), and selenium (5 samples). Metals concentrations in sediment samples did not exceed PRGs.

#### *3.2.14.3.2 Volatile Organic Compounds*

Eighteen sediment samples were collected from six locations and analyzed for VOCs. Detectable concentrations of VOCs were present in 72 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.14.3.3 Semi Volatile Organic Compounds*

Eighteen sediment samples were collected from six locations and analyzed for SVOCs. SVOCs were not detected in any of the samples.

#### *3.2.14.3.4 Polycyclic Aromatic Hydrocarbons*

Eighteen sediment samples were collected from six locations and analyzed for PAHs. Detectable concentrations of PAHs were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

#### *3.2.14.3.5 Polychlorinated Biphenyls*

Eighteen sediment samples were collected from six locations and analyzed for PCBs. PCBs were not detected in any of the samples.

#### *3.2.14.3.6 Pesticides and Herbicides*

Eighteen sediment samples were collected from six locations and analyzed for pesticides and herbicides. Detectable concentrations of pesticides/herbicides were present in 28 percent of the samples; however, concentrations did not exceed screening levels.

#### 3.2.14.3.7 *Dioxins and Furans*

Four sediment samples were collected from two locations and analyzed for dioxins and furans. Detectable concentrations of dioxins/furans were present in each of the samples; however, concentrations did not exceed screening levels.

#### 3.2.14.3.8 *Poor Purging Compounds*

Four sediment samples were collected from two locations and analyzed for PPOs. PPOs were not detected in any of the samples.

#### 3.2.14.3.9 *PCB Congeners*

Four sediment samples were collected from four locations and analyzed for PCB congeners. Detectable concentrations of PCB congeners were present in each of the samples; however, TEQ concentrations did not exceed screening levels.

#### 3.2.14.4 Findings Relative to Adjoining Study Areas

There are currently no indications that chemical concentrations locally detected in sediments and soils within this area have affected neighboring study areas. Available analytical results for inorganic constituents in Pond A-5, however, indicate that sediments in this pond may have been impacted by stormwater and sediment runoff from the RCRA Canyon Area and/or the West Canyon Spray Area.

#### 3.2.14.5 Conclusions Regarding Nature and Extent of Soil Impacts

Inorganic constituents were found to exceed ecological screening levels in all of the sediment samples collected from the two treated liquids impoundments. The most prevalent inorganics detected included barium, cadmium, copper, nickel, and selenium. Exceedances are primarily limited to surface sediment samples, but are also locally present in sediments at depths of 2.5 to 5 feet bgs.

Low concentrations of organic constituents were detected in each of the sediment samples from the treated liquids impoundments, including either VOCs, PAHs, pesticides and herbicides, PCB congeners, and/or dioxins and furans. However, none of these constituents were detected at concentrations exceeding screening levels.

Shallow sediment and soil conditions in this study area have been adequately characterized, and no further data are necessary.

### **3.3 *Soil and Sediment Physical Properties***

Soil and sediment samples collected from the on-site Stormwater Ponds, Central Drainage Area, Maintenance Shed Area, and Treated Liquids Impoundments were tested for physical properties, pH, and TOC and FOC by PTS Laboratories. Soil samples were collected at depths of 10 feet bgs from hollow stem auger soil borings. Sediment samples from the Stormwater Ponds and Treated Liquids Impoundments were collected at depths of 0, 2-3, and 4-5 feet bgs at each sampling location. The analytical testing program and laboratory results for soil and sediment physical properties are summarized in Tables B-2 and B-19, respectively.

The pH of each sample was measured using test method 9045C and total organic carbon was measured using the Walkley-Blakely method. Total porosity of the samples was measured using method API RP40. Moisture content (as a percent of the dry weight of the soil) and volumetric moisture content, bulk density, and Atterberg Limits of the samples were measured using methods ASTM D2216, ASTM D2937, and ASTM D4318 respectively. Using these results of this testing program, a Unified Soil Classification System (USCS) soil type was assigned to each of the samples.

Of the six soil samples tested, four were classified as inorganic silts (MH) and two were classified as inorganic clays of high plasticity (CH). These classifications were derived primarily from the results of the Atterberg Limits tests (ASTM D4318). The most common Atterberg Limits tests are the Plastic Limit, Liquid Limit, and Plasticity Index, as are moisture contents that define the engineering behavior of fine-grained soils. The Plastic Limit is the moisture content at which a soil begins to behave as a plastic material. The Liquid Limit is the moisture content at which a soil begins to behave as a liquid. The Plasticity Index is the arithmetic difference between the Liquid Limit and the Plastic Limit, and represents the range of moisture contents over which a soil behaves as a plastic material. The Liquid Limit, Plastic Limit, and Plasticity Index of the soil samples had average values of 76.9, 35.8, and 41.2 respectively, with maximum values of 84.8, 46.8, and 57.3, and minimum values of 63.7, 24.1, and 30.8 respectively. The average moisture content in soil samples was 38.7 percent, with a maximum of 43 percent and a minimum of 37 percent. The moisture content results (ASTM D2216) indicate that most of the samples tested fall within the range of slightly to moderately plastic behavior.

The soil samples had an average pH of 6.6, with a maximum value of 7.18 and a minimum value of 5.7. Volumetric moisture contents ranged from 0.33 to 0.45, and averaged 0.4. Bulk density measurements yielded an average value of 1.0 grams per cubic centimeter (g/cc), and had a maximum value of 1.22 g/cc and a minimum value of 0.92 g/cc. The average total porosity in soil samples was 59.1 percent of bulk volume (Vb) with a maximum value of 62.2 percent Vb and a minimum value of 50.8 percent Vb. Total organic carbon concentrations were non-detect for each of the soil samples analyzed.

The sediment samples tested fell into one of three USCS classes: organic clays of medium to high plasticity (OH), inorganic clays of high plasticity (CH), and inorganic silts (MH). A majority of the samples fell into the organic clays class (OH), although inorganic silts made up a significant proportion of the samples collected. Moisture contents ranged from 23.9 percent to 275.2 percent with an average of 82.4 percent. Moisture content in samples from the Stormwater Ponds and Treated Liquids Impoundments generally decreases with sample depth, and is over 100 percent in many of the uppermost pond sediment samples due to these samples being largely comprised of organic rich, highly saturated sediment. Liquid Limits ranged from 103.20 to 55.70 with an average of 76.88, plastic limits ranged from 51.20 to 21.90 with an average of 34.52, and plasticity indices ranged from 63.80 to 22.60 with an average of 42.36. The Atterberg Limits results are also indicative of materials having a high organic content.

The volumetric moisture content of each sample was calculated using the ratio of volume of water to total sample volume, and ranges from 0.28 to .089, with an average value of 0.6. The bulk density of each sample ranged from 1.53 g/cc to 0.32 g/cc and averaged 0.94 g/cc. The total porosity of each sample was also measured, averaging 70.3 percent Vb and ranging from 144.30 percent Vb to 32.20 percent Vb. pH values ranged from 8.74 to 6.31, with an average

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value of 7.3. Total organic carbon values averaged 9,096 mg/kg, with a maximum value of 35,000 mg/kg and a minimum value of 1,500 mg/kg.

## 4.0 DATA ADEQUACY AND DQO EVALUATION

The soil and sediment data obtained during this RI investigation were evaluated with respect to the soil and sediments Data Quality Objectives (DQOs) identified in the RI/FS Work Plan. RI/FS Work Plan Sections 4.1 through 4.6 identify specific decisions and decision rules for issues related to this Task, including those related to human and ecological risk assessment, contaminant nature, extent, fate and transport, and feasibility study (FS) evaluations. Decisions specific to soil and sediment data are listed below.

### 4.1 DQO Decisions Related to Human Health and Ecological Risk Assessments for Soils and Sediments

The specific decisions and decision rules related to human health risk assessment for soils and sediments are as follows:

- *What are the chemicals and media of potential concern relative to human exposures and what levels of sensitivity/confidence are required to support human health risk-related decisions?*
- *If the soil, sediment, surface water and groundwater concentrations for chemicals that are naturally occurring are greater in each study area than background concentrations, chemical will be included as COPC in risk assessment.*
- *If the 95% upper confidence limit (UCL) on the mean soil, sediment, soil vapor, surface water and groundwater concentration for COPCs in the study area result in risk estimates within acceptable limits for the relevant exposure pathways, then no further sampling will be proposed for the chemical or media. If cumulative risks for the study area are within acceptable limits, no further action will be recommended.*
- *A 95% confidence against Type I errors ( $\alpha = 0.05$ ) and an 80% confidence against Type II errors ( $\beta = 0.20$ ) will be targeted for UCL calculations. For background comparisons  $\alpha = 0.2$  and  $\beta = 0.1$  will be targeted per 2002 Superfund guidance.*

The specific decisions and decision rules related to ecological risk assessment for soils and sediments are as follows:

- *What are the chemicals and media of concern relative to ecological pathways and receptors and what levels of sensitivity/confidence are required to support ecological risk related decisions?*
- *Where is contamination located and are chemicals being transported?*
- *If the maximum and/or 95% UCL on the mean soil, soil vapor, sediment, and/or surface water concentrations for COCs in each study area are greater than ecological risk screening levels, then additional sampling and analysis may be proposed.*
- *If the maximum and/or 95% UCL on the mean soil, soil vapor, sediment, and surface water concentrations for COCs in the study area are less than ecological risk screening levels, then no further sampling will be proposed.*
- *A 95% confidence against Type I errors ( $\alpha = 0.05$ ) and an 80% confidence against Type II errors ( $\beta = 0.20$ ) will be targeted for UCL calculations. For background comparisons:  $\alpha = 0.2$  and  $\beta = 0.1$  will be targeted.*

The soil and sediment data developed for each study area during the RI provide the information necessary to identify COPCs and perform risk calculations relative to potential human and ecological exposures. Specifically, soil and sediment samples have been collected and analyzed in accordance with the RI/FS Work Plan, and laboratory data are of acceptable quality and are suitable for determination of COPCs and use in risk assessment.

In accordance with the above-listed decision rules, data adequacy for human health and ecological risk assessments is evaluated relative to two statistical error rates or DQOs, UCL-related and background-related. Statistical methodology and evaluation of UCL-related and background-related DQOs are presented in Attachment B-4 and Attachment B-5, respectively. These evaluations are summarized below for each of three study areas. Although the concepts of statistical error (“false acceptance” or “false exceedance”) are applicable to other study areas, quantitative assessment of alpha and beta require the assumption that all samples are independent random samples of the same population. Therefore, DQOs are only evaluated in detail for study areas where random sampling was applied, namely RCRA Canyon, Remaining On-site Soil, and Former Ponds and Pads subarea.

The UCL-related DQO is evaluated using the resulting exposure point concentration (EPC), which may be either a UCL or a maximum detected concentration, which is sometimes used as a surrogate for the UCL, for example, in the case of low detection frequencies. The resulting EPC is evaluated with respect to both estimation uncertainty (statistical error relative to the mean being estimated) and decision uncertainty (statistical error relative to the risk-based screening level (SL). Measures of these two uncertainties are calculated in Tables B4 – 1 through B4 – 3 for the three study areas.

*Cases are considered to meet UCL-related DQOs if either or both estimation uncertainty or decision uncertainty is low. Cases are considered to not meet DQO error standards if estimation uncertainty and decision uncertainty are both high.*

Background-related DQOs are evaluated using the minimum detectable difference (MDD) between the compound-specific background means and each the means for each study area (Tables B6-1 through B6-3).

*Cases are considered to meet background-related DQOs if either estimation uncertainty for a two-sample t-test is low OR the study area mean is well below the lowest toxicologically-based screening level.*

*The above rule differs from, and is more accurate than, the “Stated DQO”, which is the background-related DQO stated in the work plan. For comparison purposes, cases considered to meet the “Stated DQO” are also identified in Table B6-1 through B6-3.*

Cases where a DQO is not met for particular chemicals are discussed below for each study area. Each chemical has differing priority as a risk driver, and generally, larger uncertainty intervals can be tolerated for non-risk drivers.

## 4.1.1 RCRA Canyon

### 4.1.1.1 UCL-related DQO

Decision uncertainty is adequately low for all metals with the exception of copper and manganese. Estimation uncertainty for copper is adequately low while estimation uncertainty for manganese is slightly elevated. Therefore, EPC-Related DQOs are considered approximately met for copper, and adequately met for all other metals.

Decision uncertainty is adequately low for all PCB and dioxin compounds shown in Table B4-1, with the possible exception of Avian PCB Congener toxic equivalency quotient (PCBC TEQ), for which a screening level was not available. With estimation uncertainty moderate for this compound, the DQO may not be met for Avian PCBC TEQ. The DQO is met for the remaining PCB and dioxin compounds.

Decision uncertainty is adequately low for all pesticide compounds shown in Table B4-1. Therefore the DQO is met for all pesticide compounds.

Decision uncertainty is adequately low for all polycyclic aromatic hydrocarbons (PAH) and semi-volatile organic compounds (SVOCs) shown in Table B4-1, with the possible exception of benzo(g,h,i)perylene for which a screening level was not available. Since estimation uncertainty is adequately low for benzo(g,h,i)perylene, the DQO is met for all PAH and SVOC compounds.

Decision uncertainty is adequately low for all VOC compounds shown in Table B4-1, with the possible exception of 1,2-dichloroethene and propanal, for which screening levels were not available. With estimation uncertainty high for these two compounds, the DQO may not be met for 1,2-dichloroethene and propanal. However, DQOs are met for the remaining VOC compounds.

### 4.1.1.2 Background-related DQO

For RCRA Canyon, the background-related DQO was met for all metals except for chromium and selenium (Table B6-1).

The two-sample t-tests of background condition, for both chromium and selenium, have minimum detectable differences (at the stated error rates,  $\alpha = 0.2$ ,  $\beta = 0.1$ ) that could be improved (narrowed) with additional sampling, potentially to the extent needed to detect a difference over background. Additionally the lowest risk-based screening levels for both metals are well below background so exceedance of the background analysis could potentially drive COPC selection. Selenium has the additional uncertainty of having substantial censoring due to "below detection limit" data.

## 4.1.2 Remaining On-site Area

### 4.1.2.1 UCL-related DQO

Decision uncertainty is adequately low for total cyanides as is estimation uncertainty. Therefore the DQO is well met for cyanide.

Decision uncertainty is adequately low for all metals, with the exception of lead. For lead, the estimation uncertainty is calculated as being negative due to an inconsistency in the data sets used for calculating the mean and for calculating the UCL. On a given data set, the UCL should always be higher than the mean, and therefore a negative value for REI would be impossible (aside from severe non-detect handling artifacts which are not the case for this metal). Therefore, the REI is not currently accurate and the DQO may not be met for lead. However, the DQO is well met for all other metals.

Decision uncertainty is adequately low for all PCB and dioxin compounds in Table B4-2, with the exception of mammalian PCBC TEQ, and possibly avian PCBC TEQ (for which a screening level was not available). With estimation uncertainty for these two compounds also high, the DQO is not met for mammalian PCBC TEQ and may not be met for avian PCBC TEQ. However the DQO is met for the remaining PCB and dioxin compounds. Since mammalian PCBC TEQ has a mean of 4.4 mg/kg and EPC of 16.4 mg/kg (the maximum detected concentration), the large estimation interval spans the screening level of 15.92 mg/kg. Therefore the probability of a beta-type error (“false exceedance”) is much larger than desired for mammalian PCBC TEQ and additional sampling would likely help to bring the EPC for this compound below the screening level.

Decision uncertainty is adequately low for all herbicide and pesticide compounds shown in Table B4-2, as is estimation uncertainty. Therefore DQOs are well met for all herbicides and pesticides.

Decision uncertainty is adequately low for tert-butyl alcohol (TBA), as is estimation uncertainty. Therefore the DQO is well met for TBA.

Decision uncertainty is adequately low for all PAH and SVOC compounds shown in Table B4-2, with the exception of n-nitrosopyrrolidine and possibly benzo(g,h,i)perylene (for which a screening level was not available). For n-nitrosopyrrolidine, the estimation uncertainty is calculated as being negative due to an inconsistency in the data sets used for calculation of the mean versus calculation of the UCL. Therefore, the REI is not currently accurate and the DQO may not be met for n-nitrosopyrrolidine. With estimation uncertainty adequately low for benzo(g,h,i)perylene, the DQO is met for all PAH and SVOC compounds, with the exception of n-nitrosopyrrolidine.

Decision uncertainty is adequately low for all VOC compounds shown in Table B4-2, except possibly for isopropanal and propanal, for which screening levels were not available. With estimation uncertainty for these compounds also high, the DQO may not be met for isopropanal, and propanal. The DQO is met for the remaining VOCs.

#### 4.1.2.2 Background-related DQO

For Remaining On-site Soils, the background-related DQO was considered met for all metals (Table B6-2). Although the DQO was not strictly met for tin, the case of tin is considered directly below and determined to meet general standards of sample number adequacy

The two-sample t-test of background condition for tin has a minimum detectable difference (at the stated error rates,  $\alpha = 0.2$ ,  $\beta = 0.1$ ) that could be improved (narrowed) with additional sampling, potentially to the extent needed to detect a difference over background. Additionally the lowest risk-based screening levels for tin are near background so exceedance of the

background condition could potentially drive COPC selection. As discussed in Attachment A-1 of Appendix A, the distribution of tin across the site, down to all sample depths, met appeared as a single slightly skewed lognormal distribution, which though shifted somewhat from the background sample distribution, had all characteristics of being ambient rather than contamination-related. Therefore, the background condition for tin was characterized using an site-wide ambient UTL.

### 4.1.3 Former Ponds and Pads Area

#### 4.1.3.1 UCL-related DQO

Decision uncertainty is adequately low for all metals with the exception of barium. With estimation uncertainty moderately elevated the DQO is not met for barium. However the DQOs are met for the remaining metals.

Decision uncertainty is adequately low for all PCB and dioxin compounds in Table B4-3, with the exception of Sum of PCB Congeners and possibly Avian PCBC TEQ, for which a screening level was unavailable. With estimation uncertainty moderately high for these two compounds the DQO is not met for Sum of PCB congeners and may not be met for Avian PCBC TEQ. The DQO is met for the remaining PCB and dioxin compounds.

Decision uncertainty is adequately low for all herbicide and pesticide compounds shown in Table B4-3. Therefore the DQO is met for all herbicides and pesticides.

Decision uncertainty is adequately low for acrolein and tert-butyl alcohol (TBA) as is estimation uncertainty. Therefore the DQO is well met for both compounds.

Decision uncertainty is adequately low for all PAH and SVOC compounds shown in Table B4-3, with the exception of n-nitrosodimethylamine, and possibly benzo(g,h,i)perylene, for which a screening level was not available. The estimation uncertainty for both analytes is calculated as being negative due to an inconsistency in the data sets used for calculating the means and UCLs. Therefore, the REIs are not currently accurate and the DQO may not be met for n-nitrosopyrrolidine and benzo(g,h,i)perylene. However, the DQO is adequately met for the remaining PAH and SVOC compounds.

Decision uncertainty is adequately low for all VOC compounds shown in Table B4-3, with the possible exceptions of 1,2-dichloroethene, isopropanal, and propanal, for which screening levels were not available. The estimation uncertainty for all three compounds is calculated as being zero or negative due to an inconsistency in the data sets used for calculating the means and UCLs. Therefore, the REIs are not currently accurate and the DQO may not be met for 1,2-dichloroethene, isopropanal, and propanal. The DQO is met for the remaining VOCs.

#### 4.1.3.2 Background-related DQO

For Former Ponds and Pads soils, the background-related DQO was met for all metals except for nickel and zinc (Table B6-3). The DQO criteria were not strictly met for tin, however this case is considered further below and determined to meet general standards of sample number adequacy.

The two-sample t-test of background condition for tin has a minimum detectable difference (at the stated error rates,  $\alpha = 0.2$ ,  $\beta = 0.1$ ) that could be improved (narrowed) with additional sampling, potentially to the extent needed to detect a difference over background. Additionally the lowest risk-based screening levels for tin are near the study area mean so exceedance of the background analysis could potentially drive COPC selection. However, as mentioned in Section 4.1.2, tin is considered at ambient levels across the site and to not exceed the background condition.

For zinc, the study area mean is relatively close to the background mean, and therefore additional sampling has only a moderate chance of reducing the minimum detectable difference enough to detect an exceedance above background. However due to the proximity of the screening level to the study area mean, the DQO for zinc is not met.

For nickel, the difference between the study area and background means for is larger and closer to what the current minimum detectable difference is. Therefore, additional sampling may change the result of the two-sample test for nickel. Additionally, the screening level is similar to the background mean and so the exceedance of background could potentially drive the COPC selection.

#### **4.2 DQO Decisions Related to Soil Contaminant Nature, Extent, Fate, and Transport Evaluation for Soils and Sediments**

The specific decisions and decision rules related to soil and sediment contaminant nature, extent, fate, and transport are as follows:

- *What is the extent of soil contamination in former waste disposal and treatment areas?*
- *What constituents are present in the surface tar noted in the Burial Trench Area?*
- *What is the distribution of contaminants in the remaining on-site soils area over and between locations of former ponds and pads?*
- *Is there residual contamination in the RCRA Canyon Area?*
- *If locations of shallow soil contamination are identified, deeper data will be collected if needed to plan remediation for a particular area or to assess potential groundwater quality impacts. For example, if relatively shallow contamination (5 feet and less) is indicated in the RCRA Canyon Area, deeper samples will be collected because the preliminary remedy for that area includes excavation of the affected soils;*
- *To assess potential off-site contaminant transport, the investigation will be focused on drainages (and other similar preferential pathways) because contaminants would be expected to concentrate there; and*
- *If adequate lithologic or aquifer hydraulic property data do not exist in a critical site Subarea, additional data collection will be recommended.*

As further described in the following sections, soil and sediment data collected during the RI are generally considered sufficient to characterize the nature, and in most cases the extent, of impacts to these media, and no further soil or sediment data are judged to be necessary. As described in the preceding sections, the review of available inorganics data for background locations, as well as for off-site and on-site areas, indicate that there are more than sufficient numbers of samples (i.e., high power) and adequate spatial distribution of samples to perform the necessary additional statistical evaluations (e.g., calculate UCLs) that factor into the human health and ecological risk assessments to be conducted as part of the RI. Lithologic conditions within across the Site have been adequately defined, and in conjunction with soil physical

property data and the chemical data developed to date, provide the information needed to evaluate fate and transport of the contaminants present in the various study areas.

#### **4.2.1 Capped Landfills Area**

Investigations conducted at grout settlement location within the Capped Landfill Area indicate that vegetated fill material above the HDPE liner has not been significantly impacted by fugitive vapor emissions from the underlying landfill. Available soil data for this area are sufficient to characterize soil conditions above the liner membrane in these locations, and no further data are needed.

#### **4.2.2 RCRA Canyon Area**

Available data indicate a variety of inorganic constituents are present above screening levels in surface to medium depth soils across a broad portion of the RCRA Canyon Area. Screening level exceedances by organic constituents are limited to only one location within this area, and are present at a depth of 12.5 feet bgs where human and ecological exposures are unlikely. Currently available data are judged sufficient to adequately define the nature and extent of soil impacts by within this portion of the Site, and thus no further data are deemed necessary for the RCRA Canyon Area.

#### **4.2.3 West Canyon Spray Area**

Available data indicate that surface and shallow subsurface soils in the West Canyon Spray Area have been impacted by a variety of inorganic constituents at concentrations in excess of screening levels, and that the organic constituents are not present in excess of screening levels at any depth. Currently available data are judged sufficient to adequately define the nature and extent of soil impacts by within this portion of the Site, and thus no further data are deemed necessary for the West Canyon Spray Area.

#### **4.2.4 Burial Trench Area**

Surface and subsurface soils in the Burial Trench Area have been widely impacted by former waste disposal activities in this area. Available data indicate that shallow to deep soils, principally within the central portion of the area, contain comparatively high concentrations of a variety of inorganic and organic constituents. Deep soil impacts by VOCs are also present along the southern margin of the area, as are lesser impacts to shallow soils by PPOs and PAHs along the western margin of the area. Field indications of soil impact, including visible tarry materials, staining, odors and elevated PID readings typically correspond with significantly elevated organics concentrations. One isolated sample collected in the central portion of the study area is reported to contain an anomalously high concentration of PCB Aroclor 1254 and PCB congener TEQ, indicating that deep soils in this study area have been locally impacted by PCBs and related compounds. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

These findings are consistent with the former use of this area for deep waste disposal, and are not unexpected considering that no clean-up has been conducted in this area. Deep soil contamination had been expected in this area, and is suspected of providing a continuing source for groundwater contamination historically detected in extraction well PSCT-4. The nature and extent of impacts to surface and shallow soil in this area have been adequately

characterized, and the chemical constituents present in tar materials have been identified. No further data are needed in areas to the north or east, as they abut areas that are already capped (P/S Landfill) or planned for capping (PCB Landfill), and subsurface contamination to the south likely extends no further than the nearby PSCT. The lateral extent of impacts deeper soils in the western and southwestern portion of the Burial Trench Area was defined during Phase II investigations and no further data are needed.

#### **4.2.5 Central Drainage Area**

Findings of investigations completed within the Central Drainage indicate that shallow to deep soils in the area lying west of the Sump 9B road contain significantly elevated concentrations of organic constituents, principally VOCs and pesticides/herbicides. Inorganic constituents in excess of screening levels are present principally in surface to shallow soils within the western portion of the study area. Areas found to contain highest concentrations of these chemicals lie down slope from the P/S landfill and the Gallery Well, in proximity to Sump 9B, former Pond R, the former loading dock, and in several locations along the historical drainage once traversing this area. These findings are not surprising given their position relative to former waste disposal facilities, and are consistent with data for other media indicating that this portion of the Central Drainage Area has experienced significant chemical impact. With only limited exception, data for those areas lying east of the Sump 9B road indicate soils in this portion of the study area have not been significantly affected. The lateral and vertical extent of soil impacts with the Central Drainage Area have been adequately characterized and no additional data are necessary.

It is likely that the Central Drainage Area will require capping east of former Pad 9A and Pad 9B and north of the PSCT due to the presence of residual contaminants in both the soil and groundwater. While screening level exceedances are limited to only one location in areas lying east of the Sump 9B road, the eastern boundary for a cap would probably be the current limit of the existing EE/CA Cap. Capping this area would assist in the ultimate goal of directly discharging storm water draining from this area of the site.

#### **4.2.6 Liquids Treatment Area**

Available data indicate that screening level exceedances are limited to variety of inorganic constituents present in surface to intermediate depth soils across the study area, and that organics exceedances are limited to pesticides and herbicides in surface soils at one location. These exceedances are spatially associated with historical and existing process equipment and related facilities, most notably at temporary tanks north of Operations building. VOC exceedances are restricted to deep soils lying at or below the groundwater table, and are likely affected by groundwater contamination. The presence of elevated herbicides in exposed surface soils in this area is not surprising, and may be attributable to the prior use of weed control chemicals (Round-up<sup>®</sup> or equivalent) in areas surrounding liquids conveyance piping and storage vessels. Soil conditions in the Liquids Treatment Area have been adequately characterized and no additional data are necessary.

#### **4.2.7 Maintenance Shed Area**

Surface to deep soils across the Maintenance Shed Area were reported to contain a variety of inorganic constituents in excess of screening levels, and surface and shallow soils were reported to contain high levels of diesel to motor oil range TPH. Detectable concentrations of

BTEX were reported at two locations, but not in excess of screening levels. Areas of maximum soil impact correspond with locations in proximity to former facilities or historical ground surface staining. Dioxin and furan Total TEQs in excess of screening levels were reported in surface soils only, in association with elevated TPH. While high TPH concentrations in surface to shallow soils may extend easterly beneath a portion the P/S Landfill buttress and lower surface soil concentrations may also possibly extend to the eastern and southern limits of this area, available data indicate that maximum concentrations lie in proximity to former facilities and features in this area, and diminish laterally away from these features. Soil conditions in this study area have been adequately characterized and no additional data are necessary.

#### **4.2.8 Administration Building Area**

Investigations completed in the Administration Building Area indicate surface and subsurface contamination in this area to be minimal. No organic constituents were detected in excess of screening levels, and screening levels for inorganic constituents were not exceeded in samples shallower than 20 feet bgs. With the exception of elevated PID readings in shallow soil in Remaining On-site Area boring RISBON-49, conditions in this location are largely consistent with those for other borings completed within the Administration Building Area. Jointly, these data indicate surface and subsurface soil throughout this Study Area to contain a broad range of organic constituents, but at concentrations uniformly below screening levels. Available data are considered sufficient to characterize surface and subsurface conditions in the Administration Building Area, thus no further data are necessary.

#### **4.2.9 Roadways**

Results of shallow soil sampling conducted throughout the existing and historical roadway system indicate only very low concentrations of organic constituents are locally present in surface soils in this area, with screening level exceedances limited to only two isolated locations. Inorganic constituents, however, are present above screening levels in close to one-half of the roadway samples collected. Existing data are judged sufficient to characterize the nature and distribution of soil impacts in the Roadways, and no further data are necessary.

#### **4.2.10 Remaining On-site Area**

A variety of inorganic constituents exceeded screening levels in surface to shallow soils broadly across the Remaining On-site Areas, with exceedances in deeper soils limited to several locations along the southern Site boundary. With only limited exception organic constituents were rarely encountered at concentrations in excess of screening levels within this study area. PPOs and PAHs were detected in excess of screening levels in surface and deep soil in several areas along the southern Site boundary. Maximum impacts were encountered in deep soils in the vicinity of location RISBON-59, with screening level exceedances detected in shallow to deep soils in surrounding Phase II and III borings (see Section 5.0 for Phase III results). Shallow to deep soil impacts in this area are apparently attributable to former waste impoundments once located near the western end of the present RCF Pond. No screening level exceedances were reported for randomly distributed statistical soil sample locations, or those collected to assess specific areas of concern, including pipeline leaks. These data indicate that prior cleanup efforts conducted throughout the Remaining On-site Areas were very effective in removing the majority of contaminated soils formerly associated with historical features once present in this area. Available data are considered sufficient to characterize

surface and subsurface conditions in the Remaining On-site Soils Area, thus no further data are necessary.

#### **4.2.11 Former Ponds and Pads Subarea**

Inorganic constituents are present above screening levels in approximately one-third of the locations sampled within the Former Ponds and Pads Subarea, principally for surface soil samples. Available data for organic constituents indicate few significant soil impacts exist within the Former Ponds and Pads Subarea, and that these impacts are limited in extent and apparently attributable to limited residual contamination associated with former Pond A and Pond B. Additional organics impacts include PCB Aroclor 1260 and PCB Congeners TEQ, which were encountered above screening levels in surface soils at four isolated locations in the east central portion of this study area. No indications of significant soil impacts were encountered in deep borings and MIP investigations completed along historical drainage paths. Results from the randomly distributed surface soil samples collected throughout the area further support the finding that significant soil impacts are limited in extent. Together these findings indicate that prior soil cleanup activities conducted within the Former Ponds and Pads Subarea were very effective. With the exception of one location with PCBs above screening levels, it appears that no significant soil impacts are associated with post-owner pipeline leaks and spills that were targeted for sampling. Available data indicate that soil conditions in this study area have been adequately characterized and that no additional data are necessary.

#### **4.2.12 Off-site Areas**

Inorganic constituents were not detected above screening levels in surface soil samples collected from the B-Drainage within the Off-site Areas. Off-site sediments locally contain inorganics in excess of screening levels; however, the positions of these exceedances relative to other samples suggest they are unrelated to Site activities. Similarly, the positions of off-site sediment samples containing low concentrations of pesticides, herbicides, and SVOCs suggest these are likely unrelated to former Site activities. These data indicate that the Off-site Areas have not been significantly affected by historical Site activities or present on-site conditions. Soil and sediment conditions in this study area have been adequately characterized, and no additional data are necessary.

#### **4.2.13 Stormwater Ponds**

Inorganic constituents were found to exceed ecological screening levels in the majority of sediment samples collected from each of the three stormwater ponds, with exceedances primarily limited to surface sediment samples. Organic constituents were reported above screening levels in the majority of sediment samples from the RCF, and in a single sample from each Pond 13 and the A-Series Pond. Sediment conditions the Stormwater Ponds have been adequately characterized, and no further data are necessary.

#### **4.2.14 Treated Liquids Impoundments**

Inorganic constituents were found to exceed ecological screening levels in all of the sediment samples collected from the two treated liquids impoundments, with exceedances primarily limited to surface sediment samples. Low concentrations of organic constituents were detected in each of the sediment samples from the treated liquids impoundments; however, none of these constituents were detected at concentrations exceeding screening levels. Shallow

sediment and soil conditions in this study area have been adequately characterized, and no further data are necessary.

### **4.3 DQO Decisions Related to FS Evaluations for Soils and Sediments**

The specific decisions and decision rules related to feasibility study are as follows:

- *What is the chemical nature and physical extent of the contaminated area requiring remediation?*
- *What are the relevant physical properties of the subsurface vadose zone and/or saturated zone where contamination is present?*
- *The FS does not require any specific limits on chemical quality data evaluation decision errors, but rather relies on the chemical data evaluation decision limits that are appropriate for site characterization and risk assessment.*

#### **4.3.1 Capped Landfills Area**

As corrective measures are already in-place at the Capped Landfills Area, and available data indicate no significant impact to vegetated fill material above the HDPE liner at former grout settlement locations, further corrective actions are not required for this area.

#### **4.3.2 RCRA Canyon Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the RCRA Canyon Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.3 West Canyon Spray Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the RCRA Canyon Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.4 Burial Trench Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Burial Trench Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.5 Central Drainage Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Central Drainage Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.6 Liquids Treatment Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Liquids Treatment Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.7 Maintenance Shed Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Maintenance Shed Area, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.8 Administration Building Area**

Available soil data for the Administration Building Area, including that for location RISBON-49, indicate surface and subsurface impacts to be broadly present throughout the area, but at concentrations uniformly below screening levels, suggesting that no corrective actions are necessary for this study area. Existing data are judged sufficient to complete the FS for the Administration Building Area.

#### **4.3.9 Roadways**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Roadways, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.10 Remaining On-site Area**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Remaining On-site Areas, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.11 Former Ponds and Pads Subarea**

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the Former Ponds and Pads Subarea, and to allow for adequate evaluation of remedial measures for this area.

#### **4.3.12 Off-site Areas**

Results of off-site surface soil and sediment samples indicate these materials have not been significantly affected by historical Site operations or existing on-site conditions. Consequently, no corrective actions are likely necessary for these media, and existing data are considered sufficient to complete the FS.

#### **4.3.13 Stormwater Ponds**

Sufficient data has been collected in to adequately define the nature and extent of sediment impacts in the Stormwater Ponds, and are judged sufficient to assess appropriate future management alternatives and/or remedial measures for this area.

#### **4.3.14 Treated Liquid Impoundments**

Sufficient data has been collected in to adequately define the nature and extent of sediment impacts in the Treated Liquids Impoundments, and are judged sufficient to assess appropriate future management alternatives and/or remedial measures for this area.

## 5.0 PHASE III INVESTIGATION SUMMARY – RISBON-59 AREA

### 5.1 Introduction

This section summarizes results of the Phase III soil investigation conducted in the vicinity of boring location RISBON-59, located near the western end of the RCF Pond (Figure B-21a). These investigations were completed in accordance with the *Revised Final Phase III RI Sampling Plan for Follow-up RISBON-59 Soil Sampling (Phase III Sampling Plan)*, dated March 27, 2007, which was prepared by the CSC and submitted to the EPA (CSC, 2007). The number and location of these Phase III borings were first proposed by the CSC in the RISBON-59 data summary package that was sent to EPA on December 11, 2006. EPA responded to that package in a letter dated January 26, 2007 that was subsequently discussed and agreed to via email exchanges. The following sections describe the nature and findings of the work completed as part of this investigation.

#### 5.1.1 Purpose of Investigation

The CSC performed field sampling and contracted laboratory chemical and physical analyses of soil samples collected with the purpose of further characterizing the soil contamination encountered around RISBON-59 during the Phase I and Phase II RI sampling program. The joint findings of these investigations will be used to assess the nature and extent of chemical impacts, to evaluate potential exposures to human and ecological receptors, and to assist in the evaluation of corrective measures, as appropriate based upon the findings.

#### 5.1.2 Previous Investigations – Phase I and II

Sampling activities, field observations, and analytical results for Phase I and II investigations completed in the RISBON-59 area were incorporated into discussions presented in Section 3.2.10 of this Appendix. Provided below for perspective is a brief summary of Phase I and II work completed in this portion of the Site.

##### 5.1.2.1 Phase I Scope and Findings

Phase I RI sampling activities completed near the western limit of the RCF Pond included one Type 7 boring (RISBON-59), situated just southeast of the limit of former Pond 2, along the pathway of an historical surface drainage that formerly traversed the area. This boring was planned to assess the potential presence of NAPL in this former drainage location.

The Phase I work completed at this location included an CPT/MIP profile, followed-up with a soil boring to collect a discrete soil sample at the depth which demonstrated the highest response on the MIP detectors. The CPT/MIP profile was completed to a total depth of approximately 58 feet bgs, with indications of organic chemicals recorded on the flame-ionization detector (FID) at depths of between approximately 27 to 44 feet bgs, and maximum instrument response on the FID at approximately 31 feet bgs. The FID recorded no response either above or below this interval, and no instrument response was noted for either the photo-ionization detector or electron capture detector through the total depth explored in this location.

After consultation with EPA, it was agreed that follow-up soil sampling at RISBON-59 would be focused on the FID detector maxima, and a discrete soil sample was then collected for chemical

analysis from the approximate depth interval 29 to 32.5 feet bgs. The soil sample collected from this depth was described as black silty clay, with an oily appearance and moderate to strong petroleum-like odor. This single soil sample was analyzed for the Modified Appendix IX list of constituents, with additional COPCs. While analytical results for this sample detected a variety of organic constituents, only a few compounds within the PPO analytical class were measured in exceedance of screening levels. The CSC performed partitioning calculations on this sample using the measured laboratory results for summed volatile and semi-volatile organic compounds which indicated the suite of organic chemicals detected were present at 143.1% of their combined solubility limit. This sample location was listed as "potential for NAPL to exist" (see Interim Progress Report Appendix M, Table M-2). Based upon these findings, the CSC proposed additional characterization activities as part of Phase II investigations at the Site.

#### 5.1.2.2 Phase II Scope and Findings

The CSC completed Phase II RI investigations during July 2006 in the vicinity of RISBON-59 to further assess the nature and extent of soil impacts in this area, and evaluate whether NAPL may be present. The Phase II RI investigations included installation of piezometer RIPZ-37 at the location of Phase I soil boring RISBON-59, and completion of three additional Type 6 soil borings to the west, east and south of the piezometer (locations RISBON-83, -84, and -85, respectively). The piezometer was installed to a depth of 50 feet bgs, with a screened interval extending from 30 feet to 50 feet bgs, spanning the groundwater table in this area. To date, no NAPL has been observed in this piezometer.

Borings RISBON-83, -84, and -85 were completed to depths of 58 feet, 60 feet, and 52.5 feet bgs respectively. As described in Section 3.2.10, five soil samples were collected at selected depths from each of the three soil borings for analysis of the Modified Appendix IX list of constituents with additional COPCs. While analytical results of all samples collected from the three step out borings detected a variety of organic constituents, only four of the 15 samples tested were reported to contain PPOs and/or PAHs at concentrations in excess of available screening levels.

Poor purging organics and PAHs were reported to exceed PRGs, and these exceedances are limited to discrete soil samples collected from three of the four soil borings completed in the RISBON-59 area. No ecological screening level exceedances are noted for soil samples collected in this area. Screening level exceedances were reported at a depth 29 feet bgs in boring RISBON-59, depths of 30 and 55 feet bgs in boring RISBON-83, and at 51 feet bgs in boring RISBON-85. No screening level exceedances are reported for boring location RISBON-84.

#### 5.1.3 **Scope of Phase III Investigation**

The CSC collected and analyzed a total of 12 soil samples from seven Type 6 soil borings completed in this area as part of the Phase III sampling program. Samples were each analyzed for the modified Appendix IX suite of analytes, with additional COPCs.

Phase III boring locations were chosen so that they would lie outside the boundary of a former waste impoundment that was located in this area of the site and visible on 1974 and 1975 historical aerial photographs. The northern and southern Phase III sampling locations are located to be as close to the historic natural drainage as possible (RISBON-88b and -89).

All soil Phase I, II, and III sampling locations completed in the RISBON-59 area are depicted on Figures B-21a through B-21c, and interpretative cross-sections through this area are presented in Figures B-21d and B-21e. The identity, collection depth, and chemical testing program for all soil samples collected as part of the Phase III sampling program are summarized in Tables B-20 and B-21. These data complement existing soil data collected during preceding Phases I and II investigations in the RISBON-59 area.

Results of the work completed as part of the Phase III soil investigation are discussed in Section 5.3 of this Appendix.

## **5.2 Methodology**

The Phase III sampling program was completed in accordance with the approved Phase III Sampling Plan (CSC, 2007). Field sampling and sample handling were conducted in accordance with those used during preceding Phase I and II sampling programs, and were performed in accordance with the appropriate methods and procedures identified in Appendices A and B of the RI/FS Work Plan.

### **5.2.1 Detailed Approach**

Using coordinates derived from Figure 4.1-P3 of the Phase III Sampling Plan, all soil sampling locations were first staked in the field by the surveying contractor. All staked sampling locations were then visited by URS personnel accompanied by CSC and EPA staff and representatives and reviewed for appropriateness. Adjustments to some of the staked sampling locations were made in consultation with oversight personnel, as necessary or appropriate based upon field conditions. All relocated sample points were re-surveyed in order to accurately record the actual sample location. Survey coordinates for all soil and sediment sample locations are presented in tabular and digital format in Attachment B-2 to this Appendix.

All Phase III field sampling was conducted between April 16 and April 20, 2007. All sampling activities were conducted in accordance with procedures outlined in the Site Health & Safety Plan, which was reviewed and adhered to by all on-site workers.

### **5.2.2 Contractors and Subcontractors**

#### **5.2.2.1 Principal Contractor – URS Corporation**

The CSC contracted URS Corporation (URS) to complete the Phase III Soil Investigation. URS subcontracted support services used to survey and stake planned sampling locations, perform drilling and sampling activities, and to perform chemical and physical testing of the samples collected. The same supervisor that we used for the Phase I and II sampling, David Myers (URS) was the field manager again for the Phase III sampling. As required, the CSC's Project Coordinator also provided supervision of URS while they were in the field. The specific work completed by each subcontractor supporting the Phase III sampling program is further described below.

#### **5.2.2.2 Surveying Subcontractor – Cannon Associates**

All field surveying and demarcation of sampling locations was subcontracted to Cannon Associates of Santa Maria, California (formerly Pacific Engineering, Incorporated) All surveying

activities were conducted under the direct supervision of a California registered civil engineer (Clay Bradfield, California registered civil engineer No. C47085). Using northing-easting coordinates derived from Figure 4.1-P3 of the Phase III Sampling Plan, Cannon Associates located and staked all planned soil and sediment sampling locations on the ground surface.

#### 5.2.2.3 Drilling Subcontractor – Gregg Drilling

All drilling and soil sample collection activities were subcontracted to Gregg Drilling, Incorporated of Signal Hill, California. Gregg Drilling is a licensed California drilling contractor (California C57HIC license No. 485165). Gregg Drilling used both hollow-stem auger and direct-push drilling equipment to perform Phase III sampling activities.

#### 5.2.2.4 Analytical Testing Subcontractors – Sequoia Analytical

Laboratory chemical testing of soil samples collected during the Phase III sampling program was performed by Sequoia Analytical (Sequoia) of Petaluma, California (California Environmental laboratory Accreditation Program [ELAP] certification No. 2374), which performed the majority of analytical testing. All analyses conducted on Phase III soil samples were conducted by Sequoia, and included the Modified Appendix IX suite of analyses with additional COPCs.

### 5.2.3 **Equipment and Tools**

Equipment and tools used for Phase III sampling activities were the same as those used for earlier Phase I and II investigations, and are described in Section 2.1.5 of this Appendix.

### 5.2.4 **Sample Handling and Shipping**

Sample handling and shipping procedures used for Phase III sampling activities were the same as those used for earlier Phase I and II investigations, and are described in Section 2.1.6 of this Appendix.

## 5.3 ***Investigation Results***

Surface and subsurface soil samples were collected in order to further characterize the nature and extent of soil impacts detected in the vicinity of RISBON-59 during preceding Phase I and II investigations. The CSC expects to use the results from these samples to assess contaminant nature and extent, evaluate potential human and ecological risks, and evaluate and develop response actions for this area as necessary.

### 5.3.1 **Drilling and Subsurface Conditions**

Lithologic conditions encountered in the RISBON-59 area include weathered, olive-brown, yellowish gray claystone overlain by approximately 1 to 10 feet of olive-brown gray clay and claystone fragments. The top 0.5 feet of soil was comprised of road base at locations RISBON-86B, -87B, and -88B. The top 0.5 feet of RISBON-89 was made up of grasses and soil. The contact between the upper and lower HSUs was encountered in six of the seven Phase III borings, at depths of between approximately 17 to 44 feet bgs, depending on location. Groundwater was encountered at location RISBON-88B (41 ft bgs) and at location RISBON-89 (0.5 ft bgs).

Field indications of soil impact were observed in each Phase III boring, and typically included slight to moderate petroleum or chemical odors, and localized grayish to black staining. Black tarry material was locally encountered at approximately 17.5 and 36.5 feet bgs in locations RISBON-87 and -88b, respectively. Discolored and/or tarry soil was and often associated with slight to strong petroleum and chemical odors. Field indications of soil impacts were most frequently noted at depths of between approximately 8.5 to 22 feet bgs; however, slight odors and soil discoloration were locally noted at depths ranging from approximately 3 to 34 feet bgs. Very dark gray soil was noted at RISBON-86 and -86B at 1 and 2 feet bgs, respectively. Elevated headspace readings were only rarely encountered, and where present, typically corresponded with other field indications of soil impact. Headspace readings are summarized in Table B-23 and boring logs are included in Attachment B-1.

### 5.3.2 Sample Collection

The CSC collected and analyzed a total of 12 soil samples from a total of seven Type 6 Phase III Borings completed in this area. Three of these six borings (RISBON-86, -87, and -88) were drilled and logged, but were not sampled based on strong field indications of soil impact. Corresponding alternate sampling locations (RISBON-86b, -87b, and 88b) were established further away from the RISBON-59 area contaminant maxima in hope of delineating the lateral extent of soil impacts in this area. Sampling was conducted at location RISBON-89 as originally planned. Three soil samples were collected at each of the four sampling boring locations with the intent that at least one sample was 5 feet above the potential contamination, one sample was in the apparent center of the contaminated depth interval, and one sample was 5 feet below the potential contamination (or at the HSU contact if, whichever was shallower).

### 5.3.3 Analytical Results

Summaries of the analytical program and detected COPCs are provided in Tables 20 and B-21, respectively. Comprehensive data tables including specific concentrations for each compound can be found in Appendix R. The prevalence of specific COPCs in the study area and their concentration ranges by depth class are presented in Table B-22. Sampling locations in the vicinity of RISBON-59 are illustrated on Figure B-21a. Inorganics detected above screening levels and summary analytical results with field observations are illustrated in Figures B-21b and B-21c, respectively. East-west (A – A') and north-south (B – B') interpretative cross-sections are shown in Figures B-21d and B-22e, respectively.

#### 5.3.3.1 Metals and Cyanide

Twelve soil samples were collected from four borings (Type 6) and analyzed for metals and cyanide. Detectable concentrations of metals were present in each sample. Detectable concentrations of cyanide were found in 17 percent of the samples. A total of 23 metals were detected in samples in all of the locations. Cyanide was detected in samples in two of the four locations. Lead was detected above available screening levels.

Inorganic constituents exceeded screening levels in one location north of RISBON-59. In samples collected up to and including 5 feet bgs, ecological screening levels were exceeded at location RISBON-89, where lead was reported at a concentration of 13 mg/kg (0.5 ft bgs).. In samples collected up to and including 10 feet bgs, PRGs were not exceeded. In samples collected deeper than 10 feet bgs, metals were not detected at concentrations exceeding PRGs.

### 5.3.3.2 VOCs

Twelve soil samples were collected from 4 borings (Type 6) and analyzed for VOCs. Detectable concentrations of VOCs were present in 50 percent of the samples; however, concentrations did not exceed screening levels.

### 5.3.3.3 SVOCs

Twelve soil samples were collected from 4 borings (Type 6) and analyzed for SVOCs. Detectable concentrations of SVOCs were present in 8 percent of the samples; however, concentrations did not exceed screening levels.

### 5.3.3.4 PAHs

Twelve soil samples were collected from 4 borings (Type 6) and analyzed for PAHs. Detectable concentrations of PAHs were present in 100 percent of the samples. A total of 16 PAHs were detected in samples collected from the 4 Phase III locations. N-Nitrosomethylethylamine, N-Nitrosodiethylamine, N-Nitrosodi-n-butylamine, and N-Nitrosodimethylamine were detected above available screening levels.

Concentrations exceeded screening levels in all 4 locations in the RISBON-59 area. In samples collected up to and including 5 feet bgs, ecological screening levels were not exceeded. In samples collected up to and including 10 feet bgs, human health screening levels were exceeded at RISBON-87B and RISBON-89. Furthermore, in samples collected deeper than 10 feet bgs, PAHs were detected at concentrations exceeding industrial PRGs at locations RISBON-86B, -87B, -88B, and -89. In samples collected at depths ranging from 0 up to and including 5 feet bgs, no PAHs were detected above ecological screening levels.

In samples collected at depths ranging from 0 up to and including 10 feet bgs, N-Nitrosomethylethylamine, N-Nitrosodiethylamine, N-Nitrosodi-n-butylamine, and N-Nitrosodimethylamine were detected above human health screening levels. In this depth range, N-Nitrosomethylethylamine was detected in 20 percent of the samples at a concentration of 0.15 mg/kg and exceeded human health screening levels at RISBON-87B (6 ft bgs). N-Nitrosodiethylamine was detected in 20 percent of the samples at a concentration of 0.34 mg/kg and exceeded human health screening levels at RISBON-87B (6 ft bgs). N-Nitrosodi-n-butylamine was detected in 20 percent of the samples at a concentration of 0.37 mg/kg and exceeded human health screening levels at RISBON-87B (6 ft bgs). N-Nitrosodimethylamine was detected in 20 percent of the samples at a concentration of 0.14 mg/kg and exceeded human health screening levels at RISBON-89 (0.5 ft bgs).

In samples collected greater than 10 feet bgs, N-Nitrosomethylethylamine, N-Nitrosodiethylamine, and N-Nitrosodi-n-butylamine were detected above industrial PRGs. In this depth range, N-Nitrosomethylethylamine was detected in 57 percent of the samples at concentrations ranging from 0.11 to 0.14 mg/kg and exceeded industrial PRGs at RISBON-86B (15 and 30 ft bgs), RISBON-87B (35 ft bgs), and RISBON-89 (21 ft bgs). N-Nitrosodiethylamine was detected in 29 percent of the samples at concentrations of 0.57 and 0.96 mg/kg and exceeded industrial PRGs at RISBON-86B (15 ft bgs) and RISBON-87B (35 ft bgs). N-Nitrosodi-n-butylamine was detected in 29 percent of the samples at concentrations of 0.52 and 0.68 mg/kg and exceeded industrial PRGs at RISBON-86B (15 ft bgs) and RISBON-88B (42 ft bgs).

#### 5.3.3.5 Pesticides and Herbicides

Twelve soil samples were collected from 4 borings (Type 6 ) and analyzed for pesticides and herbicides. Detectable concentrations of pesticides and herbicides were present in 17 percent of the samples; however, concentrations did not exceed screening levels.

#### 5.3.3.6 PCB Congeners

Twelve soil samples were collected from 4 borings (Type 6) and analyzed for PCB congeners. Detectable concentrations of PCB Congeners were present in 8 percent of the samples; however, concentrations did not exceed screening levels.

### 5.3.4 Findings Relative to Adjoining Areas

Available data indicate that soil impacts detected in the RISBON-59 area affect portions of both the Remaining On-site Soils Area and the Former Ponds and Pads Area along the central southern margin of the Site, and that impacts in this area are apparently attributable to former waste ponds once present in this portion of the Site. There is no indication that impacts in this area affect other portions of the Site or surrounding area.

### 5.3.5 Conclusions Regarding Nature and Extent of Soil Impacts

Available data, including analytical laboratory results, MIP measurements and field observations, indicate that the highest concentrations and greatest variety of contaminants within in this area are present at depths of between approximately 27 to 36 feet bgs in RISBON-59, and diminish both laterally and vertically away from this location.

Screening level exceedances recorded for PAHs and/or pesticides and herbicides at surrounding boring locations are present at depths ranging between approximately 0.5 bgs (RISBON-89) and 51 feet bgs (RISBON-85), and apparently reflect lessening constituent concentrations lying peripheral to a local contaminant maxima encountered at RISBON-59. Because screening level exceedances detected at 42 feet bgs in location RISBON-88b and at 51 feet bgs in location RISBON-85 are reported for samples collected from the saturated zone, results from these samples may not be representative of true soil matrix concentrations in these locations.

Contamination detected in the RISBON-59 area is coincident with the southern margin of former waste management Pond 2 as well as with a preceding former waste impoundment visible on historical aerial photographs from 1974 and 1975. While prior pond closure activities conducted during the period 1989-1991 are reported to have removed contaminated materials from the majority this area, agency correspondence indicates that organic contaminants were left in place in the southeast corner of Pond 2, abutting and underlying the berm supporting NTU Road (see Section 2.8.1 and Table 2-17 of RI/FS Work Plan). Analytical results and observations of subsurface conditions in this area jointly indicate that maximum soil impacts generally coincide with the location of former waste impoundments in this area, and that impacts generally diminish laterally away from this area (Figures B-21d and B-21-e). Screening level exceedances encountered in locations RISBON-59, -83, and -89 lie within or directly adjacent to these former features, whereas locations RISBON-86b and -87b lie outside the estimated limits of these former features. While subsurface soil conditions and the nature of contamination present in these outlying locations are overall similar to those present in the area of principal soil impacts

surrounding RISBON-59, intervening soil borings indicate that screening level exceedances detected in these outlying locations may not be contiguous with those in proximity to RISBON-59. The historical drainage formerly traversing this area may possibly have influenced contaminant distribution in this area, as screening level exceedances are reported for deep samples collected from locations RISBON-89 and -88b which were completed along this former drainage.

#### **5.4 Data Adequacy and DQO Evaluation**

The soil data obtained during the Phase III investigation were evaluated with respect to the soil DQOs identified in the RI/FS Work Plan. RI/FS Work Plan Sections 4.1 through 4.6 identify specific decisions and decision rules for issues related to this task, including those related to contaminant nature, extent, fate and transport, and FS evaluations. Decisions specific to soil and sediment data are listed below.

##### **5.4.1 DQO Decisions Related to Soil Contaminant Nature, Extent, Fate, and Transport Evaluation**

The specific decisions and decision rules related to soil contaminant nature, extent, fate, and transport in the RISBON-59 area are as follows:

- *What is the extent of soil contamination in former waste disposal and treatment areas?*
- *What is the distribution of contaminants in the remaining on-site soils area over and between locations of former ponds and pads?*
- *If locations of shallow soil contamination are identified, deeper data will be collected if needed to plan remediation for a particular area or to assess potential groundwater quality impacts. For example, if relatively shallow contamination (5 feet and less) is indicated in the RCRA Canyon Area, deeper samples will be collected because the preliminary remedy for that area includes excavation of the affected soils;*
- *To assess potential off-site contaminant transport, the investigation will be focused on drainages (and other similar preferential pathways) because contaminants would be expected to concentrate there; and*
- *If adequate lithologic or aquifer hydraulic property data do not exist in a critical site Subarea, additional data collection will be recommended.*

As further described below, soil data collected during the Phase III RI are generally considered sufficient to characterize the nature, and in most cases the extent, of impacts to these media, and no further soil or sediment data are judged to be necessary. As described in Section 4.1 of this Appendix, the review of available inorganics data for background locations, as well as for off-site and on-site areas, indicate that there are more than sufficient numbers of samples (i.e., high power) and adequate spatial distribution of samples to perform the necessary additional statistical evaluations (e.g., calculate UCLs) that factor into the human health and ecological risk assessments to be conducted as part of the RI. Lithologic conditions within the RISBON-59 area have been adequately defined, and in conjunction with soil physical property data and the chemical data developed to date, provide the information needed to evaluate fate and transport of the contaminants present in this area.

#### 5.4.1.1 RISBON-59 Area

Available data, including analytical laboratory results, MIP measurements and field observations, indicate that the highest concentrations and greatest variety of contaminants within in this area are present at depths of between approximately 27 to 36 feet bgs in RISBON-59, and diminish both laterally and vertically away from this location. Screening level exceedances recorded for organic constituents at surrounding boring locations are present at depths ranging between approximately 0.5 bgs and 51 feet bgs and apparently reflect lessening contaminant concentrations lying peripheral to a local maxima encountered at RISBON-59. Contamination detected in the RISBON-59 area is coincident with the southern margin of former waste management Pond 2 as well as with a preceding former waste impoundment visible on historical aerial photographs from 1974 and 1975, and these impacts generally diminish laterally away from this area. Screening level exceedances for Phase III borings completed outside the estimated limits of these former waste management impoundments, while overall similar in nature, may not be contiguous with those in proximity to RISBON-59. Moreover, the historical drainage formerly traversing this area may possibly have influenced contaminant distribution in this area, as screening level exceedances are reported for deep samples collected from borings completed along this former drainage. Available data are considered sufficient to characterize surface and subsurface conditions in the RISBON-59 area, thus no further data are necessary.

#### 5.4.2 **DQO Decisions Related to FS Evaluations for Soils**

The specific decisions and decision rules related to feasibility study are as follows:

- *What is the chemical nature and physical extent of the contaminated area requiring remediation?*
- *What are the relevant physical properties of the subsurface vadose zone and/or saturated zone where contamination is present?*
- *The FS does not require any specific limits on chemical quality data evaluation decision errors, but rather relies on the chemical data evaluation decision limits that are appropriate for site characterization and risk assessment.*

#### 5.4.2.1 RISBON-59 Area

Sufficient data has been collected in to adequately define the nature and extent of soil impacts in the RISBON-59 area, and to allow for adequate evaluation of remedial measures for this area.

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