Nevada
Environmental
Restoration
Project

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Resource Conservation and
Recovery Act
Industrial Site Environmental
Restoration Site
Characterization Report

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Area 6 Steam Cleaning
Effluent Ponds

September 1996

MASTER

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

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**RESOURCE CONSERVATION AND RECOVERY ACT
INDUSTRIAL SITE ENVIRONMENTAL RESTORATION
SITE CHARACTERIZATION REPORT**

AREA 6 STEAM CLEANING EFFLUENT PONDS

DOE Nevada Operations Office
Las Vegas, Nevada

MASTER

September 1996

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List of Acronyms and Abbreviations

%R	Percent recovery
3-D	Three-dimensional
CFR	<i>Code of Federal Regulations</i>
COC	Constituent(s) of concern
CRDL	Contract-required detection limit(s)
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
ft	Foot (feet)
ICP	Inductively coupled plasma
IT	IT Corporation
LDR	Land Disposal Restriction
m	Meter(s)
m ³	Cubic meter(s)
mg/kg	Milligram(s) per kilogram
μg/kg	Microgram(s) per kilogram
mg/L	Milligram(s) per liter
MS/MSD	Matrix spike/matrix spike duplicate(s)
NA	Not applicable
ND	Not detected
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
PCB	Polychlorinated biphenyl(s)
PCE	Tetrachloroethene
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RAL	Regulatory action level
RCRA	Resource Conservation and Recovery Act
RL	Regulatory limit
RPD	Relative percent difference
SCEP	Steam Cleaning Effluent Pond(s)

List of Acronyms and Abbreviations (Continued)

SVOC	Semivolatile organic compound(s)
TC	Toxicity characteristic
TCA	1,1,1 Trichloroethane
TPH	Total petroleum hydrocarbon(s)
TPH-G	Total petroleum hydrocarbon in the gasoline range
TPH-D	Total petroleum hydrocarbon in the diesel range
TPH-O	Total petroleum hydrocarbon in the motor oil range
UDL	Undiluted detection limit
VOC	Volatile organic compound(s)
yd ³	Cubic yard(s)

1.0 Introduction

The Area 6 North and South Steam Cleaning Effluent Ponds (SCEPs) are historic disposal units located at the Nevada Test Site (NTS) in Nye County, Nevada (see Figures 1-1, 1-2, and 1-3). The NTS is operated by the U.S. Department of Energy, Nevada Operations Office (DOE/NV) which has been required by the Nevada Division of Environmental Protection (NDEP) to characterize the site under the requirements of the Resource Conservation and Recovery Act (RCRA) Part B Permit (NDEP, 1995) for the NTS and Title 40 *Code of Federal Regulations*, Part 265.

1.1 Project Objectives

The objectives of this project were twofold:

- Characterize surface and subsurface conditions at the site with respect to the on-site disposal units.
- Provide sufficient information to develop closure strategies for the ponds.

To this end, investigative excavation was conducted within and in the vicinity of the ponds to accomplish the following goals:

- Evaluate the condition of the surrounding sediment and determine if constituents of concern (COC) were present in the subsurface.
- Assess the potential for migration of potential COCs downward from the ponds through the surrounding sediment.
- Estimate the extent of contaminant migration (if present) from the ponds.

There were eight trench excavations and one pit excavation made within the ponds to intercept contamination below and around the base and sides of the ponds. Soil cutting and vapor samples were collected from the excavations at specified intervals during characterization activities for chemical analyses. Detailed field observations of subsurface conditions, including lithologic description of excavation cuttings, were also made during the characterization activities.

Figure 1-1
Location of the Nevada Test Site

SCALE

Reference:
 Ratheon Services Nevada, Survey Department
 Drawing title "SCEPS", dated 28 November 1995
 Survey: SPW, KDB, RCC
 Origin : 6243395.000 N 555700.000 E
 Scale : 1:300
 Contour Interval: 0.5 Meters

1 ALCAP 94

N. 6243396.570
 E. 555789.080
 EL. 1195.478

2 AL CAP 95

N. 6243315.547
 E. 555830.948
 EL. 1195.517

LEGEND

FENCE

CENTERLIN

EDGE OF R

NORTH SCE

SOUTH SCE

6-05 ROAD

Figure 1-3
Location of the North and South
Steam Cleaning Effluent Ponds

The Site Characterization Plan (DOE, 1996a) included analysis of groundwater (see Table 4-1 of DOE, 1996a), if it was encountered within the investigation depth. It also included a potential second investigation phase consisting of subsurface drilling and analysis of soil samples for physical parameters used for hydrologic modeling as well as chemical analysis (see Sections 4.3, 4.4.2, and Table 4-1 of DOE, 1996a). Since groundwater was not encountered during the characterization, no groundwater samples were collected for analysis. Implementation of the second characterization phase was based on the identified depth of contamination at the site. If the contamination had exceeded the maximum depth of the excavation equipment used during the first characterization phase, then the second phase would have been implemented. Since this was not the case, subsurface drilling was not conducted, and soil samples were not analyzed for physical parameters. Samples for physical parameter analysis could also have been collected if the extent of the contamination had been determined to be significantly larger than anticipated, thus promoting the use of *in situ* remediation techniques rather than excavation and disposal of the contaminated soil for closure. However, since the amount of contamination did not exceed the anticipated volume, it was not necessary to collect the physical parameter samples for this purpose either.

1.2 Report Content

To make this site characterization report more concise, the complete field documentation and laboratory data such as Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain-of-Custody Forms, soil sample descriptions, laboratory certificates of analyses, headspace screening results, and surveillance results are not included. These documents are retained in project files and will be supplied upon request. Appendix A of this report, which contains the discussion about the results of previous investigations, has been reproduced from the *Resource Conservation and Recovery Act Industrial Site Environmental Restoration Site Characterization Plan for the Area 6 Steam Cleaning Effluent Ponds* (DOE, 1996a). Additional descriptions of the site history, waste, inventories, and spill information are discussed in detail in the Site Characterization Plan (DOE, 1996a) and are not repeated in this report.

2.0 Field Investigation and Sampling Activities

The primary objective of excavation activities and sampling at the SCEPs was to determine the presence, concentration, lateral extent, and vertical extent of any contaminant plumes present based on the conceptual model study areas presented in the Site Characterization Plan (DOE, 1996a). With the completion of the characterization activities, the study areas are now considered contaminant zones, and their definitions are further refined as follows:

- North SCEPT
 - Zone 1 is the contaminated sediment and/or soil in the pond bottom which includes total petroleum hydrocarbons (TPHs) above NDEP action levels, but no RCRA-regulated contamination.
 - Zone 2 is uncontaminated soil (or soil contaminated above detection limits, but below the applicable action level) below and around the pond.
- South SCEPT COCs for each study area are as follows:
 - Zone 1 is contaminated sludge, sediment, or soil in the pond bottom which includes mostly TPH contamination above the NDEP action levels and minor amounts of RCRA-regulated volatile organic compounds (VOCs) above detection limits, but below Land Disposal Restriction (LDR) levels.
 - Zone 2 is contaminated sludge on the surface of the pond berms which includes mostly TPH above NDEP action levels with low concentrations (i.e., above detection limits) of RCRA-regulated VOCs, but below LDR levels.
 - Zone 3 is contaminated soil below and around the pond surface that is TPH-impacted above NDEP action levels and has no RCRA-regulated constituents.
 - Zone 4 is uncontaminated soil (or soil contaminated above detection limits, but below the applicable action level) that may be found below and around the pond.

A secondary objective was to remove the primary contaminant source material (i.e., Zone 1) from the South SCEPT. Field investigation activities conducted for the site characterization at both SCEPs involved sampling sludge contained in the bottom of the South SCEPT and excavating eight sampling trenches (four in each pond). Samples were obtained at measured intervals from the trenches for chemical analysis. The deepest excavation was 6.1 meters (m) (20 feet [ft]) within the South SCEPT.

Field activities were performed in accordance with an approved site-specific health and safety plan. Samples were collected and documented by following established sampling, field activity documentation, sample collection documentation, decontamination, chain of custody, shipping, and radiation screening protocols, procedures, and field sampling instructions as indicated in the Site Characterization Plan (DOE, 1996a). Quality control (QC) samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and sample duplicates) were collected as required by the *RCRA Industrial Sites Quality Assurance Project Plan (QAPP)* (DOE, 1996b) and approved contractor procedures (IT Corporation [IT], 1994a). All field and sample documentation is maintained in project files. During the field activities, waste minimization practices were followed, including segregation of the waste from each investigative trench, segregation of suspected contaminated soil from suspected uncontaminated soil, separation of personal protective equipment into bags (based upon daily use), and collection and segregation of the rinsate waters from decontamination operations.

2.1 Soil Sampling Logistics

Prior to excavation, horizontal trench sample locations were selected and staked on the ground surface in a pattern designed for evaluation of areas where lateral migration of COCs might have occurred, particularly in the vicinity of the ponds and below the base of the ponds. The zone below the base of the ponds was evaluated to establish how far COCs have migrated downward from the ponds. Trenches and pits were excavated using a track hoe with an approximate 0.9-m (3-ft) wide bucket and an approximate 7.6-m (25-ft) reach. Samples were obtained from the hoe bucket by either driving brass sampling tubes by hand into the soil or using disposable scoops to collect the soil and place it into the sampling tubes. Prior to sampling from the bucket, the personnel breathing zone was screened using a photoionization detector to evaluate the ambient air conditions with respect to the requirements of the site-specific health and safety plan. The track hoe was shut off while all sample collection activities were conducted. Samples were consistently obtained from the most visually impacted material in the backhoe bucket to ensure a worst-case analysis for each sampling interval.

While the soil was being excavated, the sample collection team set out the required sample containers for the sampling interval and noted the condition of the soil being excavated. The sample containers were annotated for their respective analyses and placed in a cooler. When the desired interval was excavated, the time was noted by the lead sampler, and the sampling team proceeded to the staged backhoe bucket to retrieve the sample.

Collection of samples from the backhoe bucket began with samples for VOC and TPH in the gasoline range (TPH-G). For a full sample suite, samples were collected in the following order:

- Total VOCs
- Toxicity characteristic (TC) VOCs
- Total petroleum hydrocarbons (on-site and off-site analysis)
- TC metals, TC semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs)

Each of the samples were placed on ice immediately following containerization. As samples were collected, special care was taken to optimize the sample for its specific type of analysis. The VOC samples were collected with as little disturbance of the soil as possible to minimize granulation (volatilization), and pebbles within the soil were removed when possible. Sample containers were filled to eliminate or minimize headspace, and the rim was cleaned using the sampling tool or a gloved hand to ensure a good seal when closing the container. Teflon liners were placed under all sampling tube plastic end caps. As samples were collected, notes about weather conditions, soil description, and sample quantities were recorded on Sample Collection Logs.

At each sampling interval, a sample for on-site analysis and an archive sample for off-site analysis were collected. After containerizing each sample, the lead sampler and a sampling assistant placed sample labels with the sample number, date, and time on each of the containers destined for the on-site laboratory. Each of these containers was then put into a ziplock bag and placed in a cooler. A Chain of Custody for the on-site samples was maintained and updated for each sample. The samples destined for possible off-site analysis were labeled and placed in individual sealed plastic bags; collected in a single larger self-sealing bag marked with the sample number, date, and time; and placed into an iced cooler with a trip blank (if applicable) for coolers containing samples for VOC analysis. After a series of samples were collected from a trench or pit, splits of the sample sets were submitted to the on-site lab. The remaining sample splits were left on ice and maintained in the custody of the sample team. Based on the results of the on-site laboratory analysis, samples were then selected for shipment to the off-site lab (e.g., impacted and unimpacted samples were selected, as appropriate, to represent the sampling intervals of interest). Excavation continued in each trench to a minimum of 1.5 m (5 ft) below the ground surface in areas in which no contamination was encountered or until a confirmatory, unimpacted sample was obtained in areas where contamination was encountered.

When the on-site laboratory received the samples, they were analyzed for TPH by the U.S. Environmental Protection Agency (EPA) Method 8015 Modified (EPA, 1986) to determine if the various sample points were unimpacted. The normal turnaround time for the on-site results was approximately 45 minutes to one hour. If COCs were detected, excavation continued in the sampling trench to the next vertical sampling interval until all of the "horizontal" locations at a specific, vertical interval showed no signs of impact, either visually or analytically, from the on-site laboratory. All excavation samples were analyzed by the on-site laboratory. Section 3.0 of this report discusses the results of the sample analysis.

2.2 North SCEP Subsurface Characterization Sample Event Logistics

Access to the interior of the North SCEP was gained on the east side of the pond where an old slump from the side of the pond helped to create an access way for the track hoe. Once within the pond, four sampling trenches were excavated (see Figure 2-1) radiating from the center of the pond, parallel to the long and short axes of the rectangular pond with an offset in the trench in the area of the pond inlet pipe. Sample sets were collected at approximate 1.5-m (5-ft) horizontal and vertical intervals in the sampling trenches using the track hoe bucket. Excavation in the North SCEP was halted at approximately 0.75 to 1.5 m (2.5 to 5 ft) outside of the inner edge of the pond berm and at a total depth of 1.5 m (5 ft) when no indications of contamination were observed during the sampling and no hydrocarbon contamination was reported by the on-site laboratory. Several samples from each trench were selected for off-site analysis. The North SCEP sample locations are indicated on Figure 2-1.

2.3 South SCEP Subsurface Characterization Sample Event Logistics

Sample event logistics at the South SCEP consisted of three separate events: construction and sampling of an access ramp into the interior of the pond, removal of the Zone 1 and part of the Zone 2 sludge from the pond interior, and excavation and sampling of trenches within the pond.

2.3.1 South SCEP Access Ramp Construction

Because of the width, height, and slope of the South SCEP berm, it was necessary to excavate an access trench through the berm to gain entrance to the pond interior. The access ramp was cut using front-end loaders, and the removed soil was systematically staged outside of the pond so that it could be replaced in the opposite order to which it was removed upon completion of the characterization activities in order to reduce the mixture of contaminated and uncontaminated soil. The base of the ramp was approximately 25 feet wide, and the sides were excavated at an approximate 1:1.5 slope. Figure 2-2 topographically depicts the South SCEP access ramp.

Figure 2-1
North SCEP Trench and Sample Locations

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2.3.2 South SCEP Zone 1 and 2 Sludge Removal

Once entrance to the interior of the South SCEP was gained, the track hoe excavator was used to remove the material designated in the conceptual model (see DOE, 1996a) as Zone 1. This material was visually impacted sludge and soil with high total petroleum hydrocarbon content (as determined by the on-site laboratory) and suspected RCRA-regulated contaminant content. The material encompassed most of the base of the pond (i.e., approximately 8 m [26 ft] in diameter) and was approximately 1.5 m (5 ft) thick. Much of the Zone 1 material consisted of sludge and soil that appeared dark gray to black in color, often with the consistency of old grease. As the material was excavated, samples were obtained (see Section 2.1 for additional information on sampling) from the track hoe bucket to determine the lateral and vertical extent of the zone. The excavated soil was placed directly into roll-off bins. A total of approximately 98 cubic meters (m^3) (128 cubic yards [yd^3]) of sludge and highly impacted soil was removed from Zone 1. The removal of this material was planned to help prevent the spread of contamination on the site and to reduce the potential for continued contaminant migration in case precipitation occurs at the site. The excavated material was sampled on a basis of approximately one sample per 3.8 m^3 (5 yd^3) of material excavated which corresponded to at least two samples per roll-off bin with a total of eleven bins filled.

After completing the removal of the Zone 1 material, the portions of Zone 2 that were going to be intercepted by sampling trenches were also excavated, and the material was placed in a roll-off bin. The Zone 2 material was excavated from the ground surface to approximately 0.5 m (2 ft) depth where the soil was harder and showed little or no visual indications of contamination. A total of approximately 7.7 m^3 (10 yd^3) of Zone 2 material was removed. The excavated Zone 2 material was also sampled on a basis of approximately one sample per 3.8 m^3 (5 yd^3) of excavated material.

2.3.3 Trench Sampling

After the removal of the Zone 1 material and the partial removal of the Zone 2 material, four sampling trenches radiating from the approximate center of the pond (see Figure 2-2) were excavated. The trenches were oriented along the long and short axes of the oblong, irregularly shaped pond in approximate northwest-southeast and northeast-southwest directions. These directions corresponded to the current configuration of the pond as well as the past configuration of the pond in which the long and short axes were in opposite directions from their current configuration. Trenches A, B, and C extended approximately 12.2 to 13.7 m (40 to 45 ft) from the center of the pond while Trench D, located along the axis of the entrance ramp, extended approximately 19.8 m (65 ft) from the pond center. Sample sets were collected from the trenches

in the same fashion as those collected for the North SCEP (i.e., 1.5 m [5 ft] vertical and horizontal intervals). See Section 2.1 for additional information. The cut from the access ramp was also sampled in 1.5-m (5-ft) vertical intervals and 1.5- and 3.0-m (5- and 10-ft) horizontal intervals along the north face of the cut. The samples and visual observations from the access cut and Trench 4 provided the best profile of the berm material because of the ease in viewing and sampling the soil. Figure 2-3 shows the approximate sample locations for the South SCEP. (Note that the sample numbers on the figure have been shortened to their last two or three digits [e.g., SCP00107 is indicated as 107 on the map].)

2.4 Geologic Analysis

As samples were collected, soil characteristics such as sand and gravel content, relative amounts of pebbles and cobbles, the absence or presence of clays, and any unusual variations were noted. This information was recorded in field notes for the project. In addition to a visual description, information about the difficulty of excavation was noted.

The geologic conditions in the shallow subsurface (i.e., approximately 6.1 m [20 ft] or less below the ground surface) have been evaluated through analysis of samples gathered during the excavation of the access ramp into the South SCEP, the excavation of the material at the base of the South SCEP, and the excavation of sampling trenches in the North and South SCEPs. The subsurface appeared to consist of a mixture of unconsolidated sands and gravels, typical for this area, which made up the South SCEP berm and were underlain by more consolidated sand-gravel and sand-silt-clay mixtures. In general, the natural stratigraphy of the SCEPs site to 6.1 m (20 ft) can be characterized as a variable mixture of sands, gravels, clays, silts, and evaporites. In the vicinity of the ponds (particularly the North SCEP), the sediments tended to be fairly well-cemented from the surface to a depth of approximately 1.5 m (5 ft) where the calcarious cementation lessened. The lithology throughout the section maintained a high sand and gravel content with variable percentages of clay, silt, and evaporites. Distinct, mappable horizons were not evident in the stratigraphy.

2.5 Technical Changes

In the SCEPs Site Characterization Plan (DOE, 1996a), the entrance ramp into the South SCEP was planned for the southwest side of the pond with an alternate location on the northwest side. Upon further evaluation by Bechtel Nevada civil engineers, it was determined that the northwest entrance would be easier to construct and would provide better access. Based on this evidence, the southwest ramp location was abandoned. The overall construction configuration of the ramp remained the same.

Figure 2-3
South SCEP Trench and Access Cut
Sample Locations

3.0 Sampling Analytical Results

The results of the analysis of samples obtained from within and around the SCEPs have been compiled and analyzed to determine the presence and/or extent of contamination in the soil surrounding the ponds. The analytical results are summarized in the following sections. The complete laboratory result data packages are available in project files. Section 4.0 of this report presents a discussion and summary of quality control samples. In addition, a review of the results of previous sampling and investigation activities is included in Appendix A of this report (as reproduced from the SCEPs Site Characterization Plan [DOE, 1996a]).

During the excavation activities, a total of 132 soil samples were collected for analysis (41 from North SCEP and 91 from South SCEP). A list of the characterization sample numbers (including field duplicate samples) and locations is presented in Table 3-1. Gaps in the numeric sample sequence represent rinsate, field, and trip blank (quality control) samples that are not included on this table, but are discussed in Section 4.2. Samples SCP00061 through SCP00100 do not include sample depths because these samples were obtained from Zones 1 and 2 on a volume basis, rather than a measured interval basis as presented in the Site Characterization Plan. The complete laboratory result data packages are maintained in project files.

The sample analytical parameters and laboratory analytical methods for the subsurface soil characterization are presented in Table 3-2. The sample analytical parameters were selected through the application of site process knowledge and preliminary sampling according to the EPA's Data Quality Objectives (DQOs) process (EPA, 1994). The results of the DQO process are documented, in part, in the Site Characterization Plan with the remainder of the documentation retained in project files. Samples were analyzed on site by Calscience Environmental Laboratories, Incorporated, and off site at Quanterra in Earth City, Missouri. The parameters selected for analysis were based on the anticipated COCs associated with the activities known to have been conducted at the site, the results of previous sampling at the site, and a wide range of other contaminant types potentially encountered on the NTS.

3.1 North Steam Cleaning Effluent Pond Results

None of the samples obtained from approximately 1.5 m (5 ft) below the surface of the North SCEP showed any visual indications of contamination, and all of the analysis results from both the on-site and off-site laboratories were below the contract-required detection limits (CRDLs; see the Industrial Sites Quality Assurance Project Plan [DOE, 1996b]). Based on the results of

Table 3-1
Subsurface Soil Samples for On-Site and Off-Site Analysis

Sample #	Onsite	Offsite	m	Depth	ft	Location
SCP00011	X		1.5	5.0		NSCEP 45West
SCP00012	X		1.5	5.0		NSCEP 40West
SCP00014	X	X	1.5	5.0		NSCEP 35West
SCP00015	X	X	1.5	5.0		NSCEP 30West
SCP00016*	X	X	1.5	5.0		NSCEP 30West
SCP00017	X	X	1.5	5.0		NSCEP 25West
SCP00018	X	X	1.5	5.0		NSCEP 20West
SCP00019	X	X	1.5	5.0		NSCEP 15West
SCP00020	X	X	1.5	5.0		NSCEP 10West
SCP00021	X	X	1.5	5.0		NSCEP 5 West
SCP00022	X	X	1.5	5.0		NSCEP Center
SCP00023	X	X	1.5	5.0		NSCEP 35 South
SCP00025	X		1.5	5.0		NSCEP 30 South
SCP00026	X		1.5	5.0		NSCEP 25 South
SCP00027	X		1.5	5.0		NSCEP 20 South
SCP00028	X	X	1.5	5.0		NSCEP 15 South
SCP00029	X		1.5	5.0		NSCEP 10 South
SCP00030	X	X	1.5	5.0		NSCEP 5 South
SCP00031	X	X	1.5	5.0		NSCEP 40 East
SCP00032	X		1.5	5.0		NSCEP 35 East
SCP00033	X		1.5	5.0		NSCEP 30 East
SCP00035	X	X	1.5	5.0		NSCEP 25 East
SCP00036	X		1.5	5.0		NSCEP 20 East
SCP00037*	X		1.5	5.0		NSCEP 15 East
SCP00040	X		1.5	5.0		NSCEP Soil Pile E
SCP00041	X	X	1.5	5.0		NSCEP 10 East
SCP00042	X		1.5	5.0		NSCEP 5 East
SCP00043	X	X	1.5	5.0		NSCEP 35 North
SCP00044	X		1.5	5.0		NSCEP 30 North
SCP00045	X		1.5	5.0		NSCEP 25 North
SCP00046	X	X	1.5	5.0		NSCEP 20 North
SCP00047	X		1.5	5.0		NSCEP 15 North
SCP00048*	X		1.5	5.0		NSCEP 15 North
SCP00049	X		1.5	5.0		NSCEP 10 North
SCP00050	X	X	1.5	5.0		NSCEP 5 North
SCP00051	X		1.5	5.0		NSCEP Soil Pile N
SCP00052	X			surface		NSCEP Excavator Tracks
SCP00053	X			surface		NSCEP Excavator Tracks
SCP00058	X		1.5	5.0		NSCEP Yard
SCP00059	X		1.5	5.0		NSCEP Yard
SCP00060	X		1.5	5.0		NSCEP Yard
SCP00061	X					SSCEP Zone 1
SCP00065	X	X				SSCEP Zone 1
SCP00068	X	X				SSCEP Zone 1
SCP00069	X	X				SSCEP Zone 1
SCP00070	X	X				SSCEP Zone 1
SCP00071	X	X				SSCEP Zone 1
SCP00073	X	X				SSCEP Zone 1
SCP00074	X	X				SSCEP Zone 1
SCP00075	X	X				SSCEP Zone 1
SCP00076	X	X				SSCEP Zone 1
SCP00077	X	X				SSCEP Zone 1
SCP00078	X	X				SSCEP Zone 1
SCP00079	X	X				SSCEP Zone 1
SCP00080	X	X				SSCEP Zone 1
SCP00081	X					SSCEP Zone 1
SCP00082	X					SSCEP Zone 1
SCP00083	X					SSCEP Zone 1
SCP00087	X	X				SSCEP Zone 1
SCP00088	X	X				SSCEP Zone 1
SCP00089	X					SSCEP Zone 1
SCP00090	X	X				SSCEP Zone 1
SCP00092	X	X				SSCEP Zone 1
SCP00093	X	X				SSCEP Zone 1

Sample #	Onsite	Offsite	m	Depth	ft	Location
SCP00094	X	X				SSCEP Zone 1
SCP00095	X	X				SSCEP Zone 1
SCP00096	X	X				SSCEP Zone 1
SCP00099	X	X				SSCEP Zone 2
SCP00100	X	X				SSCEP Zone 2
SCP00103	X	X	1.5	5.0		SSCEP 40 East
SCP00104*	X	X	1.5	5.0		SSCEP 40 East
SCP00105	X		1.5	5.0		SSCEP 35 East
SCP00106	X		1.5	5.0		SSCEP 30 East
SCP00107	X	X	1.5	5.0		SSCEP 25 East
SCP00108	X		1.5	5.0		SSCEP 20 East
SCP00109	X		1.5	5.0		SSCEP 15 East
SCP00110	X		1.5	5.0		SSCEP 10 East
SCP00114	X		3.1	10.0		SSCEP 20 East
SCP00115	X		3.1	10.0		SSCEP 15 East
SCP00116	X	X	3.1	10.0		SSCEP 10 North
SCP00117	X		1.5	5.0		SSCEP 45 North
SCP00118	X		1.5	5.0		SSCEP 40 North
SCP00119	X	X	1.5	5.0		SSCEP 35 North
SCP00120	X		1.5	5.0		SSCEP 30 North
SCP00121	X		1.5	5.0		SSCEP 25 North
SCP00122	X	X	1.5	5.0		SSCEP 20 North
SCP00123	X		1.5	5.0		SSCEP 15 North
SCP00125	X		1.5	5.0		SSCEP 35 South
SCP00126	X		1.5	5.0		SSCEP 30 South
SCP00127	X	X	1.5	5.0		SSCEP 25 South
SCP00128	X		1.5	5.0		SSCEP 25 South
SCP00129	X		1.5	5.0		SSCEP 20 South
SCP00130	X	X	1.5	5.0		SSCEP 15 South
SCP00131	X		3.1	10.0		SSCEP 10 South
SCP00132	X	X	3.1	10.0		SSCEP 5 South
SCP00133	X	X	1.5	5.0		SSCEP 5 East
SCP00134	X	X	1.5	5.0		SSCEP Center
SCP00135	X		1.5	5.0		SSCEP 5 North
SCP00136	X		1.5	5.0		SSCEP 10 North
SCP00141	X		3.1	10.0		SSCEP 5 North
SCP00142	X	X	1.5(trench)	5.0		SSCEP 5 West
SCP00143	X		1.5(trench)	5.0		SSCEP 10 West
SCP00144	X	X	1.5(trench)	5.0		SSCEP 15 West
SCP00145	X		1.5(trench)	5.0		SSCEP 20 West
SCP00146	X	X	1.5(trench)	5.0		SSCEP 25 West
SCP00147	X		1.5(trench)	5.0		SSCEP 30 West
SCP00148	X	X	1.5(trench)	5.0		SSCEP 35 West
SCP00149*	X	X	1.5(trench)	5.0		SSCEP 35 West
SCP00150	X		1.5(trench)	5.0		SSCEP 40 West
SCP00151	X		1.5(trench)	5.0		SSCEP 45 West
SCP00152	X		1.5(trench)	5.0		SSCEP 50 West
SCP00153	X		1.5(trench)	5.0		SSCEP 55 West
SCP00154	X	X	1.5(trench)	5.0		SSCEP 60 West
SCP00155	X		1.5(trench)	5.0		SSCEP 65 West
SCP00156	X	X			Access Ramp	SSCEP 15 B
SCP00157	X	X			Access Ramp	SSCEP 20 B
SCP00158	X	X			Access Ramp	SSCEP 25 B
SCP00159	X	X			Access Ramp	SSCEP 30 B
SCP00160	X	X			Access Ramp	SSCEP 35 B
SCP00161	X	X			Access Ramp	SSCEP 45 B
SCP00162	X	X			Access Ramp	SSCEP 55 B
SCP00163	X	X			Access Ramp	SSCEP 15 L
SCP00164	X	X			Access Ramp	SSCEP 25 L
SCP00165	X	X			Access Ramp	SSCEP 35 L
SCP00166	X	X			Access Ramp	SSCEP 45 L
SCP00167	X	X			Access Ramp	SSCEP 55 L
SCP00171	X	X	4.6	15		SSCEP 5 North
SCP00172	X		6.1	20		SSCEP 5 North

*Field duplicate samples

m = meters

ft = feet

Table 3-2
Chemical Analytical Methods Used for SCEPs Characterization Samples

Analytical Parameter	Analytical Method
Total Volatile Organic Compounds	EPA ^a 8240
TC ^b Volatile Organic Compounds	EPA 1311/8240
TC Semivolatile Organic Compounds*	EPA 1311/8270
TC Metals: ICP ^c (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver)	EPA 1311/6010
TC Metals: Mercury	EPA 1311/7470
Total Petroleum Hydrocarbons - Gasoline, Diesel, and Motor Oil**	EPA 8015 (modified)
Polychlorinated Biphenyls*	EPA 8080
Gross Alpha/Beta (decontamination rinsate only)	SM 7110 ^d
Gamma Scan (decontamination rinsate only)	HASL 300, 4.5.2.3 ^e

*South SCEP waste characterization analysis only

**On-site and off-site laboratory analyses and methods

^aU.S. Environmental Protection Agency SW-846 (EPA, 1986)

^bToxicity characteristic

^cInductively coupled plasma

^dStandard Methods for the Examination of Water and Waste Water (APHA, 1992)

^eEnvironmental Methods Laboratory Procedure Manual, HASL-300 (DOE, 1992)

preliminary sampling at the site (see Appendix A), it is apparent that the contamination present at the North SCEP is limited to a thin layer of hydrocarbon contamination with an estimated volume of approximately 5.0 m³ (6.5 yd³) on the bottom surface of the pond near the inlet pipe (see Appendix A and Section 5.0 of this report and the Site Characterization Plan for additional information). This supports the conceptual model proposed in the Site Characterization Plan (DOE, 1996a) for the North SCEP, which suggested that only a small amount of hydrocarbon contamination exists near the surface of the soil at the base of the pond.

3.2 South Steam Cleaning Effluent Pond Results

Contamination at the South SCEP was more extensive than what was identified at the North SCEP, but it was still relatively limited in lateral and vertical extent. The total, original contaminant volume is estimated to have been approximately 900 m³ (1,177 yds³) of which approximately 106 m³ (138 yds³) was removed from the site during the characterization activities (see Section 5.0 for additional information about the contaminant configuration). The following sections discuss the results of analyses of COCs which were detected in samples obtained from the South SCEP.

3.2.1 Volatile Organic Compounds

The results of South SCEP soil samples that were analyzed for VOCs and TC VOCs by the off-site laboratory are presented in Table 3-3. The results of the analyses indicated the presence of total VOCs, but not TC VOCs above the CRDLs in some of the samples from Zones 1 and 2 in the South SCEP. None of the VOCs detected were reported above NDEP action levels (NDEP, 1992). No VOCs were detected in the North SCEP or in the South SCEP Zone 3 soil.

3.2.2 Total Petroleum Hydrocarbons

A total of 87 south SCEP soil samples were analyzed by the on-site laboratory in addition to 57 samples that were analyzed by the off-site laboratory for TPH. TPH was identified at levels above the detection limits in 37 samples, and it was identified in three ranges by both laboratories: gasoline (TPH-G), diesel (TPH-D), and oil (TPH-O), with the highest concentrations occurring in the TPH-O range. The results from samples in which TPH was detected are presented in Table 3-4. The results ranged from nondetected (i.e., below the CRDLs) to 954 milligrams per kilogram (mg/kg) on site and 560 mg/kg off site for TPH-G, nondetected to 14,300 mg/kg on site and 2,900 mg/kg off site for TPH-D, and nondetected to 92,500 mg/kg on site and 23,000 mg/kg off site for TPH-O. The combined TPH-G, TPH-D, and TPH-O results are used as a measurement of the total TPH content of the samples, and they ranged from nondetected to 124,042 mg/kg on site and 25,400 off site.

The differences in results from the on-site and off-site laboratories are related to the inherent heterogeneity of the contaminated soil, the differences in the instruction and objectives of the two laboratories, the inherent differences in the application of laboratory methods between fixed-base and mobile laboratories, and the resulting detection limits used for analysis of the samples. The detection limits for undiluted samples analyzed by the on-site laboratory were reported at 5.0 mg/kg for TPH-G and 50 mg/kg for TPH-D and TPH-O, while the detection limits for undiluted samples analyzed by the off-site laboratory were 0.5 mg/kg for TPH-G and 25 mg/kg for TPH-D and TPH-O. Also of note, is the use of the laboratories and the instruction given them with respect to the analysis of each sample. The on-site laboratory was under the direction of the field crew and was instructed to analyze the most highly impacted material in each sample container submitted. In contrast, samples were submitted to the off-site laboratory in the standard fashion (i.e., without specific direction to analyze the most highly impacted materials), which then returned results more indicative of an average of the contamination within given containers. This difference in direction will usually result in the on-site laboratory obtaining higher contaminant results than the off-site laboratory; it is the desired outcome since the results of on-site analysis are used to indicate when the depth or lateral extent of contamination has been

Table 3-3
Detected Total Volatile Organic Compound Off-Site Laboratory Analysis Results
for the South SCEP Subsurface Soil Samples

Sample Number	Constituents of Concern in micrograms/kilogram (µg/kg)							
	Chlorobenzene	Ethylbenzene	Methylene Chloride	PCE ^a	1,1,2,2-Tetrachloroethane	Toluene	TCA ^b	Xylene
RAL ^c	2.2E+05	2.3E+05	1.8E+04	1.7E+04	1.1E+03	8.8E+05	3.0E+06	3.2E+05
SCP00069	ND ^d	88	ND	26	ND	28	ND	ND
SCP00070	ND	47	ND	ND	ND	ND	ND	ND
SCP00074	ND	ND	7	ND	ND	ND	ND	ND
SCP00079	ND	ND	8	ND	ND	ND	ND	ND
SCP00087	34	39	ND	33	ND	33	ND	370
SCP00090	ND	1600	ND	ND	ND	ND	ND	ND
SCP00094	ND	ND	ND	8	11	ND	6	ND
SCP00099	ND	ND	ND	ND	ND	ND	6	ND
SCP00100	ND	ND	ND	34	ND	ND	ND	ND

^a Tetrachloroethene

^b 1,1,1 Trichloroethane

^c Regulatory action level based on Preliminary Remediation Goals for industrial sites (NDEP, 1992 and EPA, 1996)

^d Not detected

Table 3-4
Detected Total Petroleum Hydrocarbon Laboratory Analysis Results
for South SCEP Soil Samples
(Page 1 of 2)

Sample Number	Constituents of Concern in milligrams/kilogram (mg/kg)							
	On-Site Laboratory				Off-Site Laboratory			
	TPH-G ^a	TPH-D ^b	TPH-O ^c	Total	TPH-G	TPH-D	TPH-O	Total
UDL ^d	5.0	50	50		0.5	25	25	
RL ^e				100				100
SCP00068*	ND ^f	1,260	3,040	4,300	ND	90	NA ^g	90
SCP00069*	954	2,180	5,260	8,394	6.5	300	NA	306.5
SCP00070*	660	578	1,390	2,628	0.63	4,000	NA	4,001
SCP00071*	ND	2,050	4,950	7,000	ND	290	NA	290
SCP00073*	ND	2,920	5,040	7,960	ND	ND	3,400	3,400
SCP00074*	ND	748	1,290	2,038	ND	ND	1,000	1,000
SCP00075*	ND	94.6	163	258	ND	ND	160	160
SCP00076*	10	2,680	4,620	7,310	ND	ND	1,300	1,300
SCP00077*	ND	1,270	2,180	3,450	0.81	ND	1,400	1,401
SCP00078*	8.1	474	818	1,300	ND	ND	500	500
SCP00079*	ND	7,220	12,400	19,620	ND	ND	4,700	4,700
SCP00083*	ND	459	791	1,250	NA	NA	NA	NA
SCP00087*	80.8	3,990	11,730	15,801	6.3	770	7,400	8,176
SCP00088*	42	31,500	92,500	124,042	6.4	ND	3,000	3,006
SCP00089*	8.9	672	1,970	2,651	NA	NA	NA	NA
SCP00090*	132	477	1,400	2,009	410	330	1,200	1,940
SCP00092*	43.8	1,750	5,150	6,944	ND	200	800	1,000
SCP00093*	ND	ND	ND	ND	ND	ND	55	55
SCP00094*	ND	1,090	3,210	4,300	5.8	610	2,900	3,516
SCP00099**	720	14,300	35,900	50,920	2.0	ND	23,000	23,002
SCP00100**	6.6	12,500	31,300	43,807	560	2,900	20,000	23,460
SCP00108	ND	57	143	200	NA	NA	NA	NA
SCP00109	ND	ND	102	102	NA	NA	NA	NA
SCP00110	ND	384	965	1,349	NA	NA	NA	NA

Table 3-4
Detected Total Petroleum Hydrocarbon Laboratory Analysis Results
for South SCEP Soil Samples
(Page 2 of 2)

Sample Number	Constituents of Concern in milligrams/kilogram (mg/kg)							
	On-Site Laboratory				Off-Site Laboratory			
	TPH-G ^a	TPH-D ^b	TPH-O ^c	Total	TPH-G	TPH-D	TPH-O	Total
UDL ^d	5.0	50	50		0.5	25	25	
RL ^e	100				100			
SCP00119	ND	ND	ND	ND	ND	ND	120	120
SCP00127	ND	ND	ND	ND	ND	ND	110	110
SCP00130	ND	ND	ND	ND	ND	ND	55	55
SCP00132	ND	ND	ND	ND	ND	ND	31	31
SCP00135	ND	1,240	2,930	4,170	NA	NA	NA	NA
SCP00141	ND	414	1,120	1,534	NA	NA	NA	NA
SCP00156	ND	956	2,580	3,536	ND	ND	1,200	1,200
SCP00157	ND	67	181	248	ND	ND	98	98
SCP00158	ND	949	2,560	3,509	ND	ND	480	480
SCP00159	ND	766	2,070	2,836	ND	ND	540	540
SCP00160	ND	425	1,150	1,575	ND	ND	560	560
SCP00163	ND	917	2,480	3,397	ND	ND	2,400	2,400
SCP00165	ND	51.9	140	192	ND	ND	ND	ND

Bold indicates results above the regulatory action level.

*Zone 1 samples

**Zone 2 samples

No asterisk = Zone 3

^aTotal petroleum hydrocarbon in the gasoline range

^bTotal petroleum hydrocarbon in the diesel range

^cTotal petroleum hydrocarbon in the motor oil range

^dUndiluted detection limit

^eRegulatory limit (NDEP, 1992)

^fNot detected above detection limits

^gNot analyzed

exceeded. Another important factor is the matrix of the material being analyzed. Much of the material from Zones 1 and 2 consisted of black oily sludge which can often require dilution of the sample and can result in substantial matrix interferences and, ultimately, a decrease in precision.

It is important to note that out of 71 soil samples analyzed for TPH by both the on-site and off-site laboratories, only five samples (i.e., SCP00093, SCP00119, SCP00127, SCP00130, and SCP00132) yielded non-detect results on site and detect results off site. Only two of these were above the regulatory limit of 100 mg/kg (i.e., 110 and 120 mg/kg) while two were only 5 mg/kg above the on-site laboratory detection limit for TPH-O, and one was below the on-site detection limit for TPH-O. In general, the results of the off-site laboratory confirmed the results of the on-site laboratory for detected versus nondetected results.

3.2.3 Toxicity Characteristic Metals

The South SCEPs soil samples were analyzed for the TC metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). The purpose of the TC metals analysis was to determine the leachability of the metals in soil, if they were present. None of these parameters, with the exception of barium and cadmium, were identified above the applicable detection limits. The TC barium and cadmium were identified in some of the samples with maximum concentrations of 1.0 and 0.11 milligrams per liter (mg/L) (i.e., background levels of these metals), which is significantly below the respective regulatory limits of 100 and 1.0 mg/L.

3.2.4 Semivolatile Organic Compounds and Polychlorinated Biphenyls

Samples taken from South SCEPT Zone 1 were analyzed for SVOCs and PCBs as part of the requirements for waste management. The results of the analyses indicated that SVOCs and PCBs were not present in the samples above CRDLs.

4.0 Quality Assurance

The results of quality assurance (QA) and QC activities for the SCEPs characterization sampling event are summarized in the following text, including a discussion on measurement of the QA/QC objectives and documentation of nonconformances. Detailed information about the QA program for this sampling event is contained in the RCRA Industrial Sites Quality Assurance Project Plan (QAPP) (DOE, 1996b).

4.1 Quality Control Samples

Three North SCEPT and two South SCEPT samples were taken as a field duplicates. The samples and duplicates were assigned individual sample numbers and were sent as blind samples to both the on-site and off-site laboratories. Additional samples were selected by the off-site laboratory to be analyzed as laboratory duplicates.

QC samples were collected and analyzed throughout the SCEPs sample collection process. A list of collected field QC samples is presented in Table 4-1. A total of six field blanks, ten equipment rinsate blanks, two pressure tank (heavy equipment rinsate) source blanks, six matrix spike/matrix spike duplicates (MS/MSDs), and five field duplicates were taken for analysis by the on-site and off-site laboratories. Twenty-one trip blanks were obtained for analysis by the off-site laboratory. The field blanks were taken by placing distilled water into appropriate sample bottles and preserving them according to the requirements specified in the RCRA Industrial Sites QAPP (DOE, 1996b). Equipment rinsate blanks were obtained by collecting the final rinse solution (i.e., distilled water), which was poured over the decontaminated sampling equipment into the appropriate sample bottles, and preserving it as applicable. Sealed and preserved trip blanks were received from the off-site laboratory and were placed in each cooler of samples sent to the off-site laboratory. All QC samples except trip blanks were analyzed by both the on-site and off-site laboratories. The results of the QC samples are discussed in the following sections.

4.1.1 Field Quality Control Samples

Review of the field blank analytical data for the characterization sampling indicated that cross-contamination from field methods did not occur during sample collection. The field blanks were analyzed for the parameters listed in Table 3-1, and none of the COCs, other than common laboratory contaminants (i.e., acetone and methylene chloride at significantly less than five times the detection limit), were identified above the detection limits.

Table 4-1
North and South SCEPs Field Quality Control Samples
Collected for Laboratory Analysis
(Page 1 of 2)

Sample Number	Sample Type	Notes
SCP00009	Equipment blank	Sampling equipment
SCP00010	Trip blank	VOC analysis only
SCP00013	Trip blank	VOC analysis only
SCP00016	Field duplicate	On-site and off-site analysis
SCP00024	Trip blank	VOC analysis only
SCP00034	Field blank	On-site and off-site analysis
SCP00037	Field duplicate	Onsite analysis only
SCP00038	Equipment blank	Sampling equipment
SCP00039	Trip blank	VOC analysis only
SCP00048	Field duplicate	On-site analysis only
SCP00054	Field blank	On-site analysis only
SCP00055	Equipment blank	Heavy equipment
SCP00056	Equipment blank	Sampling equipment
SCP00057	Trip blank	VOC analysis only
SCP00062	Pressure tank (source) blank	On-site analysis only
SCP00063	Equipment blank	Heavy equipment
SCP00064	Trip blank	VOC analysis only
SCP00066	Pressure tank (source) blank	On-site analysis only
SCP00067	Trip blank	VOC analysis only
SCP00072	Trip blank	VOC analysis only
SCP00084	Field blank	On-site and Off-site analysis
SCP00085	Trip blank	VOC analysis only
SPC00086	Equipment blank	Sampling equipment
SCP00091	Trip blank	VOC analysis only
SCP00097	Trip blank	VOC analysis only
SCP00098	Equipment blank	Heavy equipment
SCP00101	Trip blank	VOC analysis only
SCP00102	Equipment blank	Heavy equipment
SCP00104	Field duplicate	On-site and off-site analysis
SCP00111	Trip blank	VOC analysis only
SCP00112	Trip blank	VOC analysis only

Table 4-1
North and South SCEPs Field Quality Control Samples
Collected for Laboratory Analysis
(Page 2 of 2)

Sample Number	Sample Type	Notes
SCP00113	Field blank	On-site and off-site analysis
SCP00124	Trip blank	VOC analysis only
SCP00137	Field blank	On-site analysis only
SCP00138	Equipment blank	Sampling equipment
SCP00139	Trip blank	VOC analysis only
SCP00140	Trip blank	VOC analysis only
SCP00149	Field duplicate	On-site and off-site analysis
SCP00168	Trip blank	VOC analysis only
SCP00169	Field blank	On-site and off-site analysis
SCP00170	Trip blank	VOC analysis only
SCP00173	Equipment blank	Sampling equipment
SCP00174	Trip blank	VOC analysis only
SCP00179	Trip blank	VOC analysis only

Equipment rinsate blanks were collected from the sampling equipment and the heavy equipment used during the characterization and were analyzed for the parameters listed in Table 4-2. None of the COCs were identified above the detection limits in the equipment rinsate and source blanks with the exception of low levels (i.e., significantly less than five times the detection limit) of common laboratory contaminants (e.g., bis[2-ethylhexyl]phthalate, and butylbenzylphthalate) in some equipment blanks. The only COC identified in the heavy equipment rinsate blanks was low-level total lead.

During the actual sampling event, field duplicates were collected and analyzed for the same site characterization parameters listed in Table 3-2. The field duplicate sampling results, indicating the presence of COCs, are listed in the table contained in Section 3.0 of this report along with all other sample results. Trip blanks were analyzed for total VOCs only. None of the COCs were identified above the detection limit in any of the trip blanks for the characterization.

Table 4-2
Analytical Methods Used for Analysis of Quality Control Samples

Analytical Parameter	Analytical Method
Volatile Organic Compounds (characterization soil samples and water samples for waste management)	EPA ^a 8240
TC ^b Volatile Organic Compounds (characterization soil samples only)	EPA 1311/8240
TC Semivolatile Organic Compounds (characterization soil samples only)	EPA 1311/8270
Semivolatile Organic Compounds (waste management water samples only)	EPA 8270
TC Metals (characterization soil samples only)	EPA 1311/6010/7470
Total Metals (waste management water samples only)	EPA 6010 and 7470
Total Petroleum Hydrocarbons (characterization soil samples and water samples for waste management)	EPA 8015 (modified)
Polychlorinated Biphenyls (characterization soil samples and water samples for waste management)	EPA 8080
Gross Alpha/Beta (waste management water samples only)	SM 7110 ^c
Gamma Scan (waste management water samples only)	HASL300, 4.5.2.3 ^d

^aU.S. Environmental Protection Agency SW-846 (EPA, 1986)

^bToxicity characteristic

^cStandard Methods for the Examination of Water and Waste Water (APHA, 1992)

^dEnvironmental Measurements Laboratory Procedure Manual, HASL-300 (DOE, 1992)

Review of the analytical data from the off-site laboratory for the trip, field, and rinsate blanks indicates that the North and South SCEP soil samples were not contaminated during field activities or shipment. Cross-contamination, due to incomplete decontamination, did not occur.

4.1.2 Laboratory Quality Control Samples

Analysis of method QC blanks and laboratory control samples was performed for each parameter analyzed by Quanterra. Laboratory duplicate (sample split) analysis was performed on three samples from the characterization activities. Six samples were also designated for MS/MSD analyses by either or both the on-site and off-site laboratories. In general, the laboratory duplicate results were considered to be in agreement with the original sample results. The complete QC sample results are maintained in the project files.

4.2 Quality Assurance Objectives Measurements

The QA objectives ensure that the analytical data collected are meaningful, defensible, and useable for the desired purposes. Measurement of specific QA objectives is discussed in the following sections.

4.2.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Additional information regarding the measurement of precision may be found in the RCRA Industrial Sites QAPP (DOE, 1996b). Precision is assessed by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, analyzing, and comparing laboratory duplicates from one or more field samples. It is reported as relative percent difference (RPD) which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100. For the subsurface soil sampling project, the accepted precision goals for the off-site laboratory analyses are specified in the RCRA Industrial Sites QAPP (DOE, 1996b) and are listed in Table 4-3, which also presents the results of measurement of precision for the SCEPs soil sampling data. The table lists the total number of RPD precision measurements by analysis type, the acceptable (i.e., target) RPD range per the RCRA Industrial Sites QAPP (DOE, 1996b), and the number and percent of precision RPD measurements within the acceptance range.

Table 4-3
On-Site and Off-Site Laboratory Precision Measurements for
Area 6 Steam Cleaning Effluent Ponds Subsurface Soil Sampling Data

Parameter	Field Duplicate and Laboratory Duplicate Totals								Total On-Site	Total Off-Site
	On-Site Analysis			Off-Site Analysis						
	TPH-G ^a	TPH-D ^b	TPH-O ^c	TC ^d VOCs ^e	TC Metals	Total VOCs	TPH-G	TPH-D		
Total Number of RPD ^f Precision Measurements	8	8	8	54	9	35	3	3	24	104
Actual Range of Precision RPD Results	1 - 15.7	0.9 - 14.2	0.8 - 17.6	0 - 19.1	0 - 20.0	0 - 22.5	3.6 - 11.0	0 - 27.1	NA ^g	NA
Target Range for Precision RPD ^h	0 - 50	0 - 40	0 - 40	0 - 25	0 - 20	0 - 24	0 - 50	0 - 40	NA	NA
Number of Precision RPD Measurements within Target Range	8	8	8	54	9	35	3	3	24	104
Percent of Precision RPD Measurements within Target Range	100	100	100	100	100	100	100	100	100	100

^aTotal petroleum hydrocarbon - gasoline range

^bTotal petroleum hydrocarbon - diesel range

^cTotal petroleum hydrocarbon - oil range

^dToxicity characteristic

^eVolatile organic compounds

^fRelative percent difference

^gNot applicable

^hAs per the RCRA Industrial Sites QAPP (DOE, 1996b)

The values shown in Table 4-3 indicate the precision between field samples and the field and laboratory duplicates. Approximately 97.2 percent of the precision measurements were within the specified parameter-specific target ranges. For the subsurface soil samples analyzed on site, matrix spike and matrix spike duplicates were used to assess precision of the on-site laboratory. All on-site RPD measurements were within the established laboratory precision limits (see Table 4-3).

4.2.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in a measurement system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

The target accuracy ranges established for the subsurface soil samples analyzed by the off-site laboratory and the actual accuracies achieved are shown in Table 4-4 for both matrix spike and laboratory control samples. Based on the results shown in this table, 96.4 percent of all QC sample recoveries were within the acceptable limits, indicating excellent analytical accuracy. Additional information about measurement of accuracy for these samples is found in the RCRA Industrial Sites QAPP (DOE, 1996b). Parameter-specific accuracy (percent recovery) measurements may be found in the off-site laboratory analytical report data package maintained in the project files.

On-site accuracy measurements were also performed to determine the percent of recovery for the subsurface soil samples analyzed for TPH (see Table 4-4). Over 87.5 percent of all percent-recovery values were within the established limits for the on-site laboratory. The reason for the lower accuracy was cited by the on-site laboratory personnel as being related to matrix interferences caused by the wide range of hydrocarbons contained in some of the samples analyzed. This factor could also have affected the results of the off-site laboratory to some degree as well.

Field accuracy is assessed by confirming that the documents of record track the sample from its origin, through transfer of custody, to its disposal. The goal of field accuracy is for all samples to

Table 4-4
On-Site and Off-Site Laboratory Accuracy Measurements for
Area 6 Steam Cleaning Effluent Ponds Subsurface Soil Sampling Data

Parameter	On-Site Analysis			Off-Site Analysis								Total On-Site	Total Off-Site
	TPH ^a Gasoline	TPH Diesel	TPH Oil	TC ^b VOCs ^c	TC Metals	Total VOCs	Total Metals	TPH Gasoline	TPH Diesel	Gross Alpha/ Beta	Gamma Scan		
Total Number of %R ^d Measurements	16	16	16	273	104	213	56	22	6	18	24	48	716
Matrix Spike Samples (range of actual %R)	94 - 131	89 - 177	88 - 177	38 - 172	82 - 110	87 - 153	NA ^e	81 - 96	67 - 88	NA	NA	NA	NA
Laboratory Control Samples (range of actual %R)	115 - 118	93 - 104	94 - 135	45 - 172	67 - 107	77 - 146	70 - 105	88 - 113	NA	94 - 130	96 - 108	NA	NA
%R Target Range ^f (Water)	NA	NA	NA	61 - 145	80 - 120	61 - 145	75 - 125	75 - 125	20 - 102	75 - 125	80 - 120	NA	NA
%R Target Range (Soil)	75 - 125	1 - 153	1 - 153	61 - 145	80 - 120	59 - 172	75 - 125	75 - 125	1 - 153	NA	NA	NA	NA
Number of %R Measurements within the Target Range	14	14	14	262	95	213	52	22	6	16	24	42	690
Percent of %R Measurements within the Target Range	87.5	87.5	87.5	96.0	91.3	100	92.9	100	100	88.9	100	87.5	96.4

^aTotal petroleum hydrocarbons

^bToxicity characteristic

^cVolatile organic compounds

^dPercent recovery

^eNot applicable

^fAs per the RCRA Industrial Sites QAPP (DOE, 1996b)

be collected from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. Any deviations from these requirements must be documented and explained, and the related data must be qualified accordingly. During the SCEPs sampling project, all field accuracy goals were met.

4.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness is achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of validated analytical methods. Representativeness may also be assessed through analysis of replicate samples.

The SCEPs subsurface soil sampling project identified the COCs present in the soils encountered and accurately and precisely quantified their concentrations. Samples were collected from predetermined intervals; collection and analysis was performed in accordance with approved procedures (IT, 1994a); and both field and laboratory duplicates were analyzed. As a result, the SCEPs soil sampling data may be qualified as acceptably representative of site-specific environmental conditions. Additional information about the measurement of representativeness is found in the RCRA Industrial Sites QAPP (DOE, 1996b).

4.2.4 Completeness

Completeness is defined as a percentage of measurements made that are judged to be valid. In general, the SCEPs subsurface soil sampling data exhibit a high degree of completeness. The subsurface soil sampling and analytical program was executed in accordance with the Field Sampling Instructions (IT, 1996) and associated Records of Technical Change. The specified sampling intervals were used as planned. All specified samples were collected with the exception of one field duplicate, and all sample containers reached the laboratory intact and properly preserved (if applicable). The missing field duplicate was the result of a miscalculation by the field sampling team. For all samples, sample temperature was maintained during shipment to the laboratory, and sample chain of custody was maintained during sample storage and shipment.

4.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). A standardized sampling approach and analytical

methodology are used to achieve data comparability. To ensure comparability, all SCEPs field and laboratory activities were performed and documented in accordance with approved DOE contractor procedures (e.g., IT, 1994a). Approved, standardized methods and procedures were also used to analyze and report the data (e.g., EPA, 1986, and the Contract Laboratory Program requirements). This approach ensures that the data from this project can be compared to other data sets.

4.3 Field Deficiencies/Nonconformance

On May 9, 1996, during SCEPs subsurface soil sampling field operations, a surveillance of the field operation was conducted by IT to verify that sampling activities were performed in accordance with applicable requirements. The results of the surveillance indicated no findings, deficiencies, or nonconformances.

4.4 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation and fluctuations in internal standard and calibration results. Several laboratory nonconformances were noted during analysis of the SCEPs samples. However, the noted nonconformances did not affect the overall quality of the sampling event results. Laboratory and validation data qualifiers (if applicable) were assigned to identify those isolated samples that may have had the data quality impacted. The laboratory data packages which detail nonconformances are maintained in the project files.

5.0 Contaminant Plume Modeling

Only minor subsurface contamination is currently associated with the North SCEP. Based on the results of the characterization sampling and preliminary sampling at the site, it is apparent that the contamination present at the North SCEP is limited to a thin layer of hydrocarbon contamination with an estimated volume of approximately 5.0 m^3 (6.5 yd^3). The contamination consists of low levels of TPH-D and TPH-O and is restricted to the base of the pond near the inlet pipe at a depth of less than 1.5 m (5 ft).

Due to the complexity of the shape of the contaminant plume identified at the South SCEP, the analytical data obtained from samples taken from the pond were used to develop a computer model of the plume that exists in the subsurface at that site. Since the plume consists primarily of total petroleum hydrocarbons, the combined results for all of the analyzed hydrocarbon ranges were used to define the vertical and horizontal extent of the plume and to develop a three-dimensional (3-D) model of the plume from which a volume could be estimated for the total extent of the plume.

The first process in the modeling of the plume was to evaluate the sample data and produce hand-modeled contour maps of the plume surface. The hand-drawn maps indicated that the plume is roughly bowl-shaped and thickest below the center of the pond and where infiltration occurred into the unconsolidated berm material.

Once the hand modeling was complete, the computer was used to develop 3-D representations of the contamination using the Intergraph MGE Modeler program, an industry-standard, commercially available design and modeling program for Windows NT. The program produces contour and 3-D surface maps. Figure 5-1 depicts a vertical view of the plume based on the detectable TPH values. The detectable TPH values were used rather than just values above the regulatory threshold of 100 mg/kg in order to take advantage of the greatest number of data points. The use of only values above the regulatory threshold also does not significantly decrease the volume or shape of the plume since the concentrations on its edges increased rapidly into the plume. Figure 5-2 depicts two cross sections through the pond along the orientation of the sampling trenches. The original in-place total volume of the contamination was calculated to be approximately 900 m^3 ($1,177 \text{ yds}^3$) using the Intergraph MGE Terrain Analyst program, an

Figure 5-1
South Steam Cleaning Effluent Pond
Map View of the Modeled Contamination
Prior to Characterization Activities

Section A -

Section B -

LEGEND

- ① Contaminant zones
- Lower boundary of contaminant zones

Note: All of the Zone 1 material and part of the Zone 2 and 3 material have already been removed and disposed.

Figure 5-2
South Steam Cleaning Effluent Pond
Cross Sections of the Modeled Contamination
Prior to Characterization Activities

industry-standard, commercially available modeling program for Windows NT. From this total volume of contamination, approximately 106 m³ (138 yds³) of Zone 1, 2, and 3 material have been removed from the site (i.e., all of Zone 1 and part of Zones 2 and 3). Approximately 136 m³ (178 yds³) of Zone 2 material and 666 m³ (871 yds³) of Zone 3 material remain on site to be addressed as part of the site closure activities.

6.0 Summary

Analysis of data collected during the subsurface characterization of the soils from the North and South SCEPs indicates the following:

- Only minor subsurface contamination is currently associated with the North SCEP. The contamination consists of low levels of TPH-D and TPH-O and is restricted to the base of the pond at a depth of less than 1.5 m (5 ft) and an estimated volume of approximately 5.0 m³ (6.5 yd³).
- Contamination remaining at the South SCEP consists of an estimated maximum 136 m³ (178 yd³) of RCRA-regulated solvent and hydrocarbon-impacted soil classified as Zone 2 material and approximately 666 m³ (871 yd³) of hydrocarbon-impacted soil classified as Zone 3 material.
- Approximately 98 m³ (128 yd³) of Zone 1 and 3 material (which includes all of the identified Zone 1 material present) were removed from the South SCEP. Most of the material removed was hydrocarbon-impacted only (i.e., Zone 3), with approximately 27.5 m³ (36 yd³) of material removed that was contaminated with low levels of RCRA-regulated solvents (i.e., Zone 1).
- Approximately 7.7 m³ (10 yd³) of Zone 2 material were removed from the South SCEP. The material was contaminated with low levels of RCRA-regulated solvents.
- The results of the characterization indicate compliance with the constraints and conceptual models specified in the DQOs for the project presented in the Site Characterization Plan (DOE, 1996a).

Based on these findings, it should be possible to clean close the North and South SCEPs according to NDEP regulations without further assessment. Potential remediation options include:

- Excavation and disposal of the impacted soil
- *In situ* remediation such as bioventing or vapor recovery

These and other remedial options will be evaluated for their anticipated effectiveness and cost benefit to determine which method should be recommended for use.

7.0 References

APHA, see American Public Health Association.

American Public Health Association. 1992. *Gross Alpha and Gross Beta Radioactivity, Standard Methods for the Examination of Water and Waste Water*, 18th Edition. Washington, DC.

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

IT, see IT Corporation.

IT Corporation. 1994a. *Standard Quality Practices*. Las Vegas, NV.

IT Corporation. 1994b. *Geophysical Investigation Report for Area 6 Steam Cleaning Effluent Ponds and Decontamination Pond Facility and Area 23 Building 650 Leachfield, Nevada Test Site, Mercury, Nevada*. Draft report. Knoxville, TN.

IT Corporation. 1995. *Area 6 North Steam Cleaning Effluent Pond Preliminary Investigation*. Las Vegas, NV.

IT Corporation. 1996. *Field Sampling Instructions for Soil Sampling at the Area 6 North and South Steam Cleaning Effluent Ponds for Site Characterization: ITLV/10972-160*. Las Vegas, NV.

NDEP, see Nevada Division of Environmental Protection.

Nevada Division of Environmental Protection. 1992. *Contaminated Soil and Ground Water Remediation Policy*. Carson City, NV.

Nevada Division of Environmental Protection. 1994. "Finding of Alleged Violation and Order." Carson City, NV.

Nevada Division of Environmental Protection. 1995. "Permit for a Hazardous Waste Management Facility Number NEV HW009, United States Department of Energy, Nevada Operations Office, Nevada Test Site," I.D. Number NV3890090001. Carson City, NV.

Raytheon Services Nevada, Survey Department. 1995. *SCEPS* (Drawing). Las Vegas, NV.

REEC Co, see Reynolds Electrical and Engineering Co., Inc.

- Reynolds Electrical and Engineering Co., Inc. 1991. *20-Day Report for a Waste Oil Release at the Area 6 Steam Cleaning Effluent North Pond, Nevada Test Site, Nevada Division of Emergency Management (NDEM) Case Number H910911D*. Mercury, NV.
- Reynolds Electrical and Engineering Co., Inc. 1994. "Response to Nevada Division of Environmental Protection Finding of Alleged Violation and Order, 19 July, 1994." Las Vegas, NV.
- U.S. Department of Energy. 1992. *Environmental Measurements Laboratory Procedures Manual, HASL-300*, 27th Edition, Volume 1. New York, NY.
- U.S. Department of Energy. 1996a. *Resource Conservation and Recovery Act Industrial Site Environmental Restoration Site Characterization Plan, Area 6 Steam Cleaning Effluent Ponds*. DOE/NV--415. Las Vegas, NV.
- U.S. Department of Energy. 1996b. *Resource Conservation and Recovery Act Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*. DOE/NV--372. Las Vegas, NV.
- U.S. Environmental Protection Agency. 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, PB89-148076. Washington, DC.
- U.S. Environmental Protection Agency. 1987. *Data Quality Objectives for Remedial Response Activities*. EPA/540/G-87-003. Washington, DC.
- U.S. Environmental Protection Agency. 1994. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.
- U.S. Environmental Protection Agency. 1996. *Region 9 Preliminary Remediation Goals (PRGs) 1996*. Memorandum from Stanford J. Smucker, Ph.D., Regional Toxicologist, Technical Support Team to the PRG Table Mailing List, August 1, 1996.

Appendix A
Results of Previous Evaluations

A.1.0 Results of Previous Evaluations

Samples of both soil and water have been obtained from the SCEPs on at least five occasions in the past. The following sections discuss the results of these sampling events.

A.1.1 1988 Preliminary Evaluation

In 1988, Battelle Columbus Division conducted a preliminary evaluation of the SCEPs to evaluate whether potentially hazardous wastes were being discharged to the SCEPs. Samples were obtained from the sediments and influent of both ponds and analyzed for VOCs, semi-volatile organic compounds (SVOCs), toxicity characteristic (TC) SVOCs, and TC metals. However, because of data quality problems, the laboratory data for the sample analysis results were never presented in a final report of findings that can be cited.

A.1.2 1991 North SCEPT Release Evaluation

On August 12, 1991, a heavy rainfall caused the failure of one of the North SCEPT berms and the release of oily water which covered an area of approximately 700 square meters (7,500 square feet) (REECo, 1991). On August 14, 1991, one soil and one water sample from the spill area and one water sample from within the pond were obtained and analyzed for total petroleum hydrocarbons (TPHs), TC metals, VOCs, and SVOCs. The results of the analysis soil sample showed no contaminants of concern elevated above regulatory action levels.

A.1.3 1994 Preliminary Evaluation of South SCEPT

In August 1994, REECo conducted a sampling event in response to an NDEP FOAV and Order regarding unpermitted discharges into the South SCEPT (NDEP, 1994; REECo, 1994). Liquid and soil/sediment within the pond were sampled and analyzed for total and TC metals, VOCs, and SVOCs, TPH, radionuclides, pH, and flash point.

Although total concentrations of arsenic, barium, cadmium, and chromium appeared elevated in some of the samples, none of the samples showed TC metal values elevated to even near the regulatory thresholds (i.e., Title 40, *Code of Federal Regulations* [CFR] § 261.24). No RCRA-regulated total or TC, VOCs, or SVOCs were identified in the samples above regulatory limits. TPH ranged from 29,200 to 56,600 mg/kg in the soil samples taken. TPH in the range of diesel was identified in samples ranging from nondetected in one sample to 19,300 mg/kg in a sample taken from the vicinity of the pond outflow pipe. TPH in the range of gasoline was not detected in the samples. TPH in the range of waste oil ranged from 29,200 to 37,300 mg/kg in the

samples. No man-made radionuclides or elevated levels of natural radionuclides were detected in the samples. The results of these analyses are summarized in Table A-1.

A.1.4 1994 Preliminary Evaluation of North SCEP

In September 1994, IT Corporation (IT) conducted a preliminary sampling event at the North SCEP (IT, 1995). Soil/sediment samples were obtained from four locations within the pond and on the pond berm and were analyzed for total VOCs and SVOCs, TC metals, TPH, and radionuclides.

The results of the analyses indicated the presence of elevated levels of TPH in one sample and its field duplicate (1,940 and 2,370 mg/kg respectively) taken from approximately 20 feet east of the pond outflow pipe. However, since EPA Method 418.1 was used for the TPH analysis, it is likely that the results of analyses using EPA Method 8015 Modified or its equivalents (as required by regulation) would be lower than these levels. The levels would probably still be above the regulatory action level of 100 mg/kg. Europium-155 was also reported by the laboratory as detected in one sample. However, further study of the analysis results indicated that this isotope had been misidentified by the laboratory; and thus, no man-made radionuclides were detected in the samples (IT, 1995). The results of these analyses are summarized in Table A-1.

A.1.5 1994 Geophysical Evaluation of the North and South Steam Cleaning Effluent Ponds

In October and November 1994, a geophysical investigation was conducted at the North and South SCEPs (IT, 1994b) with the following objectives:

- Determine if leachate migration away from the ponds has occurred.
- Approximate the lateral boundaries and vertical extent of any plume present in the shallow subsurface.
- Locate shallow conductive zones in the vicinity of the ponds potentially representing perched leachate.

To accomplish these objectives, electromagnetic induction surveys were conducted at various transmitter/receiver intercoil spacings and system configurations, which provided for a qualitative interpretation of changing physical conditions with depth beneath the surface. Interpretation of the results of the survey suggested possible fluid/leachate migration away from

TABLE A-1: DETECTED CONSTITUENTS OF CONCERN FOR THE 1994 PRELIMINARY

POND			NORTH STEAM CLEANING EFFLUENT POND			
LOCATION DESCRIPTION			Background Sample Outside of Pond (Zone 2)	North Berm (Zone 2)	Pond Bottom Southeast Corner (Zone 2)	20 Pi (Z
DEPTH cm (inches)			0-15.2 (0-6)	0-30.5 (0-12)	0-30.5 (0-12)	
SAMPLE #			SCP00003	SCP00004	SCP00005	
Analyte	Units	Action Level				
TPH ^a by 418.1 ^b	mg/kg ^c	NA ^d	ND ^e	ND	ND	
TPH by 8015 Mod ^f	mg/kg	100 [‡]				
TPH Diesel ^g	mg/kg	NA				
TPH Gasoline ^h	mg/kg	NA				
TPH Oil ⁱ	mg/kg	NA				
Methylene Chloride	μg/kg ^j	18,000 ^{‡‡}	ND	ND	ND	
2-Butanone	μg/kg	2.7E+07 ^{‡‡}	ND	ND	ND	
Total Xylenes	μg/kg	320,000 ^{‡‡}	ND	ND	ND	
Arsenic	mg/kg	NA				
Barium	mg/kg	NA				
Cadmium	mg/kg	NA				
Chromium	mg/kg	NA				
Lead	mg/kg	NA				
TC ^k Barium	mg/ℓ ^l	100.0 ^{‡‡‡}	1.24	0.42	0.35	
TC Cadmium	mg/ℓ	1.0 ^{‡‡‡}	ND	ND	ND	
TC Mercury	mg/ℓ	0.2 ^{‡‡‡}	ND	ND	ND	

Note: Blank cells indicate analyses not performed; bold values are at or above the applicable regulatory action levels

*Samples analyzed for TPH, total volatile organic compounds (VOCs), toxicity characteristic (TC) VOCs, TC semivolatile organic compounds (SVOCs), TC metals

**Samples analyzed for TPH, total volatile organic compounds (VOCs), total semi-volatile organic compounds (SVOCs), total metals, TC VOCs, TC SVOCs, TC

[‡]Nevada Administrative Code 459.9973 ^{‡‡}Preliminary Remediation Goals for industrial sites (NDEP, 1992; EPA, 1996) ^{‡‡‡}Title 40 Code of Federal Regulation

^{dup}Field duplicate sample

^aTotal Petroleum Hydrocarbons

^bU.S. Environmental Protection Agency (EPA) Method 418.1

^cMilligrams/Kilogram

^dNot Applicable

^eNot detected above contract required detection limits

^fEPA Method 8015 Modified

^gTPH components in the range of Diesel (C₉-C₂₄)

^hTPH components in the range of Gasoline (C₄-C₁₄)

ⁱTPH Components in the range of Oil (C₁₈-C₃₄)

^jMicrograms/Kilogram

^kToxicity Characteristic

^lMilligrams/Liter

RY SOIL SAMPLING OF THE AREA 6 STEAM CLEANING EFFLUENT PONDS

D* (IT, 1994)		SOUTH STEAM CLEANING EFFLUENT POND** (REEC _o , 1994)		
10' East of Outflow Pipe (Zone 1)	20' East of Outflow Pipe (Zone 1)	Below Exposed Outfall Pipe (Zone 2)	Below Exposed Outfall Pipe (Zone 2)	Pond Bottom Opposite Outfall Pipe (Zone 1)
0-20.3 (0-8)	0-20.3 (0-8)	0-15.2 (0-6)	0-15.2 (0-6)	0-15.2 (0-6)
SCP00006	SCP00007 ^{dup}	6-SCEP1a	6-SCEP4a ^{dup}	6-SCEP2a
1,940		2,370		
		56,600	56,100	29,200
		19,300	19,100	ND
		ND	ND	ND
		37,300	37,000	29,200
ND	ND	5	ND	ND
ND	ND	42	16	ND
ND	ND	ND	ND	7,100
		23	37	26
		510	580	150
		9.7	15	9.0
		50	51	24
		240	230	130
0.83	0.70	0.51	0.41	ND
0.011	0.008	0.18	0.21	ND
ND	ND	0.00075	0.00069	ND

, gross alpha/beta, and gamma spectroscopy (all radionuclide results were below detection limits)
metals, gamma spectroscopy, pH (not reported on table), and flash point (not reported on table)
ulations § 261.24

the North SCEP in an east-northeast direction. However, surface conditions and subsurface utilities in the area of the North SCEP (i.e., gravel road and fencing) may have skewed some of the data values, resulting in an inaccurate interpretation of subsurface conditions. No subsurface anomalies were observed in the area of the South SCEP where subsurface migration was expected.

A.1.6 1995 Preliminary Evaluation of North and South Steam Cleaning Effluent Ponds

In September 1995, IT conducted a preliminary sampling event at the North and South SCEPs. The results of this preliminary sampling are presented here. Soil/sediment samples were obtained from four locations within the North SCEP and seven locations within the South SCEP (see Figures A-1 and A-2). Sample locations included the pond bottoms and berms and were analyzed for either TPH alone or for a suite of analyses that included total VOCs, TC VOCs, TC SVOCs, TC metals, and TPH.

The results of the analyses for the North SCEP samples indicated the presence of limited TPH contamination in the soil in the bottom of the pond. The TPH contamination was in the range of oil and was noted in one sample at 53 milligrams per kilogram (mg/kg) and in a second sample at 650 mg/kg with a field duplicate sample result of 470 mg/kg. Four other samples from various locations and depths in the pond and pond berm had no detected TPH. No total VOCs, TC VOCs, TC SVOCs, or TC metals were identified in the sample and field duplicate obtained from the center of the pond and analyzed for these parameters. Table A-2 summarizes this data.

The results of analyses for the South SCEP samples indicated TPH contamination in 15 out of 16 of the samples and field duplicate taken. The TPH contamination consisted primarily of oil with some mixtures of TPH in the range of oil, gasoline, and/or diesel. TPH was detected in five samples below the regulatory action level of 100 mg/kg (i.e., 29 to 62 mg/kg). Nine samples contained TPH levels ranging from 610 to 61,000 mg/kg. Three samples, one from the wet pond bottom, one from the dry pond bottom, and one from the sludge on the berm surface on the south side of the pond, were analyzed for total VOCs, TC VOCs, TC SVOCs, TC metals, and TPH.

The sample from the dry pond bottom had a TPH concentration of 7,900 mg/kg (in the range of oil) and a TC cadmium level of 0.016 milligrams per liter (mg/L), but no other constituents were identified. The TC cadmium level is well below the 1.0 mg/L for cadmium.

Figure A-1
Site Plan and Sample Locations,
Area 6 North Steam Cleaning Effluent Pond

Figure A-2
Site Plan and Sample Locations,
Area 6 South Steam Cleaning Effluent Pond

The sample from the wet pond bottom contained TPH in the range of oil above the regulatory action level and low levels of acetone, benzene, ethylbenzene, tetrachloroethene, toluene, and xylene, all of which were at least one order of magnitude below the regulatory action level. TPH was detected at 42,000 mg/kg in the sample.

The sample from the berm sludge contained TPH in the range of gasoline, diesel, and oil (61,000 mg/kg), cis-1,2-dichloroethene (1,300 micrograms per kilogram [$\mu\text{g/kg}$]), ethylbenzene (7,100 $\mu\text{g/kg}$), toluene (10,000 $\mu\text{g/kg}$), and xylene (58,000 $\mu\text{g/kg}$). The TPH is above the NDEP action level (NAC 459.9973) while the ethylbenzene, toluene, and xylene are all above RCRA Land Disposal Restriction (LDR) levels (Title 40 CFR 268.40).

Although the ethylbenzene, toluene, and xylene may only be hydrocarbon components (i.e., not RCRA hazardous waste regulated), there is not sufficient process knowledge to show that they are not the result of the use of solvents, and because of this, they must be considered F-listed (i.e., hazardous wastes from non-specific sources) RCRA wastes (Title 40 CFR 261.31) subject to the LDRs. Table A-2 summarizes these analytical results.

TABLE A-2: DETECTED CONSTITUENTS OF CONCERN FOR THE 1995 PRELIMINARY

POND			NORTH STEAM CLEANING EFFLUENT POND										
LOCATION DESCRIPTION			Pond Bottom Southwest Quadrant (Zone 2)		Pond Bottom Northeast Quadrant (Zone 2)		North Berm (Zone 2)	Pond Bottom Center (Zone 1)		Upper Berm North Side (Zones 3 and 4)			Lower Berm North Side (Zone 1)
LOCATION #			1	1	2	2	3	4	4	1	1	1	1
DEPTH cm (inches)			30.5 (12)	61.0 (24)	30.5 (12)	61.0 (24)	30.5 (12)	2.5-15.2 (1-6)	2.5-15.2 (1-6)	30.5 (12)	61.0 (24)	106.7 (42)	30.5 (12)
SAMPLE #			SCEP 00002	SCEP 00003	SCEP 00005	SCEP 00006	SCEP 00007	SCEP 00025 [†]	SCEP 00026 ^{†dup}	SCEP 00008	SCEP 00009	SCEP 00010	SCEP 00011
Analyte	Unit	Action Level											
TPH ^a	mg/kg ^b	100 [‡]	ND ^c	ND	53 [*]	ND	ND	650 [*]	470 [*]	ND	62 [*]	58 [*]	99 ^{***}
Acetone	μg/kg ^d	8.8E+06 ^{‡‡}								ND	ND		
Benzene	μg/kg	1,400 ^{‡‡}								ND	ND		
cis-1,2-Dichloroethene	μg/kg	100,000 ^{‡‡}								ND	ND		
Ethylbenzene	μg/kg	230,000 ^{‡‡}								ND	ND		
PCE ^e	μg/kg	17,000 ^{‡‡}								ND	ND		
Toluene	μg/kg	880,000 ^{‡‡}								ND	ND		
m,p-Xylene	μg/kg	320,000 ^{‡‡}								ND	ND		
o-Xylene										ND	ND		
TC ^f Cadmium	mg/l ^g	1.0 ^{‡‡‡}								ND	ND		

Note: Blank cells indicate analyses not performed; bold values are at or above the applicable regulatory action levels

[†]Samples for full screen analysis including TPH, total volatile organic compounds (VOCs), TC VOCs, TC semi-volatile organic compounds, and TC metals

^{*}TPH components are in the range of Oil (C₁₈-C₃₄) ^{**}TPH components are in the range of Gasoline (C₄-C₁₄), Diesel (C₉-C₂₄), and Oil (C₁₈-C₃₄) ^{***}TPH components are in the range of Gasoline (C₄-C₁₄), Diesel (C₉-C₂₄), and Oil (C₁₈-C₃₄)

[‡]Nevada Administrative Code 459.9973

^{‡‡}Preliminary Remediation Goals for industrial sites (NDEP, 1992; EPA, 1996)

^{‡‡‡}Title 40 Code of Federal Regulation

^{dup}Field duplicate sample

^aTotal Petroleum Hydrocarbons

^bMilligrams/Kilogram

^cNot detected above contract required detection limits

^dMicrograms/Kilogram

^eTetrachloroethene

^fToxicity Characteristic

^gMilligrams/Liter

SOIL SAMPLING OF THE AREA 6 STEAM CLEANING EFFLUENT PONDS

SOUTH STEAM CLEANING EFFLUENT POND												
Over Berm South Side (Zone 3)		Wet Pond Bottom (Zone 1)	Dry Pond Bottom (Zones 3 and 4)					Berm Sludge South Side (Zone 2)	Dry Pond Bottom (Zone 1)		Edge of Wet Pond Bottom Southeast Side (Zone 3 or 4)	
2	2	3	4	4	4	4	4	5	6	6	7	7
2.5 (2)	61.0 (24)	5.1-25.4 (2-10)	0-30.5 (0-12)	45.7 (18)	91.4 (36)	121.9 (48)	182.9 (72)	15.2- 45.7 (6-18)	61.0- 91.4 (24-36)	106.7- 121.9 (42-48)	129.5 (51)	129.5 (51)
SCEP 0011	SCEP 00012	SCEP 00014 [†]	SCEP 00015 [†]	SCEP 00017	SCEP 00018	SCEP 00019	SCEP 00020	SCEP 00022 [†]	SCEP 00023	SCEP 00024	SCEP 00028	SCEP 00029 ^{dup}
0*	610*	42,000*	7,900*	2,400*	5,100**	770*	29***	61,000**	1,800**	700***	42***	41***
		520	ND					ND				
		630	ND					ND				
		ND	ND					1,300				
		630	ND					7,100				
		60	ND					ND				
		610	ND					10,000				
		3,200	ND					39,000				
		1,200	ND					19,000				
		ND	0.016					ND				

Components are in the range of Diesel (C₉-C₂₄) and Oil (C₁₈-C₃₄)
 Regulations § 261.24

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