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Bell Canyon Area
Soil Sampling Report
Ventura County, California
Volume I

Prepared for

Residents of Bell Canyon

Prepared by

Ogden Environmental and Energy Services Co., Inc.
San Diego, California

Provided by

Boeing North American, Inc.,
Rocketdyne Propulsion and Power

October 1998

OGDEN ENVIRONMENTAL AND ENERGY SERVICES

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
DHS	Department of Health Services
DTSC	Department of Toxic Substances Control
GPS	global positioning system
MBAS	methylene blue active substances
mg/kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ng/kg	nanograms/kilogram
NPDES	National Pollutant Discharge Elimination System
Ogden	Ogden Environmental and Energy Services Co., Inc.
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
PRG	preliminary remediation goal
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	Registered Geologist
Rocketdyne	Rocketdyne Propulsion and Power
RWQCB	Regional Water Quality Control Board
SSFL	Santa Susana Field Laboratory
SVOC	semivolatile organic compound
TCDD	tetrachlorodibenzo-p-dioxin
TEF	toxicity equivalency factor
TEQ	toxic equivalent
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
µg/kg	micrograms per kilogram

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EXECUTIVE SUMMARY

The Bell Canyon area sampling program was performed to evaluate whether chemical or radiological contaminants have migrated into Bell Canyon or adjacent areas from the Santa Susana Field Laboratory (SSFL). Based on the results of this investigation, contaminants do not appear to have migrated from the SSFL into the Bell Canyon area.

The sampling was conducted by Ogden Environmental Energy Services Co., Inc. (Ogden) between June 10 and 16, 1998, and overseen by a California Registered Geologist. It was performed on behalf of Boeing North American, Inc., Rocketdyne Propulsion and Power (Rocketdyne) in response to Bell Canyon residents' request for sampling. Regulatory agencies and an independent Health Sciences Professor were invited to observe the sampling and were present throughout much of the field program. The Health Sciences Professor also reviewed the work plan.

Sampling was performed in three residential yards, Bell Creek, SSFL drainages that lead to Bell Creek, and in undeveloped portions of Bell Canyon and the SSFL. Surficial sediments, between 0 and 1 foot deep, were collected from the finest-grained sediments available at each location. Fine-grain sediments are most likely to contain or adsorb contaminants. Residential sampling locations were selected in conjunction with agency representatives and approved by the residents prior to sample collection. Most samples collected along Bell Creek and the SSFL drainages leading to Bell Creek were located along the bank of the drainage. The samples collected in the undeveloped portions of Bell Canyon and the SSFL were selected to provide information regarding naturally occurring background soil conditions.

The analytical suite for the samples in this investigation was based on previous regulatory agency-approved sampling programs performed onsite and offsite of the SSFL. A total of 23 primary soil and/or sediment samples were collected and analyzed for a comprehensive suite of chemicals and radionuclides using 22 different analytical methods to test for over 200 different compounds. Additional soil and water samples were analyzed for quality assurance (QA) reasons. All data for this investigation were reviewed by a qualified chemist. Field procedures used by Ogden during this program followed regulatory agency-approved protocols established for an ongoing investigation currently being conducted at the SSFL. Split samples were provided to agency

representatives upon request; results for the split samples were not available at the time this report was published.

A review of the data results, laboratory protocols, and field procedures for this program indicates that all the data results are usable and met the goals of the QA program. The data review was based on the findings of the data validation performed on each sample and a review of the QA sample results.

The following were not detected in any of the soil samples analyzed in this program: petroleum hydrocarbons, hexavalent chromium, perchlorate, formaldehyde, polychlorinated biphenyls, ordnance compounds, strontium-90, and plutonium radionuclides. Very few organic chemicals were detected in the soil and/or sediment samples. Acetone was detected in one sample near the Equestrian Center. A polynuclear aromatic hydrocarbon (PAH), pyrene, was detected in one background sample. Low concentrations of dioxins were detected in 17 of the soil samples. Fluoride and chloride were detected at low concentrations in most samples. Nitrate was detected in only four of the samples at low concentrations.

Normal soils, sediments, and rocks contain some naturally occurring chemicals and radionuclides. Naturally occurring chemicals include fluoride, chloride, nitrates, dioxins, PAHs, plant-related organic compounds, and many metals. Naturally occurring radionuclides include potassium-40, tritium, uranium, and thorium isotopes, and their decay products such as radium-226. Also, historical nuclear testing throughout the world has produced by-products, including plutonium, cesium-137, strontium-90, manganese-54, and tritium, which can be detected as fallout in soil. The levels of these chemicals and radionuclides in the natural environment are highly variable and depend on many factors, including soil conditions (such as composition and moisture content), rock types and drainage patterns in the area, and wind fluctuations. Naturally occurring concentrations of chemicals and radionuclides are referred to as "background."

Several metals (barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc) were detected in most of the samples. Arsenic, beryllium, and cadmium were detected in less than half of the samples. Concentrations of most metals were similar in all the samples except for aluminum, arsenic, barium, chromium, copper, lead, and zinc. These metals generally occur at higher concentrations in soils overlying bedrock composed of shale in the eastern portion of Bell Canyon.

Low concentrations of radionuclides were detected in most of the samples. Five gamma-emitting radionuclides were detected (cesium-137, manganese-54, potassium-40, radium-226, and thorium-228). Tritium was originally detected in 11 samples; reanalysis of these samples indicates that only 1 sample had detectable tritium. The thorium and uranium radionuclides were detected at low concentrations in all the samples.

A comparison of the soil sampling results to background and published health-based comparison values was also performed. The background data used for these comparisons are based on the results obtained from the seven samples collected in undisturbed areas during this study. Health-based comparison values are based on USEPA remediation goals or release criteria approved by the California Department of Health Services and are considered safe for residential soil levels. This comparison indicates:

- Sample results in this investigation are substantially less than the health-based comparison values except for arsenic. All arsenic results are less than, or similar to, the background levels in this study.

- Sample results at the three residences, Bell Creek, and SSFL drainages are generally less than or similar to the background concentrations detected during this program. Although the dioxin and tritium results for some samples exceed the background range for this study, these values are less than health-based comparison levels.

- There does not appear to be any trend or pattern in the distribution of the sampling results in the Bell Canyon area except for selected metals and dioxins.

- Concentrations of selected metals in soils overlying shale bedrock, located primarily in the eastern portion of Bell Canyon, are higher than elsewhere in the study area and appear to be related to the higher clay content in these soils.

- Dioxin concentrations greater than background but below the health-based levels generally occur in the drainages leading to Bell Creek or in Bell Creek. Within these drainages, however, there does not appear to be a consistent pattern to the dioxin concentrations, nor do they increase in the direction of the SSFL. These observations suggest that the higher dioxin concentrations may result from natural processes.

- Sampling results for surface and slightly deeper sediments or soils are similar.

- Elevated levels of acetone, fluoride, and chloride detected in the sample collected near the Equestrian Center are greater than background. These results are likely related to activities at the stables because they were not detected at similar levels elsewhere in Bell Canyon.

Overall, the results of this investigation indicate that neither chemical nor radionuclide contaminants from the SSFL have migrated into Bell Canyon or adjacent areas.

SECTION 1
INTRODUCTION

This report has been prepared for the residents of Bell Canyon to describe the results of soil and/or sediment sampling performed in the Bell Canyon area and in the southern portion of the Santa Susana Field Laboratory (SSFL). This report has been prepared by Ogden Environmental and Energy Services Co., Inc. (Ogden), who performed the sampling, under the guidance of a California Registered Geologist (RG). It is provided to Bell Canyon residents by Boeing North American, Inc., Rocketdyne Propulsion and Power (Rocketdyne). This report describes the field activities conducted as part of the sampling and the results of the laboratory analyses.

The Bell Canyon residential area is located south of, and adjacent to, the SSFL. The locations of Bell Canyon, the SSFL, and surrounding communities are shown in Figure 1.

1.1 PURPOSE AND SCOPE

The purpose of this sampling program was to collect and analyze soil and/or sediment samples from various areas of Bell Canyon to evaluate if contaminants have migrated from the SSFL. The areas evaluated include SSFL drainages, Bell Creek, and the yards of three residents who requested sampling.

The samples collected in or adjacent to Bell Creek and the drainages leading to Bell Creek provide information about potential migration of contaminants from the SSFL. The samples collected in or adjacent to Bell Creek within Bell Canyon were located adjacent to hiking trails or in Bell Canyon Park. The samples collected in the drainages leading to Bell Creek were located in the southern, undeveloped portion of the SSFL.

Additional samples collected during this program were "background" samples. These samples were collected in unused, undeveloped portions of Bell Canyon and in the southern undeveloped portion of the SSFL to provide information about naturally occurring, background soil conditions in the area.

The scope of the proposed Bell Canyon sampling activities was described in a work plan prepared by Ogden (1998) and presented by Rocketdyne to community members in June 1998. Based on comments received at this meeting from Bell Canyon residents and

comments from regulatory agency representatives during the field program, the scope of the sampling activities was modified slightly from that presented in the work plan. Changes to the proposed scope include modifying sample locations based on homeowner and agency input, and adding laboratory analyses for selected samples based on field observations. This report describes the sampling rationales, field methods, laboratory analyses, and quality assurance (QA) procedures used in this investigation.

Sampling activities were conducted by Ogden between June 10 and 16, 1998 and required 5 days to complete (sampling was not performed on the weekend). A total of 23 primary and 1 colocated duplicate soil and/or sediment samples were collected and analyzed during the program. Additional soil and/or sediment and water samples were analyzed or reanalyzed for QA reasons. The analytical suite for the samples collected in this study was based on previous regulatory agency-approved sampling programs performed onsite and offsite of the SSFL.

1.2 COMMUNITY AND REGULATORY AGENCY INVOLVEMENT

This sampling program was developed at the request of the Bell Canyon residents and performed as a voluntary community out-reach effort by Rocketdyne. Regulatory agency and community members were invited to observe the field procedures and collect split samples to confirm laboratory results.

Several regulatory agency representatives were present during the field program to observe field sampling procedures and sampling handling protocols and to collect split samples for independent analysis at an agency laboratory. Agency staff in the field also provided input into the selection of sampling locations. Representatives were present from the following regulatory agencies during sampling: the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) on June 10, 12, and 16; the United States Environmental Protection Agency (USEPA) on June 11; and the Radiological Health and Environmental Health Branches of the California Department of Health Services (DHS) on June 10. Agency split sample results were not available at the time this report was prepared and are not included in this document.

In addition to agency representatives, Dr. Thomas Hatfield, a Professor and Director of Environmental and Occupational Health Sciences at California State University (Northridge), observed the sampling on June 10, 11, 13, and 16. Dr. Hatfield did not

collect or analyze split samples but observed all procedures and provided input for sample locations. Dr. Hatfield also reviewed the sampling work plan.

Homeowners were present during the sampling performed in their yards and split samples were provided to them if requested. A Bell Canyon resident was also present during the sampling performed at Bell Canyon Park.

1.3 DATA CONFIDENTIALITY

Residents whose properties were sampled requested that their data remain confidential. To accommodate their request, yet present all the sampling results for evaluation by all parties, the residential data are presented as Resident 1, Resident 2, and Resident 3. Only the individual residents have been told which dataset is from their property.

1.4 REPORT ORGANIZATION

- Section 1 describes the purpose and scope of this investigation and how this document is organized.
- Section 2 presents the sampling location rationales for all the samples collected.
- Section 3 describes the sampling procedures, laboratory analyses, and quality assurance procedures.
- Section 4 presents the soil and/or sediment sample results.
- Section 5 presents the QA sample results.
- Section 6 presents a comparison of the soil and/or sediment sample results.
- Section 7 provides general conclusions from this sampling program.
- Section 8 provides references cited within this report.

SECTION 2
SAMPLING RATIONALES

The soil and/or sediment samples collected during this investigation can be grouped into four categories based on location:

- Soil and/or sediment samples collected within residential yards.
- Soil and/or sediment samples collected in or adjacent to Bell Creek within Bell Canyon, including Bell Canyon Park.
- Soil and/or sediment samples collected in the SSFL drainages leading to Bell Creek.
- Soil and/or sediment samples collected in unused, undeveloped portions of Bell Canyon along hiking trails and the southern, undeveloped portion of the SSFL (background samples).

Sampling location rationales are described in the next sections according these categories. In general, the finest-grained soil and/or sediments were sampled at each location because fine-grained sediments are most likely to contain or adsorb contaminants. In sampling locations adjacent to a creek or intermittent drainage, the finest-grained sediments were sampled in sedimentary deposits along the bank of a slow-moving part of the stream.

The soil and/or sediment sampling locations selected for this investigation are presented in Figure 2. In this figure, the locations of the six samples collected in the residential yards are indicated without a sample identifier to accommodate the resident's request for confidentiality.

2.1 RESIDENTIAL SAMPLES

Six soil and/or sediment samples were collected from the three residences included in the sampling program. Because the description of the sampling locations can be used to identify the samples that came from a specific residence, descriptions of the six residential samples are generalized to maintain confidentiality.

Surface sediment samples were generally collected at the residences where drainages enter or exit the property. All locations were discussed with the resident and agency representatives and agreement was reached between all parties before sampling was conducted. The samples were collected either between 0 to 0.5 feet below ground surface (bgs) or between 0.5 and 1 feet bgs, depending on the request of the resident. Surface soil was sampled because soil from this depth interval is considered most likely to come into contact with someone's skin. Deeper soils were sampled at some locations to test older sediment concentrations.

The first sample was located at a property boundary in sediments that had been deposited along the bank of an intermittent stream. This location was selected because it represented the largest deposit of fine-grained sediments along or adjacent to the stream bed in this portion of the property.

The second sample was collected at a property boundary upslope from the home patio. This location was selected because the residents had noted that abundant runoff (water and sediment) had previously come from this area and had traveled across the patio during heavy rains. The stream channel is not well defined in this area, but several pockets of sediments were observed in small depressions of the bedrock. The actual sampling location was selected because it represented the largest fine-grained sediment deposit in this general area. At the time of sampling, an active home construction site was observed immediately upslope of the sample location. Miscellaneous debris (particle board, 1-inch-diameter pipe lengths, etc.) was also observed at the fence line just upslope from the sampling location.

The third sample was located along the southern bank of a drainage near its entrance onto a property. This location was selected because it was near the entrance to the property, represented easy access for contact with the sediment (e.g., children playing, stream crossing, etc.), and because moderately fine-grained sediments appeared to have been deposited along this portion of the drainage.

The fourth sample was located along the northern bank of the drainage near its exit from a property. This location was selected because it represented easy access for contact with the sediment (e.g., children playing, stream crossing, etc.) and did not appear disturbed by construction or landscaping activities, which were observed on the southern bank of the drainage. The finest-grained sands in the cobbly sand bar were selected for sampling.

The fifth sample was located in the northern portion of a property, just north of a fence that surrounds the landscaped portion of the yard. (Approximately 20 feet north of the fence had been cleared of weeds but not landscaped.) The surface sediment sample was collected in a low point of a gentle swale that occurred midway along the fence line. This location was selected because it appeared that the swale served as an intermittent stream and was a likely entry point of sediments into the yard.

The sixth sample was collected along an eastern property boundary adjacent to a concrete drainage ditch and immediately upslope of a lemon tree. This location was selected because the residents wanted to test for contaminants near the lemon trees. Surface sediments were sampled approximately 7 feet away from the tree to avoid inclusion of nonnative soils in the sample. By locating the sample next to a concrete ditch that drains the upper (northern) portion of the property, the sample also served to test for any potential impacts resulting from the drainage.

2.2 BELL CREEK

Seven sediment samples were collected in or adjacent to Bell Creek using community hiking trails within Bell Canyon (Figure 1). Five of these samples were located along Bell Creek north of Buckskin Road using the Chastain Falls Trail. One sample was located along the creek bank near the Equestrian Center. One sample was located within the creek in Bell Creek Park.

The locations of these seven samples were selected to achieve a sample spacing of approximately 1,500 feet along Bell Creek. This spacing was not always possible due to the restriction of locating samples within community-access portions of Bell Creek along hiking trails. The depth of the samples was selected to test different sediment depths along the creek. In general, surface sediment samples (0 to 0.5 feet bgs) were alternated with deeper sediment samples (0.5 to 1 foot bgs). Each sample was located either adjacent to, or within, a slow-moving portion of the creek to collect the finest-grained sediments possible in the sampling containers. Specific sampling rationales for each of the seven samples are described below:

BCBS06_S01 - This sample was collected from Bell Creek sediments in the Bell Canyon Park. It was collected in deeper sediments between 0.5 and 1 feet bgs in a slow-moving

portion of the creek. The finest-grained silts and sands in this portion of the creek were sampled.

BCBS03_S01 - This sample was collected along the southern bank of Bell Creek near the Equestrian Center. It was collected from fine-grained sediments (silt and sand) between 0.5 and 1 feet bgs adjacent to a slow-moving portion of the creek. Several sampling locations were attempted in the area because abundant tree roots occurred in the soils. The soils were dark gray and had a strong organic odor.

BCSS05_S01 - This sample was collected along the western bank of Bell Creek along Chastain Falls Trail, approximately 500 feet north of Buckskin Road. The sample was collected in surface sediments between 0 and 0.5 feet bgs in the finest-grained portion of a cobbly sand bar adjacent to the creek.

BCBS04_S01 - This sample was collected along the eastern side of Bell Creek along Chastain Falls Trail, approximately 300 feet north of the waterfall. The sample was collected in deeper sediments between 0.5 and 1 feet bgs in the finest-grained portion of a sand bar adjacent to the creek.

BCSS06_S01 - This sample was collected along the western side of Bell Creek along Chastain Falls Trail, approximately 1,500 feet north of BCBS04S01. The sample was collected in surface sediments between 0 and 0.5 feet bgs in the finest-grained portion of a sand bank adjacent to the creek.

BCSS07_S01 - This sample was collected in the western drainage that leads from the SSFL to Bell Creek. The sampling location was approximately 50 feet upstream of the confluence of the streams that join to form Bell Creek. It was selected by identifying the finest-grained sands in a cobbly sand bar along the western bank of this tributary stream.

BCBS05_S01 - This sample was collected in the eastern drainage that leads from the SSFL to Bell Creek. The sampling location was approximately 50 feet upstream of the confluence of the streams that join to form Bell Creek. It was selected by identifying the finest-grained sands in a muddy sand bank along the western bank of this tributary stream.

2.3 SSFL DRAINAGES

Four sediment samples were collected along the banks of the two drainages leading from the SSFL that join to form Bell Creek. Outflow from these drainages is routinely sampled by Rocketdyne as part of their National Pollutant Discharge Elimination System (NPDES) permit under the jurisdiction of the Los Angeles Regional Water Quality Control Board (RWQCB). Monitoring point NPDES-001 is located in the eastern drainage leading to Bell Creek, and NPDES-002 is located in the western drainage. The NPDES monitoring points are shown in Figure 2.

The locations of these four samples were selected to achieve an approximate 1,500 foot sample spacing, including the NPDES monitoring points. The depth of the samples was selected to test different sediment depths along the drainages. In general, surface sediment samples (0 to 0.5 feet bgs) were alternated with deeper sediment samples (0.5 to 1 foot bgs). Each sample was located either adjacent to, or within, a slow-moving portion of the creek if the stream was flowing, or adjacent to the dry stream channel if the drainage was dry. The finest-grained sediments possible were sampled. Specific sampling rationales for each of the four samples are described below:

BCSS08_S01 - This sample was collected along the northern bank of the eastern drainage that leads to Bell Creek, approximately 1,500 feet west and downstream of monitoring point NPDES-001. The eastern drainage is an intermittent stream, and most of the drainage downstream of monitoring point NPDES-001 was dry at the time of sampling. This sample was collected between 0 and 0.5 feet bgs in a small sand bar adjacent to the dry creek bed.

BCBS07_S01 - This sample was collected along the western bank of the eastern drainage that leads to Bell Creek, approximately 1,500 feet northeast and upstream of monitoring point NPDES-001. The drainage upstream of the NPDES-001 monitoring point was observed to have a well-established stream flow at the time of sampling. This sample was collected between 0.5 and 1 feet bgs in a small muddy sand bar adjacent to the creek, approximately 40 feet upstream of the confluence of two tributary drainages. The western tributary was selected because it drains developed areas of the SSFL.

BCBS08_S01 - This sample was collected along the southern bank of the western drainage that leads to Bell Creek, approximately 1,500 feet north and upstream of

monitoring point NPDES-002. The drainage upstream of the NPDES-002 monitoring point was observed to have a well-established stream flow at the time of sampling. This sample was collected between 0.5 and 1 feet bgs in small sand bar adjacent to the creek.

BCSS10_S01 - This sample was collected along the eastern bank of the western drainage that leads to Bell Creek, approximately 3,000 feet north and upstream of monitoring point NPDES-002. This portion of the western drainage was also observed to have a well-established stream flow at the time of sampling. This sample was collected between 0 and 0.5 feet bgs in a sand bar adjacent to the creek.

2.4 BACKGROUND

Six soil and/or sediment samples were collected to provide information about naturally occurring, background soil conditions in the area of this investigation. Three of the background locations were selected in undeveloped portions of Bell Canyon and three were located in the undeveloped, open-space southern portion of the SSFL.

The locations of the background samples were selected based on geological rock type and accessibility. Three different bedrock types occur in Bell Canyon: the Sandstone Member of the Chatsworth Formation, the Shale Member of the Chatsworth Formation, and the Detrital Sediments of the Lindero Canyon Formation. The generalized geology of the Bell Canyon area is presented in Figure 3, with the different rock formations indicated in different colors (Dibblee 1992). Also indicated on this figure are the locations of the samples collected during this investigation. The identification of what type of formation (rock) is present at a sampling location is important because the type of rock will determine the concentrations of inorganic chemicals naturally present in the soil.

The Sandstone Member of the Chatsworth Formation (light green in Figure 3) forms the large sandstone bluffs prominent in the western portion of Bell Canyon and the SSFL. It occurs north of Bell Creek, generally in the western portion of the community. The Shale Member of the Chatsworth Formation (dark green in Figure 3) is comprised of finer-grained sediments and forms the gentler topography of the eastern portion of Bell Canyon. The Detrital Sediments of the Lindero Canyon Formation (brown in Figure 3) includes the gray to white sandstone and conglomerates that form the large, gray cliffs south of Bell Creek and the steep terrain in the eastern portion of Bell Canyon. The other

two geologic formations shown in Figure 3, the Santa Susana Formation (blue) and the Monterey Formation (tan), are similar in composition to the Chatsworth and Lindero Canyon Formations, respectively.

Background samples were collected from the soils overlying the Chatsworth Sandstone Member, the Chatsworth Shale Member, and the Detrital Sediments of Lindero Canyon because they represent the primary rock types in the Bell Canyon area and appear to be the primary contributor of sediments to Bell Creek.

Each sampling location was selected in an undisturbed area on hillsides or adjacent to dry drainages. The depth of the samples was selected to test soil conditions at different depths. In general, surface sediment samples (0 to 0.5 bgs) were alternated with deeper sediment samples (0.5 to 1 feet bgs). Specific sampling rationales for each of the seven samples are described below:

BCSS11_S01 - This sample was collected in soils developed above the Detrital Sediments of the Lindero Canyon Formation. It was located near the top of the north-facing slope of the ridge that occurs south of Bell Creek, opposite from the central portion of the Bell Canyon residential area. The sample was located approximately 100 feet north of a dirt road that follows the ridge top. This sample was collected between 0 and 0.5 feet bgs in soils developed on a gentle slope. Outcrop of the Lindero Canyon Formation was not observed, but small chips of the white to gray sandstone were noted in animal burrows nearby.

BCSS13_S01 - This sample was collected in soils developed above the Sandstone Member of the Chatsworth Formation. It was located in the western portion of Bell Canyon, approximately 8 feet north of the hiking trail. (It should be noted that the location of this sample in Figure 2 is shown within the parcel adjacent to the community trail. Because a global positioning system (GPS) device was used to measure the sampling location [see below], it appears that the parcel lines indicated on the map may be slightly inaccurate.) This sample was collected between 0 and 0.5 feet bgs in soils developed beneath a sandstone outcrop.

BCBS09_S01 - This sample was collected in soils developed above the Shale Member of the Chatsworth Formation. It was located in the eastern portion of Bell Canyon, approximately 8 feet west of the community hiking trail. (Again, the location of this

sample in Figure 2 is shown within the parcel adjacent to the community trail. As mentioned above, it appears that the parcel lines indicated on the map may be slightly inaccurate.) This sample was collected between 0.5 and 1 feet bgs in soils developed on a gentle slope. The area was highly vegetated with grasses but small mudstone chips were abundant in the soils sampled. Poorly exposed shale outcrops occurred slightly further up along the community access trail.

BCSS09_S01 - This sample was collected in sediments deposited from the Sandstone Member of the Chatsworth Formation. It was located in a drainage in the southern undeveloped portion the SSFL approximately 500 feet north of the SSFL-Bell Canyon boundary north of Marlboro Lane. This sample was collected between 0 and 0.5 feet bgs in sediments within a dry creek bed downslope of a prominent sandstone ridge with a large water tank. This location was selected because this drainage receives sediment from the Sandstone Member of the Chatsworth Formation and because it represents the western drainage leading from an undeveloped portion of the SSFL to the unnamed creek along Hackmore Road in the central part of Bell Canyon. This intermittent creek does not drain any active part of the SSFL and was sampled near the top of its reach. Siltstone and fine-grained sandstone were exposed in the bank of the creek adjacent to the sampling location.

BCSS12_S01 - This sample was collected in soils developed above the Sandstone Member of the Chatsworth Formation. It was located in the southern undeveloped portion of the SSFL, approximately 10 feet north of the SSFL-Bell Canyon boundary near Wagon Road. This sample was collected in a topographic swale between 0 and 0.5 feet bgs in soils downslope of a sandstone outcrop.

BCSS14_S01 - This sample was collected in sediments deposited from rock that has been mapped as the Shale Member of the Chatsworth Formation (Figure 3). The sample was collected in a drainage in the undeveloped portion of the SSFL, approximately 100 feet north of the SSFL-Bell Canyon boundary northeast of Coolwater Road. It was collected upstream of where a heavily overgrown and eroded dirt road crossed an intermittent drainage. Broken clay piping encased in cement was observed in the drainage beneath the former road location. The background sample was located upstream of this debris in order to sample in undisturbed soils. Although shale outcrop occurs in the bank of a dry creek bed at and downstream of the road crossing, rock debris in the immediate vicinity of the sampling location consisted of weathered cobbles and boulders of conglomerate

(possibly Chatsworth or Lindero Canyon Formations). The sample was collected in surficial sediments between 0 and 0.5 feet bgs adjacent to the dry creek bed. This location was selected because this drainage receives sediment from the Shale Member of the Chatsworth Formation and because it represents the eastern drainage leading from an undeveloped portion of the SSFL to the unnamed creek along Coolwater Road. This intermittent creek does not drain any active part of the SSFL and was sampled near the top of its reach.

BCSS14_D01 - This was a duplicate sample collected at the same location as BCSS14S01.

- Appendix A provides descriptions of the soils sampled in this investigation (soil boring logs).

- Appendix B provides photographs of the sampling locations.

- Appendix C presents the chemical laboratory results.

- Appendix D presents the radiological laboratory results.

- Appendix E presents the QA Report.

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SECTION 3
SAMPLING AND ANALYSIS PROGRAM

The following sections describe the sampling procedures used during the field program, the laboratory analysis program, and the quality assurance program for the Bell Canyon investigation.

3.1 SAMPLING PROCEDURES

All field sampling procedures used during this program followed the regulatory agency-approved protocols established for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) being conducted by Ogden for Rocketdyne at the SSFL. The following briefly describes the procedures used for this sampling program; more detailed information is provided in Attachment 3 of the Bell Canyon Sampling Work Plan (Ogden 1998).

The sampling team was led by a California RG who described the soil characteristics of the samples following the Unified Soil Classification System (USCS). These descriptions, called boring logs, are provided in Appendix A of this report. Detailed field notes of the sampling activities were recorded in a field notebook. Each sampling location was photographed, measured with respect to buildings or distinct features and plotted on a field map, and located in space by using a portable GPS device. The sampling location photographs (except for residential locations) are provided in Appendix B of this report. After the field work was completed, the GPS information was processed and the sampling locations plotted as shown in Figure 2.

The soil and/or sediment samples for chemical analysis were collected in precleaned, 6-inch-long stainless steel sampling tubes. Where the soil was relatively dry and compact, the samples were collected by driving the sampling tubes into the ground using a portable hammering device (slide hammer). The tube was lifted vertically out of the sampling location and immediately sealed using Teflon sheets beneath a plastic cap. If the soil was too wet or loose to drive the sampling tube, the tube was pushed by hand into the soil at the appropriate depth. In this case, the sample sleeve was filled at the sampling depth and carefully removed at an upward angle from the sampling location to minimize disturbance of the soil and prevent sample loss. In a few instances, the uppermost portion

of the sampling sleeve had to be packed by hand using a precleaned, stainless steel spoon or trowel.

The samples collected for radionuclide analysis were collected by using a precleaned stainless steel trowel or sampling spoon to fill a precleaned glass jar. The same type of sampling equipment was used for these samples whether the soils and/or sediments were wet or dry. If excess water was noted when the jars were filled, it was decanted off into the sampling hole before closing the jar.

The sampling containers were labeled and wrapped in clear plastic tape, and a custody seal was affixed to the outside of the container immediately after the samples were collected. The samples were then put in plastic bags and maintained in a cooler until delivered or shipped to the laboratory. Sampling information (identification, date, time, analyses requested, etc.) was entered on a chain-of-custody form in the field as each sample was collected. Samples for chemical analysis were kept in a chilled cooler (due to laboratory analysis requirements) and delivered to the laboratory by Ogden at the end of each sampling day. The samples for radionuclide analysis were kept in a room-temperature, sealed cooler and shipped to the laboratory by Ogden at the end of the sampling program. The sample coolers were either in the direct possession of the Ogden field team or were locked in the field vehicle all times during the day prior to delivery to the laboratory or shipping agent.

Excess soil and/or sediment removed at each sampling location were put back into the ground where it was removed after sampling was completed. All sampling equipment (slide hammer, trowels, etc.) was cleaned between sampling locations using a mild detergent and triple-rinsed. The final rinse was performed using a spray of with distilled water. Water used for the equipment cleaning was maintained in three labeled buckets throughout the sampling day. At the end of each day, the cleaning water was disposed of in labeled 55-gallon containers at the SSFL. Rocketdyne managed the disposal of the equipment cleaning water as part of the waste disposal program at the SSFL.

Water samples were collected during this program for QA purposes. These samples, further described in Section 3.4, were collected in precleaned glass or plastic bottles obtained from the laboratory. Preservatives (acids, etc.) were added by the laboratory for selected analyses where appropriate. As with the soil samples, the sampling containers were labeled and wrapped in clear plastic tape, and a custody seal was affixed to the

outside. To protect the bottles, the containers were then placed in bubble-wrap and maintained in a sealed cooler until delivered to the laboratory by Ogden. The water samples for chemical analysis were kept chilled until delivered to the laboratory at the end of each sampling day. The samples for radionuclide analysis were shipped with the soil samples at the end of the sampling program.

3.2 SAMPLE NAMING CONVENTIONS

All samples collected during this investigation were assigned two identifiers. One sample identifier, called the "EPA ID," is a five-character designator for laboratory reporting purposes. These identifiers are assigned sequentially during the field program and are irrespective of sample type (soil, water, etc.). For this program, EPA IDs were assigned from RH001 through RH048.

The other sample identifier, called the "Ogden ID," is a nine-character designator for sample identification. This is the identifier indicated on the sampling location map (Figure 2).

3.3 LABORATORY ANALYSIS

The soil and water samples collected during this investigation were analyzed for a comprehensive suite of chemicals and radionuclides. The chemical and radionuclide analyses performed on the samples are listed in Table 1. Overall, 22 different laboratory methods were used to analyze over 200 different compounds in each of the soil samples collected for this program.

All laboratories used for the soil and water analyses were California certified for those methods that required certification. As indicated on Table 2, only one water sample was analyzed for methylene blue active substances (MBAS) to look for a possible "foaming" agent because bubbles were noted in the equipment cleaning water (see Section 3.4). Total organic carbon (TOC) and total sulfide analyses were added for one soil sample to help identify the amount of plant material and associated sulfurous-like odor noted in the sample during the field work.

Although hydrazine analysis of the samples was requested by Ogden, this analysis was not performed on the samples collected during the field work. This analysis could not be

performed because a specialized laboratory could not be identified that could meet either the hydrazine speciation or the detection limits required for this project.

Extra sampling sleeves were collected in the field for several samples. The laboratory identified a potential need for additional sample volume because leaves, roots, or pebbles were noted in the original sampling tubes. The extra volume was thought to be necessary by the laboratory due to the large number of analyses being performed on the samples. The extra sampling volume, however, was not required and all analyses were performed using the original sampling container.

All samples for radionuclide analysis (gamma–emitting radionuclides, tritium, strontium, isotopic thorium, isotopic plutonium, and isotopic uranium) were submitted by Ogden to:

Thermo NUtech
2030 Wright Avenue
P.O. Box 4040
Richmond, CA 94804-0040
(510) 235-2633

All samples for chemical analysis were submitted by Ogden to:

Columbia Analytical Services, Inc.
6925 Canoga Avenue
Canoga Park, CA 91303
(818) 587-5550

Columbia performed the following analyses at this facility: volatile organic compounds (VOCs, Method 8021), total petroleum hydrocarbons (TPH, Method 8015M), semivolatile organic compounds (SVOCs, Methods 8270 and 8270SIM), metals (Methods 6010/7000), hexavalent chromium (Method 7196), fluoride (Method 340.2), chloride and nitrate (Method 300), and polychlorinated biphenyl compounds (PCBs, Method 8080). Columbia forwarded a portion of the sample to the laboratories listed below for specialized analyses.

Ordnance analyses were performed at:

Paragon Analytics, Inc.
225 Commerce Drive
Fort Collins, CO 80524
(970) 490-1511

Formaldehyde and TOC analyses were performed at:

Columbia Analytical Services, Inc.
1317 South 13th Avenue
P.O. Box 479
Kelso, WA 98626
(360) 577-7222

Perchlorate analyses were performed at:

Weck Laboratories, Inc.
14859 East Clark Avenue
Industry, CA 91745-1379
(626) 336-2139

Dioxin/furan analyses were performed at:

Alta Analytical Laboratory Inc.
5070 Robert J. Mathews Parkway
El Dorado Hills, CA 95762
(916) 933-0940

3.4 QUALITY ASSURANCE PROGRAM

In an effort to ensure consistent quality in the field sampling and laboratory analysis procedures used during this investigation, quality control/quality assurance (QA/QC) samples were collected and analyzed. QA/QC samples collected in the field included field blanks, equipment rinsates, trip blanks, colocated field duplicates, matrix spike/matrix spike duplicates (MS/MSDs), and split samples. Additional laboratory

analyses were requested for some samples to confirm original analytical results. These additional analyses are also considered as part of the QA program for this investigation. The purpose of the QA samples is briefly described in the following sections; additional detail is provided in the Bell Canyon Work Plan Attachment 4 (Ogden 1998).

Field Blanks

Field blank samples are collected from the de-ionized water source used to clean the sampling equipment in the field to ensure that contamination is not introduced into the samples. Two field blanks were collected in this sampling event because two water sources were used to provide the cleaning water. Because of the unusual physical characteristics of the water from first source (bubbles or foam), an MBAS analysis was added to the analytical suite for this sample to look for "foaming" or surfactant agents.

Equipment Rinsates

Equipment rinsate samples are collected from the final water used to rinse sampling equipment to ensure that contamination is not introduced into the samples from incomplete cleaning procedures. Two equipment rinsate samples were collected during this sampling program, one from each of the two water sources used.

Trip Blanks

Trip blank samples are water samples that accompany the soil or water samples collected in the field from the time of collection to arrival at the laboratory. They are clean water samples prepared and sealed by the laboratory, labeled by Ogden, and carried around all day in the sampling storage container (ice chest or insulated cooler). Because trip blanks test for potential introduction of or cross-contamination of volatile chemicals, they are analyzed only for VOCs. Twelve trip blanks were analyzed during this investigation. Trip blanks were used not only in the large cooler maintained in the field vehicle during each day's sampling event, but also in any smaller cooler used to transport the samples from the sampling location back to the field vehicle.

Colocated Field Duplicates

Colocated field duplicates are two site soil samples collected next to each other. Analysis of this type of sample helps in understanding the variability of results that may be due to either laboratory performance or a difference in soil condition (grain size, moisture, etc.) of the samples. Slight differences in sample results are not considered unusual for colocated duplicate soil samples due to slight changes in soil conditions. One pair of colocated duplicates was collected during this sampling event.

MS/MSD Samples

MS/MSD samples are extra volumes of samples collected in the field to ensure laboratory QC procedures. For this sampling event, different samples were chosen by the laboratory to provide extra sample volume for the MS/MSD samples.

Split Samples

Split soil samples were collected by Ogden and given to DTSC or USEPA for analysis at another laboratory. In general, these samples are similar to colocated duplicate samples and are collected at the same depth beside the original sampling location. (In some instances during this program, residents requested that the agency split be collected from the next sampling interval depth.) Analysis of this type of sample allows an estimate of laboratory variability by comparing the results. Thirteen split soil samples were provided to agency representatives during this program.

Additional Soil Analyses

The approved USEPA holding time for VOC analysis is 14 days between the time of sample collection to the time of laboratory analysis. Ogden requested that the samples for VOC analysis collected during this program be analyzed within 24 hours of sample collection to minimize any potential loss of contaminates from the samples. This was not always possible due to laboratory capacity and scheduling difficulties. Three soil and/or sediment samples were recollected for additional VOC analysis to provide a comparison of the samples analyzed within 24 hours and those analyzed after 24 hours but within the USEPA holding time.

Eleven soil and/or sediment samples were reanalyzed for tritium. All radionuclide values are reported as a data result within a "plus and minus" range (Appendix D). The 11 detected tritium results in the first data set were close to the laboratory detection limit when the error on the results was considered. The samples were reanalyzed to confirm the initial results.

SECTION 4
SAMPLE ANALYSIS RESULTS

TPH, PCBs, ordnance, perchlorate, formaldehyde, hexavalent chromium, nitrite, strontium-90, and plutonium radionuclides were not detected in any of the samples collected and analyzed during this investigation.

Detected chemicals and radionuclides in the soil and/or sediment samples are presented in Tables 2 through 7. These six tables present sampling results that have been grouped into the four categories described in Section 2 (Resident 1, Resident 2, Resident 3, BCHOA Bell Creek, SSFL Drainage, and Background samples). A comprehensive summary of all detected sampling results is presented in Table 8, and a comparison of the results is presented in Section 6. All detected chemical and radionuclide results are shown in Figure 4, although the locations of the residential samples have not been indicated to maintain resident confidentiality.

Detected concentrations in these tables are reported in one of four units to describe the measured amount of a compound with respect to a specific amount of soil. The first unit is milligrams per kilogram (mg/kg), which are equivalent to one part per million. The second, which is 1,000 times lower, is micrograms per kilogram (µg/kg). It is equivalent to one part per billion. The third, 1,000 times lower yet, is nanograms per kilogram (ng/kg), equivalent to one part per trillion. The fourth is used to measure radionuclides, picoCuries per gram (pCi/g). PicoCuries are a measure of radioactivity.

4.1 VOLATILE ORGANIC COMPOUNDS

Acetone was the only detected VOC in the soil and/or sediment samples collected during this investigation. It was detected only in one sample (BCBS03S01) at a concentration of 470 µg/kg (Table 5).

4.2 SEMIVOLATILE ORGANIC COMPOUNDS

Pyrene was the only detected SVOC in the soil and/or sediment samples collected during this investigation. It was detected only in one sample (BCSS09S01, a background sample) at a concentration of 39 µg/kg using Method 8270SIM (Table 7). Pyrene is a polynuclear aromatic hydrocarbon (PAH). SVOCs were not detected in any of the

samples using Method 8270. Several tentatively identified compounds were reported for many soil samples collected during this program (Appendix C). These generally appear related to decomposing plant material. Because these compounds are only tentatively identified by the laboratory, they are not considered further in this report.

4.3 TOTAL ORGANIC CARBON AND SULFIDE

TOC and sulfide were only analyzed in one sample (BCBS03S01) because abundant organic matter and an organic, sulfurous-like odor were noted in the sample during collection. TOC in this sample was detected at 17,300 mg/kg (17.3 percent) and sulfide at 110 mg/kg (Table 5).

4.4 FLUORIDE, CHLORIDE, NITRATE, AND PH

Fluoride was detected in 21 of the 24 soil and/or sediment samples collected during this program at concentrations ranging from 1.3 mg/kg to 13 mg/kg (Table 5). Chloride was detected in 13 of the 24 soil and/or sediment samples collected during this program at concentrations ranging from 12 mg/kg to 70 mg/kg (Table 5). Nitrate was detected in 4 of the 24 soil and/or sediment samples collected during this program at concentrations ranging from 12 mg/kg to 37 mg/kg (Table 7). The pH of the soil samples was neutral and ranged from 6.2 to 8.4 (Tables 2 through 7).

4.5 DIOXINS AND FURANS

Several dioxins and furans were detected at low concentrations in all 24 soil and/or sediment samples collected and analyzed during this program. Dioxins and furans have different toxicity levels depending on their chemical structure. USEPA (1989) has developed quantitative toxicity estimates for the most toxic of the dioxins, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). To estimate health risks of the other dioxin and furan compounds (called congeners), USEPA developed toxic equivalency factors (TEFs) that relate the toxicity of each of the congeners to that of 2,3,7,8-TCDD. The detected concentrations of dioxin and furan congeners in the sample are multiplied by the appropriate TEF established by USEPA. The result of this calculation is called the toxic equivalent (TEQ). Typically, as in the results for this investigation, several dioxins and furans occur together and the TEQ values are added together to better estimate the risks associated with these compounds. This sum for each sample is called the Total TEQ

value. Nondetected dioxins or furan congeners were not included in the Total TEQ calculations.

Individual dioxin and furan congener results and the calculated total TEQ results for the soil and/or sediment samples analyzed during this investigation are presented in Tables 2 through 7. The total TEQ results range from 0 ng/kg to 0.55 ng/kg.

4.6 METALS

Nineteen metals were analyzed in the samples collected during this program based on the metals suite being analyzed for the RFI at the SSFL (Ogden 1998). Seven of the 19 metals were not detected in any of the soil and/or sediment samples collected: antimony, boron, mercury, molybdenum, selenium, silver, and thallium. The remaining 12 metals were detected in at least one sample and can be summarized by the following:

- Aluminum was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 3,300 mg/kg to 18,000 mg/kg.

- Arsenic was detected in 8 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 8 mg/kg to 16 mg/kg.

- Barium was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 22 mg/kg to 170 mg/kg.

- Beryllium was detected in 9 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 0.6 mg/kg to 1.1 mg/kg.

- Cadmium was detected in only 1 of the 24 soil and/or sediment samples analyzed, at a concentration of 1 mg/kg.

- Chromium was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 5 mg/kg to 30 mg/kg.

- Cobalt was detected in 22 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 3 mg/kg to 12 mg/kg.

- Copper was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 3 mg/kg to 30 mg/kg.

- Lead was detected in 14 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 6 mg/kg to 29 mg/kg.

- Nickel was detected in 17 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 6 mg/kg to 30 mg/kg.

- Vanadium was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 12 mg/kg to 54 mg/kg.

- Zinc was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 23 mg/kg to 110 mg/kg.

In general, several metals were detected at higher concentrations in the background samples collected from soils developed above the Shale Member of the Chatsworth Formation (Figure 3). These metals include aluminum, arsenic, barium, chromium, copper, lead, and zinc. The increased metal concentrations in these soils are likely caused by their higher clay content. Metals typically absorb more to fine-grained soils (clays and sand) than to coarse-grained soils (sands and gravel).

4.7 GAMMA-EMITTING RADIONUCLIDES

Eighteen gamma-emitting radionuclides were analyzed in the samples collected during this program based on the previous offsite sampling programs performed north of the SSFL (Ogden 1998). Thirteen of these 18 radionuclides were not detected in any of the soil and/or sediment samples collected: barium-140, beryllium-7, cerium-141, cerium-144, cesium-134, cobalt-58, cobalt-60, iodine-131, iron-59, ruthenium-103, ruthenium-106, zirconium-95, and zinc-65. The remaining 5 were detected in at least one sample and can be summarized by the following:

- Cesium-137 was detected in 10 of the 24 soil and/or sediment samples analyzed, ranging in concentration from 0.03 pCi/g to 0.15 pCi/g.

- Manganese-54 was detected in only 1 of the 24 soil and/or sediment samples analyzed, at a concentration of 0.02 pCi/g.

- Potassium-40 was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 19 pCi/g to 25 pCi/g.

- Radium-226 was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 0.05 pCi/g to 1.5 pCi/g.

- Thorium-228 was detected in all 24 soil and/or sediment samples analyzed, ranging in concentration from 0.59 pCi/g to 1.8 pCi/g.

4.8 TRITIUM

As described in Section 3, 11 of the 24 soil and/or sediment samples collected were reanalyzed to confirm the original sample analysis results. The reanalysis results are indicated on Tables 2 though 7 as "RE" Ogden IDs.

Tritium was detected at low concentrations in 11 of the 24 original samples, ranging from 0.1 pCi/g to 0.3 pCi/g. Each of these samples was reanalyzed by the laboratory using the same methods and procedures. Tritium was detected in only 1 of the reanalyzed samples at a concentration of 0.35 pCi/g.

4.9 THORIUM RADIONUCLIDES

Three thorium radionuclides were detected in all 24 soil and/or sediment samples collected and analyzed during this program: thorium-228, thorium-230, and thorium-232. Detected concentrations of these radionuclides range from 0.43 pCi/g to 1.3 pCi/g for thorium-228, 0.35 pCi/g to 1.4 pCi/g for thorium-230, and 0.44 pCi/g to 1.5 pCi/g for thorium-232.

Thorium-228 is also detected using the gamma analysis (Method 901.1). The results from the two analyses are similar.

4.10 URANIUM RADIONUCLIDES

Four uranium radionuclides were detected in the samples collected and analyzed during this program: uranium-233/234 (reported together), uranium-235, and uranium-238. Uranium-233/234 and uranium-238 were detected in all 24 soil and/or sediment samples, ranging from 0.36 pCi/g to 1 pCi/g (uranium-233/234) and 0.37 pCi/g to 1.1 pCi/g (uranium-238). Uranium-235 was detected in 21 of the 24 samples, ranging from 0.03 pCi/g to 0.07 pCi/g.

SECTION 5
QUALITY ASSURANCE PROGRAM RESULTS

This section describes the results of the data review performed for this investigation. A data review is performed to check that the sampling procedures were done correctly and that the laboratory conducted the analyses following approved protocols. This review is based on both data validation findings and QA sample results. The results of the data review indicate that the overall QA goals of this program were met.

The following briefly describes the data review findings; complete data review results are provided in the QA report (Appendix E).

Data Validation

Data validation compares the data generated by the laboratory to specific quality control criteria. The quality control criteria for this investigation were published in the Bell Canyon Quality Assurance Project Plan (QAPP), Attachment 4 in the work plan (Ogden 1998). Findings of this review on a sample-by-sample basis are provided in data validation reports (Appendices C and D) and summarized in the QA Report (Appendix E).

Based on the data validation review, all laboratory data are considered usable for this investigation. Both the radiological and chemical laboratories met the overall QA goals of the sampling program.

Quality Assurance/Quality Control Sample Results

QA/QC samples are collected and analyzed to evaluate the consistency of the field sampling and laboratory analysis procedures used during this investigation. The types of and numbers of samples collected and analyzed are described in Section 3; additional information is provided in the Bell Canyon QAPP provided in the work plan (Ogden 1998). Specific findings of the QA/QC sample review are provided in Appendix E.

Based on review of the QA/QC sample results, the laboratory procedures used during this investigation were appropriate. Review of the water QA samples resulted in estimating the results of a few detected compounds in some soil samples. The data are

representative of the site and, with the possible exception of tritium, consistent results were obtained. Although tritium was originally detected at low concentrations in 11 soil samples, only 1 sample contained detectable tritium when reanalyzed. The laboratory procedures were able to test for the contaminants being investigated in this program.

Conclusion

The overall objectives of the QA program were met by laboratory and field procedures used during this sampling program. All data results are usable for this investigation.

SECTION 6
COMPARISON OF SAMPLING RESULTS

In this section, the detected results of the sample groups and the dataset as a whole are compared to the background concentrations detected in this study and published health-based values. These comparisons are presented to help understand the results of this sampling program. Tables 9 through 13 present a comparison of the sampling results by the categories presented in Section 2 (Resident 1, Resident 2, Resident 3, Bell Creek, and SSFL Drainages).

In each table, background sample concentration ranges are provided based on the results of the seven samples collected in undisturbed areas during this program (Table 7). Normal soils, sediments, and rocks contain some naturally occurring chemicals and radionuclides. Naturally occurring chemicals include fluoride, chloride, nitrates, dioxins, PAHs, plant-related organic compounds, and many metals. Naturally occurring radionuclides include potassium-40, tritium, uranium, and thorium isotopes, and their decay products such as radium-226. Also, historical nuclear testing throughout the world has produced by-products, including plutonium, cesium-137, strontium-90, manganese-54, and tritium, which can be detected as fallout in soil. The levels of these chemicals and radionuclides in the natural environment are highly variable and depend on many factors, including soil conditions (such as composition and moisture content), rock types and drainage patterns in the area, and wind fluctuations.

The health-based values provided in these tables have been compiled from two sources. Values for chemical compounds are based on preliminary remediation goals (PRGs) published by USEPA (1998). Radionuclide values provided in these tables are based on the SSFL Sitewide Release Criteria approved by the California DHS (Rocketdyne 1996). These radiological release standards are based on various state, federal, and site-specific limits. The chemical PRGs and radionuclide criteria are considered safe for residential land use.

The majority of the detected chemicals and all the detected radionuclides in the Bell Canyon area samples are at levels below the health-based comparison values presented in the tables. However, due to the conservative basis of these values, the health-based levels are sometimes less than the native background concentrations. This is the case for

arsenic, which has a health-based value less than the naturally occurring concentrations detected in the background samples collected in this study.

A brief discussion of the findings based on these comparison tables is presented in the following sections. These comparisons include all QA sample or reanalysis results within the datasets for each category.

6.1 RESIDENT 1

All sample results at this residence are substantially less than the health-based comparison values except for arsenic. The arsenic concentrations detected at this residence are greater than the comparison value but similar to the background values detected in this study (Table 9).

Sample results at this residence are generally less than or similar to the background concentrations detected during this program. A reanalyzed tritium concentration is the only result in this sample group greater than background in this study (Table 9). The reanalyzed tritium result (0.35 pCi/g) for one site sample is greater than the maximum background value (0.24 pCi/g). The original tritium result for this sample (0.15 pCi/g) is less than the background value.

6.2 RESIDENT 2

All sample results at this residence are substantially less than the health-based comparison values except for arsenic. The arsenic concentrations detected at this residence are greater than the comparison value but similar to the background values detected in this study (Table 10).

Sample results at this residence are generally less than or similar to the background concentrations detected during this program. The total dioxin TEQ value is the only result in this sample group that appears different than background in this study (Table 10). The total dioxin TEQ value for one site sample (0.184 ng/kg) is greater than the maximum background value (0.046 ng/kg), but similar to other sample results throughout Bell Canyon.

Although samples were collected from slightly deeper sediments at this residence, the results are similar to those collected from both surface and deeper sediments in the remainder of the Bell Canyon area.

6.3 RESIDENT 3

All sample results at this residence are substantially less than the health-based comparison values except for arsenic. The arsenic concentrations detected at this residence are greater than the comparison value but similar to the background values detected in this study (Table 11).

Sample results at this residence are generally less than or similar to the background concentrations detected during this program. One metal is the only result in this sample group that appears different than background in this study (Table 11). Barium was detected in the site samples at 170 mg/kg, slightly greater than the maximum background value of 140 mg/kg.

6.4 BELL CREEK

All sample results of this group are substantially less than the health-based comparison values except for arsenic. The arsenic concentrations detected in Bell Creek are greater than the comparison value but similar to the background values detected in this study (Table 12).

Overall, the sample results from Bell Creek are generally less than or similar to the background concentrations detected during this program. The one exception to this is the sample collected near the Equestrian Center. The acetone, chloride, and fluoride concentrations detected in this sample (470 µg/kg, 13 mg/kg, and 70 mg/kg, respectively) are likely associated with activities at the horse stables.

Total dioxin TEQ and tritium results in this sample group also exceed the background range in this study (Table 12). The total TEQ values for four site samples (0.047, 0.11, 0.32, and 0.55 ng/kg) are greater than the maximum background value (0.046 ng/kg), but similar to the results throughout Bell Canyon (Figure 4). One original tritium result in this sample group exceeds the background range in this study (Table 12). This tritium

result (0.3 pCi/g) is slightly greater than the maximum background value (0.24 pCi/g). Tritium was not detected when this sample was reanalyzed.

Sample results from slightly deeper sediments along Bell Creek are similar to the sample results from surface sediments.

6.5 SSFL DRAINAGES

All sample results of this group are substantially less than the health-based comparison values except for arsenic. The arsenic concentrations detected in the SSFL drainages are greater than the comparison value but similar to the background values detected in this study (Table 13).

Sample results from the SSFL drainages leading to Bell Creek are generally less than or similar to the background concentrations detected during this program. The total dioxin TEQ and two radionuclides are the only results in this sample group that appear different from background in this study (Table 13). The total TEQ results for the four site samples (0.093, 0.13, 0.27, and 0.31 ng/kg) are greater than the maximum background value (0.046 ng/kg), but similar to other sample results throughout Bell Canyon. The thorium-232 result for one site sample (1.5 pCi/g) is slightly greater than the maximum background value (1.1 pCi/g). One tritium result (0.3 pCi/g) is slightly greater than the maximum background value (0.24 pCi/g). Tritium was not detected when this sample was reanalyzed.

Sample results from slightly deeper sediments along these drainages are similar to the sample results from surface sediments.

6.6 ALL RESULTS

Review of the sampling data as a whole indicates that there does not appear to be a difference in detected results from samples collected at slightly different depths.

A comparison of all the site results to background indicates pyrene, a PAH, was detected in one background sample at a concentration less than its health-based comparison value. Pyrene was not detected in any site samples and can occur naturally in soils.

There does not appear to be any trend or pattern in the distribution of the detected compounds in the dataset except for metals and dioxins. Concentrations of selected metals appear to be higher in soils overlying the Shale Member of the Chatsworth Formation, primarily located in the eastern portion of Bell Canyon. Dioxin concentrations greater than background levels occur in Bell Creek or in the drainages leading to Bell Creek. Within these drainages, however, there does not appear to be a consistent pattern to the dioxin concentrations, nor do they increase in the direction of the SSFL. These observations suggest that the higher dioxin concentrations detected in the samples collected from the drainages may be caused by natural erosion, transport, and sedimentation processes. In addition, the drainage samples in this investigation targeted fine-grained sediments, which tend to contain or adsorb chemicals. The dioxin results greater than the background values detected in this study are less than the health-based comparison value.

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SECTION 7
CONCLUSIONS

Overall, the results of this investigation indicate that neither chemical nor radionuclide contaminants from the SSFL appear to have migrated into the Bell Canyon area.

Based on results of the soil and/or sediment samples collected in the Bell Canyon area during this investigation, the following conclusions can be made:

- All sample results in this investigation are substantially less than the health-based comparison values. The only exceptions are the arsenic concentrations, which are similar to or less than background values.

- Sample results at the three residences, Bell Creek, and SSFL drainages are generally less than or similar to the background concentrations detected during this program. Although the dioxin and tritium results for some samples exceed the background range in this study, these values are less than health-based levels.

- There does not appear to be any trend or pattern in the distribution in the sampling results in the Bell Canyon area except for selected metals and dioxins.

- Metal concentrations detected in samples collected from soils overlying the Shale Member of the Chatsworth Formation (primarily located in the eastern portion of Bell Canyon) are similar to each other and contain higher concentrations of selected metals than those detected elsewhere in Bell Canyon.

- Dioxin concentrations greater than background but below the health-based levels generally occur in the drainages leading to Bell Creek or in Bell Creek. Within these drainages, however, there does not appear to be a consistent pattern to the dioxin concentrations, nor do they increase in the direction of the SSFL. These observations suggest that the higher dioxin concentrations may result from natural processes.

- Sampling results for surface and slightly deeper sediments or soils are similar.

- The acetone, fluoride, and chloride concentrations detected in the sample collected near the Equestrian Center are greater than background. These results are likely related to activities at the stables because they were not detected at similar levels elsewhere in Bell Canyon.

SECTION 8
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Rocketdyne Report N001SRR140127. 1996. Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL, Rev. A. August 22, 1996.

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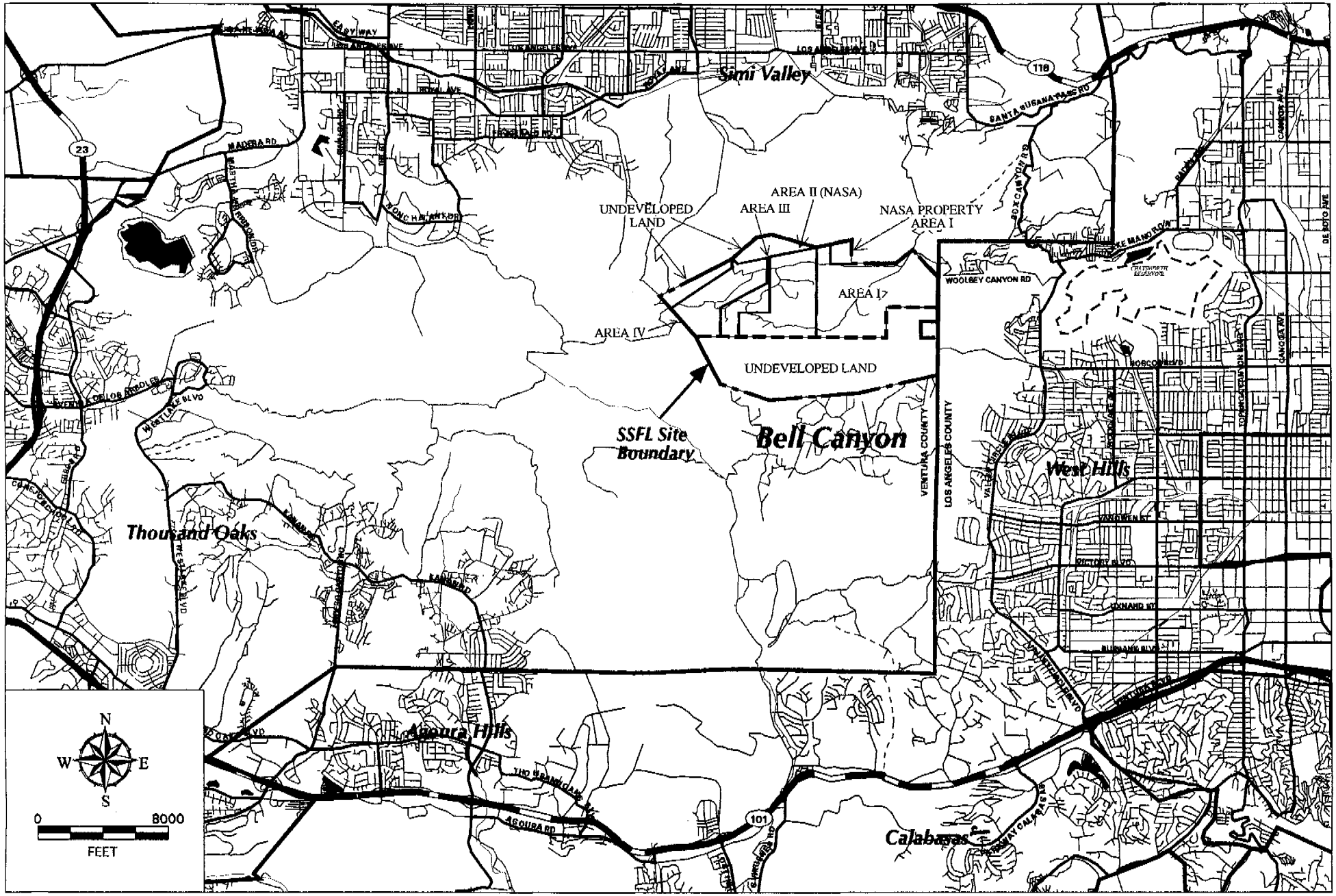


OGDEN

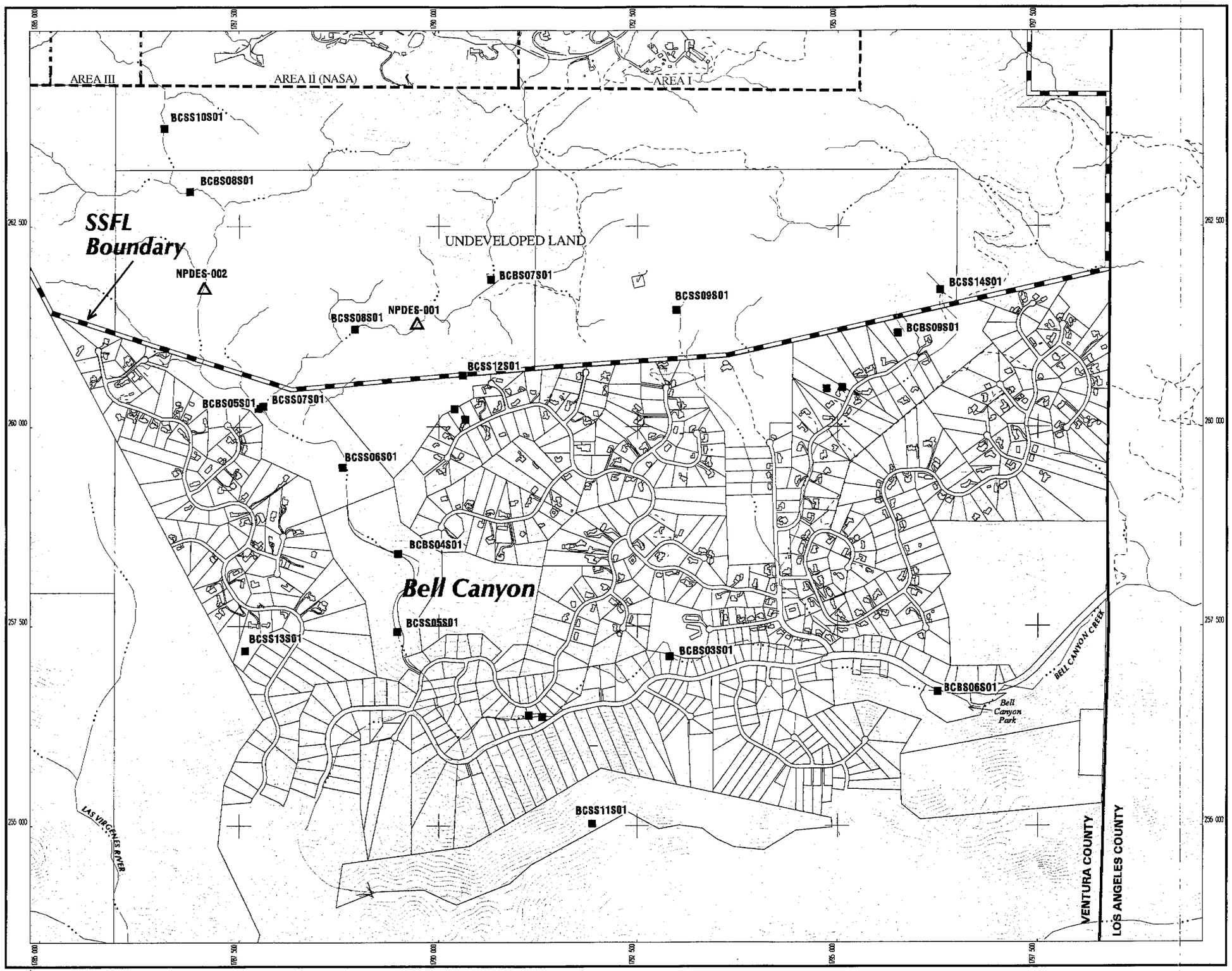
FIGURE

1

Location of Bell Canyon Area

/yap/rock/plots/figures/npdes_location_7.aml

BELL CANYON AREA SOIL SAMPLING LOCATIONS



Legend

- ■ BCBS01S01 - Sample Location
- △ NPDES Monitoring Point

Note: Resident Sample Identifiers Not Included By Request Of Residents To Maintain Confidentiality.

Basemap Legend

Buildings
Contours
Drainages
Dirt Roads
Roads
Parcels *

*** WARNING: This map was created by the Ventura County Computer Aided Mapping (CAM) System, which is designed and operated solely for the convenience of the County and related public agencies. The County does not warrant the accuracy of this map, and no decision involving a risk of economic loss or physical injury should be made in reliance thereon.**

MAP NOTES:
MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V.

FIGURE 2

N

FEET
0 600 1200 2400
1 inch = 1200 feet

DATE: 09/30/98
FILE: /yap/rocb/plots/figures/npdes17x11.aml

OGDEN Environmental and Energy Services

Generalized Geology of the Bell Canyon Area

Legend

- ■ BCBS01 - Soil Sample Location
- ▲ BCBS09 - Background Soil Sample Location
- △ NPDES Monitoring Point
- Qa — Quaternary Alluvium: gravel, sand and clay, landslide debris
- Tm — Monterey Formation: gray-brown, white-weathering shale and sandstone
- Detrital Sediments of Lindero Canyon: light gray to nearly white massive sandstone, and conglomerates
- Santa Susana Formation: gray claystone, tan coherent fine grained sandstone, and cobble conglomerates
- Chatsworth Formation--Sandstone Member: light gray to light brown sandstone, separated by thin partings of siltstone
- Chatsworth Formation--Shale Member: gray clay shale

Note: Resident Sample Identifiers Not Included By Request Of Residents To Maintain Confidentiality.

Basemap Legend

- Drainages
- Roads
- Contours
- Dirt Roads
- Parcels *

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MAP NOTES:
MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V.

FIGURE 3

FEET
0 600 1200 2400
1 inch = 1200 feet

DATE: 09/29/98
FILE: /yap/rock/plots/figures/npdes_geo.aml

OGDEN Environmental and Energy Services

BELL CANYON AREA SOIL SAMPLING RESULTS

Legend

●	Sample Location
▲	NPDES Monitoring Point
BCSS03	Ogden ID (Surface Sample, 0' bgs)
BCBS03	Ogden ID (Boring Sample, 1' bgs)
S01,D01,etc	Sample Or Duplicate Sample Number
D##.#	Depth In Feet
RH###	EPA Sample ID
J	Data Qualifier, Estimated Value
Tritium-RE	Tritium Reanalysis Result
ug/kg	Micrograms Per Kilogram
mg/kg	Milligrams Per Kilogram
ng/kg	Nanograms Per Kilogram
pCi/g	Picocuries Per Gram

Comparison Values

Acetone	1400000	ug/kg	Copper	2800	mg/kg
Pyrene	1500000	ug/kg	Lead	130	mg/kg
TOC	NE	mg/kg	Nickel	150	mg/kg
Sulfide	NE	mg/kg	Vanadium	520	mg/kg
Fluoride	330	mg/kg	Zinc	22000	mg/kg
Chloride	NE	mg/kg	Cesium-137	9.2	pCi/g
Nitrate	NE	mg/kg	Manganese-54	6.11	pCi/g
pH	NE	pH	Potassium-40	27.6	pCi/g
TOTAL TEQ	3.8	ng/kg	Radium-226	5	pCi/g
Aluminum	75000	mg/kg	Thorium-228	5	pCi/g
Arsenic	0.38	mg/kg	Tritium	31900	pCi/g
Barium	5200	mg/kg	Thorium-230	NE	pCi/g
Beryllium	150	mg/kg	Thorium-232	5	pCi/g
Cadmium	9	mg/kg	Uranium-233/234	30	pCi/g
Chromium	210	mg/kg	Uranium-235	30	pCi/g
Cobalt	3300	mg/kg	Uranium-238	35	pCi/g

Notes:
1. Resident sample identifiers not included by request of residents to maintain confidentiality.
2. Only detected results presented; Non-detected results presented as (-) only if multiple samples analyzed at that location.
3. Comparison Values based on USEPA Residential PRGs (chemicals) or DHS Approved Release Criteria (Radionuclides).
4. Only TOTAL TEQ result included for detected dioxins or furans.
5. Thorium-228 result reported for thorium analysis only (EERF 00-07).

Basemap Legend

- Buildings
- Drainages
- Roads
- Contours
- Dirt Roads
- Parcels *

* WARNING: This map was created by the Ventura County Computer Aided Mapping (CAM) System, which is designed and operated solely for the convenience of the County and related public agencies. The County does not warrant the accuracy of this map, and no decision involving a risk of economic loss or physical injury should be made in reliance thereon.

MAP NOTES:
MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V.

FEET
0 250 500 1000 1500 2000
1 inch = 500 feet

FIGURE 4

DATE: 10/05/98
FILE: /yap/rock/plots/plotamls/npdes.aml

OGDEN Environmental and Energy Services

Table 1

SAMPLE ANALYTICAL SUITE

Laboratory Analytical Method	Types of Chemicals/Radionuclides
Method 8021	Volatile organic compounds
Method 8015M	Total petroleum hydrocarbons
Method 8270SIM	Semivolatile organic compounds (selected ions, low detection limits)
Method 8270	Semivolatile organic compounds (standard ions list and detection limits)
Methods 6010/7000	Metals
Method 7196	Hexavalent chromium
Method 9045	pH
Method 340.2	Fluoride
Method 300	Chloride, nitrate
Method 376.1	Total sulfide
ASTM D1479-82M	Total organic carbon
None Established (a)	Perchlorate
ASTM D19	Formaldehyde
Method 8080	Polychlorinated biphenyls
Method 1613B	Dioxin and furan compounds
Method 8330	Ordnance compounds
Method 901.1	Gamma-emitting radionuclides (inlcuding cesium-137 and cobalt-60)
Method 905M	Strontium-90
Method 906M	Tritium radionuclide
Method EERF 00-04	Plutonium radionuclides
Method EERF 00-07	Thorium radionuclides
Method EERF 00-06	Uranium radionuclides

(a) No formal regulatory-approved method for perchlorate analysis exists although the Department of Health Services has reviewed the procedures performed. The laboratory followed an analytical procedure similar to Method 300.

ASTM = American Society of Testing and Materials
EERF = Eastern Environmental Radiation Facility/Radiochemistry Procedures Manual

TABLE 2

RESIDENT 1 SOIL SAMPLING RESULTS

EPA NO	RH002				RH002RE				RH003			
OGDEN ID	BCSS01S01				BCSS01S01				BCSS02S01			
Date Sampled	6/10/98				6/10/98				6/10/98			
Operational Unit	RES. 1				RES. 1				RES. 1			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
TOTAL TEQ	***0.0160***								***0.000000***			
OCDD	***16.0***								10.0	U	U	
340.2 (MG/KG)												
Fluoride	***5.80***								***2.70***			
ANIONS (MG/KG)												
Nitrate	***12.0***		*J*	*H*					11.0	U	UJ	H
GAM (pCi/g)												
Potassium-40	***23.0***								***23.0***			
Cesium-137	***0.0450***								0.0310	U	U	
Radium-226	***0.8500***								***1.30***			
Thorium-228	***0.9800***								***1.40***			
H3 (pCi/g)												
Tritium	***0.1500***	*J*	*J*		***0.3600***	*J*	*J*		***0.1000***	*J*	*J*	
METALSRT (MG/KG)												
Aluminum	***6,800***								***10,000***			
Arsenic	5.00	U	U						***9.00***			
Barium	***53.0***								***76.0***			
Beryllium	0.5000	U	U						***0.6000***			
Chromium	***9.00***								***15.0***			
Cobalt	***4.00***								***5.00***			
Copper	***10.0***								***8.00***			
Lead	***6.00***								***8.00***			
Nickel	***6.00***								***11.0***			
Vanadium	***17.0***								***26.0***			
Zinc	***37.0***		*J*	*A*					***47.0***		*J*	*A*
PH (PH)												
PH	***7.80***		*J*	*H*					***7.10***		*J*	*H*
TH (pCi/g)												
Thorium-228	***0.8300***								***1.20***			
Thorium-230	***0.7300***								***1.10***			
Thorium-232	***0.8100***								***1.20***			
U (pCi/g)												
Uranium-238	***0.5800***								***0.9900***			
Uranium-235	***0.0500***								***0.0600***			
Uranium-233/234	***0.6500***								***1.00***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 2

RESIDENT 1 SOIL SAMPLING RESULTS

EPA NO	RH003RE				Intentionally Blank				Intentionally Blank			
OGDEN ID	BCSS02S01											
Date Sampled	6/10/98											
Operational Unit	RES. 1											
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
TOTAL TEQ												
OCDD												
340.2 (MG/KG)												
Fluoride												
ANIONS (MG/KG)												
Nitrate												
GAM (pCi/g)												
Potassium-40												
Cesium-137												
Radium-226												
Thorium-228												
H3 (pCi/g)												
Tritium	0.1100	U	U									
METALSRT (MG/KG)												
Aluminum												
Arsenic												
Barium												
Beryllium												
Chromium												
Cobalt												
Copper												
Lead												
Nickel												
Vanadium												
Zinc												
PH (PH)												
PH												
TH (pCi/g)												
Thorium-228												
Thorium-230												
Thorium-232												
U (pCi/g)												
Uranium-238												
Uranium-235												
Uranium-233/234												

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 3

RESIDENT 2 SOIL SAMPLING RESULTS

EPA NO	RH004				RH005				RH005RE			
OGDEN ID	BCBS01S01				BCBS02S01				BCBS02S01			
Date Sampled	6/10/98				6/10/98				6/10/98			
Operational Unit	RES. 2				RES. 2				RES. 2			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD	5.00	U	U		***8.40***							
OCDD	***44.0***				***100***							
TOTAL HPCDD	***6.20***	***U***		-	***17.0***							
TOTAL HPCDF	5.00	U	U		***5.70***	***U***		-				
TOTAL TCDF	1.00	U	U		***1.60***							
TOTAL TEQ	***0.0440***				***0.1840***							
340.2 (MG/KG)												
Fluoride	***2.40***				***2.40***							
ANIONS (MG/KG)												
Chloride	***15.0***				***12.0***							
GAM (pCi/g)												
Potassium-40	***21.0***				***24.0***							
Radium-226	***0.5000***				***0.9300***							
Thorium-228	***0.5900***				***1.00***							
H3 (pCi/g)												
Tritium	0.1000	U	U		***0.1400***	***J***	***J***		0.1200	U	U	
METALSRT (MG/KG)												
Aluminum	***4,000***				***3,300***							
Barium	***61.0***				***29.0***							
Chromium	***6.00***				***7.00***							
Cobalt	***3.00***				***3.00***							
Copper	***3.00***				***5.00***							
Nickel	***8.00***				***9.00***							
Vanadium	***13.0***				***14.0***							
Zinc	***28.0***		***J***	***A***	***28.0***		***J***	***A***				
PH (PH)												
PH	***8.10***		***J***	***H***	***7.70***		***J***	***H***				
TH (pCi/g)												
Thorium-228	***0.6700***				***1.10***							
Thorium-230	***0.4700***				***1.40***							
Thorium-232	***0.6700***				***0.8900***							
U (pCi/g)												
Uranium-233/234	***1.00***				***0.4100***							
Uranium-235	***0.0500***				***0.0300***	***J***	***J***					
Uranium-238	***0.9400***				***0.4600***							

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 4

RESIDENT 3 SOIL SAMPLING RESULTS

EPA NO	RH006				RH006RE				RH007			
OGDEN ID	BCSS03S01				BCSS03S01				BCSS04S01			
Date Sampled	6/10/98				6/10/98				6/10/98			
Operational Unit	RES. 3				RES. 3				RES. 3			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
OCDD	***15.0***								10.0	U	U	
TOTAL PECDF	***6.40***	***U***		-					5.00	U	U	
TOTAL TCDF	***5.30***	***U***		-					1.00	U	U	
TOTAL TEQ	***0.0150***								***0.000000***			
340.2 (MG/KG)												
Fluoride	***5.40***								***5.40***			
ANIONS (MG/KG)												
Chloride	12.0	U	U						***12.0***			
GAM (pCi/g)												
Cesium-137	***0.1500***								***0.0890***			
Potassium-40	***19.0***								***20.0***			
Radium-226	***1.10***								***1.20***			
Thorium-228	***1.60***								***1.50***			
H3 (pCi/g)												
Tritium	***0.1500***	***J***	***J***		0.1200	U	U		***0.1600***	***J***	***J***	
METALSRT (MG/KG)												
Aluminum	***18,000***								***18,000***			
Arsenic	***14.0***								***14.0***			
Barium	***140***								***170***			
Beryllium	***1.00***								***1.00***			
Chromium	***30.0***								***28.0***			
Cobalt	***12.0***								***11.0***			
Copper	***26.0***								***28.0***			
Lead	***27.0***								***22.0***			
Nickel	***30.0***								***27.0***			
Vanadium	***52.0***								***52.0***			
Zinc	***110***		***J***	***A***					***110***		***J***	***A***
PH (PH)												
PH	***7.80***		***J***	***H***					***7.80***		***J***	***H***
TH (pCi/g)												
Thorium-228	***1.10***								***1.00***			
Thorium-230	***0.9700***								***0.9200***			
Thorium-232	***0.9600***								***1.10***			
U (pCi/g)												
Uranium-233/234	***1.00***								***1.00***			
Uranium-235	***0.0670***								***0.0700***			
Uranium-238	***0.9800***								***1.10***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 4

RESIDENT 3 SOIL SAMPLING RESULTS

EPA NO	RH007RE				Intentionally Blank				Intentionally Blank			
OGDEN ID	BCSS04S01											
Date Sampled	6/10/98											
Operational Unit	RES. 3											
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
OCDD												
TOTAL PECDF												
TOTAL TCDF												
TOTAL TEQ												
340.2 (MG/KG)												
Fluoride												
ANIONS (MG/KG)												
Chloride												
GAM (pCi/g)												
Cesium-137												
Potassium-40												
Radium-226												
Thorium-228												
H3 (pCi/g)												
Tritium	0.1200	U	U									
METALSRT (MG/KG)												
Aluminum												
Arsenic												
Barium												
Beryllium												
Chromium												
Cobalt												
Copper												
Lead												
Nickel												
Vanadium												
Zinc												
PH (PH)												
PH												
TH (pCi/g)												
Thorium-228												
Thorium-230												
Thorium-232												
U (pCi/g)												
Uranium-233/234												
Uranium-235												
Uranium-238												

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH011				RH012				RH012RE			
OGDEN ID	BCBS03S01				BCSS05S01				BCSS05S01			
Date Sampled	6/11/98				6/11/98				6/11/98			
Operational Unit	BCHOA BELL CREEK				BCHOA BELL CREEK				BCHOA BELL CREEK			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD	31.0	U	U		12.0	U	U					
OCDD	***320***				***47.0***							
TOTAL HPCDD	***55.0***	***U***		-	12.0	U	U					
TOTAL HPCDF	31.0	U	U		12.0	U	U					
TOTAL TEQ	***0.3200***				***0.0470***							
340.2 (MG/KG)												
Fluoride	***13.0***				***4.70***							
376.1 (MG/KG)												
Sulfide, Total	***110***		***J***	***H***								
8021A (UG/KG)												
Acetone	***470***	***E***	***J***	***8***	61.0	U	U					
ANIONS (MG/KG)												
Chloride	***70.0***				***16.0***							
GAM (pCi/g)												
Cesium-137	***0.0260***				0.0290	U	U					
Potassium-40	***21.0***				***23.0***							
Radium-226	***1.00***				***0.7100***							
Thorium-228	***1.40***				***1.30***							
H3 (pCi/g)												
Tritium	0.0800	U	U		***0.2300***	***J***	***J***		0.1700	U	U	
METALSRT (MG/KG)												
Aluminum	***6,900***		***J***	***A***	***4,400***		***J***	***A***				
Arsenic	***8.00***				6.00	U	U					
Barium	***63.0***		***J***	***A***	***30.0***		***J***	***A***				
Chromium	***15.0***				***7.00***							
Cobalt	***5.00***				***3.00***							
Copper	***10.0***				***5.00***							
Lead	***9.00***				6.00	U	U					
Nickel	***17.0***				6.00	U	U					
Vanadium	***30.0***				***13.0***							
Zinc	***40.0***		***J***	***A***	***30.0***		***J***	***A***				
PH (PH)												
PH	***8.10***		***J***	***H***	***8.30***		***J***	***H***				
TH (pCi/g)												
Thorium-228	***1.00***				***0.9300***							
Thorium-230	***0.8500***				***0.5700***							
Thorium-232	***1.00***				***0.9100***							

OEES Technical Information Systems RGEN Ver. 2a

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH011				RH012				RH012RE			
OGDEN ID	BCBS03S01				BCSS05S01							
Date Sampled	6/11/98				6/11/98							
Operational Unit	BCHOA BELL CREEK				BCHOA BELL CREEK							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
TOC (MG/KG)												
TOC	***17,300***											
U (pCi/g)												
Uranium-233/234	***0.8800***				***0.5800***							
Uranium-235	***0.0700***				***0.0300***	***J***	***J***					
Uranium-238	***0.7700***				***0.6100***							

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH013				RH013RE				RH014			
OGDEN ID	BCBS04S01				BCBS04S01				BCSS06S01			
Date Sampled	6/11/98				6/11/98				6/11/98			
Operational Unit	BCHOA BELL CREEK				BCHOA BELL CREEK				BCHOA BELL CREEK			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD	12.0	U	U						9.70	U	U	
OCDD	***34.0***								***110***			
TOTAL HPCDD	12.0	U	U						***13.0***	***U***		-
TOTAL HPCDF	12.0	U	U						9.70	U	U	
TOTAL TEQ	***0.0340***								***0.1100***			
340.2 (MG/KG)												
Fluoride	***1.30***								***2.70***			
376.1 (MG/KG)												
Sulfide, Total												
8021A (UG/KG)												
Acetone	58.0	U	U						60.0	U	U	
ANIONS (MG/KG)												
Chloride	***31.0***								***12.0***			
GAM (pCi/g)												
Cesium-137	0.0230	U	U						***0.0340***			
Potassium-40	***22.0***								***23.0***			
Radium-226	***0.0480***								***0.5400***			
Thorium-228	***0.8000***								***0.7800***			
H3 (pCi/g)												
Tritium	***0.1700***	***J***	***J***		0.1200	U	U		***0.3000***	***J***	***J***	
METALSRT (MG/KG)												
Aluminum	***3,400***		***J***	***A***					***4,100***		***J***	***A***
Arsenic	6.00	U	U						6.00	U	U	
Barium	***22.0***		***J***	***A***					***27.0***		***J***	***A***
Chromium	***6.00***								***7.00***			
Cobalt	2.00	U	U						***3.00***			
Copper	***3.00***								***4.00***			
Lead	6.00	U	U						6.00	U	U	
Nickel	6.00	U	U						6.00	U	U	
Vanadium	***12.0***								***13.0***			
Zinc	***23.0***		***J***	***A***					***26.0***		***J***	***A***
PH (PH)												
PH	***8.10***		***J***	***H***					***8.10***		***J***	***H***
TH (pCi/g)												
Thorium-228	***0.8300***								***0.9200***			
Thorium-230	***0.6900***								***0.5800***			
Thorium-232	***0.9200***								***0.9800***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH013				RH013RE				RH014			
OGDEN ID	BCBS04S01								BCSS06S01			
Date Sampled	6/11/98								6/11/98			
Operational Unit	BCHOA BELL CREEK								BCHOA BELL CREEK			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
TOC (MG/KG)												
TOC												
U (pCi/g)												
Uranium-233/234	***0.4400***								***0.4300***			
Uranium-235	0.0400	U	U						0.0500	U	U	
Uranium-238	***0.4200***								***0.5200***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH014RE				RH015				RH016			
OGDEN ID	BCSS06S01				BCSS07S01				BCBS05S01			
Date Sampled	6/11/98				6/11/98				6/11/98			
Operational Unit	BCHOA BELL CREEK				BCHOA BELL CREEK				BCHOA BELL CREEK			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD					16.0	U	U		***21.0***			
OCDD					31.0	U	U		***340***			
TOTAL HPCDD					16.0	U	U		***38.0***			
TOTAL HPCDF					16.0	U	U		***18.0***	***U***		-
TOTAL TEQ					***0.000000***				***0.5500***			
340.2 (MG/KG)												
Fluoride					***12.0***				***2.40***			
376.1 (MG/KG)												
Sulfide, Total												
8021A (UG/KG)												
Acetone					66.0	U	U		65.0	U	U	
ANIONS (MG/KG)												
Chloride					***26.0***				***19.0***			
GAM (pCi/g)												
Cesium-137					0.0150	U	U		0.0250	U	U	
Potassium-40					***19.0***				***22.0***			
Radium-226					***1.40***				***0.6500***			
Thorium-228					***1.10***				***0.8100***			
H3 (pCi/g)												
Tritium	0.1300	U	U		0.0900	U	U		***0.2600***	***J***	***J***	
METALSRT (MG/KG)												
Aluminum					***8,500***		***J***	***A***	***4,500***		***J***	***A***
Arsenic					7.00	U	U		6.00	U	U	
Barium					***110***		***J***	***A***	***31.0***		***J***	***A***
Chromium					***13.0***				***8.00***			
Cobalt					***4.00***				***4.00***			
Copper					***5.00***				***4.00***			
Lead					***8.00***				6.00	U	U	
Nickel					7.00	U	U		6.00	U	U	
Vanadium					***20.0***				***15.0***			
Zinc					***39.0***		***J***	***A***	***29.0***		***J***	***A***
PH (PH)												
PH					***8.30***		***J***	***H***	***8.00***		***J***	***H***
TH (pCi/g)												
Thorium-228					***1.00***				***0.8700***			
Thorium-230					***0.5500***				***0.5600***			
Thorium-232					***0.8300***				***0.8700***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH014RE				RH015				RH016			
OGDEN ID					BCSS07S01				BCBS05S01			
Date Sampled					6/11/98				6/11/98			
Operational Unit					BCHOA BELL CREEK				BCHOA BELL CREEK			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
TOC (MG/KG)												
TOC												
U (pCi/g)												
Uranium-233/234					***0.5400***				***0.5700***			
Uranium-235					***0.0300***	***J***	***J***		***0.0300***	***J***	***J***	
Uranium-238					***0.6800***				***0.5000***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH016RE				RH025				Intentionally Blank			
OGDEN ID	BCBS05S01				BCBS06S01							
Date Sampled	6/11/98				6/12/98							
Operational Unit	BCHOA BELL CREEK				BCHOA BELL CREEK							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD					4.90	U	U					
OCDD					***11.0***							
TOTAL HPCDD					4.90	U	U					
TOTAL HPCDF					4.90	U	U					
TOTAL TEQ					***0.0110***							
340.2 (MG/KG)												
Fluoride					***2.10***							
376.1 (MG/KG)												
Sulfide, Total												
8021A (UG/KG)												
Acetone					57.0	U	U					
ANIONS (MG/KG)												
Chloride					***14.0***							
GAM (pCi/g)												
Cesium-137					0.0130	U	U					
Potassium-40					***24.0***							
Radium-226					***0.6000***							
Thorium-228					***0.6800***							
H3 (pCi/g)												
Tritium	0.1200	U	U		0.0800	U	U					
METALSRT (MG/KG)												
Aluminum					***3,300***							
Arsenic					6.00	U	U					
Barium					***23.0***							
Chromium					***7.00***							
Cobalt					2.00	U	U					
Copper					***5.00***							
Lead					6.00	U	U					
Nickel					***7.00***							
Vanadium					***15.0***							
Zinc					***24.0***		***J***	***A***				
PH (PH)												
PH					***8.40***		***J***	***H***				
TH (pCi/g)												
Thorium-228					***0.7000***							
Thorium-230					***0.5900***							
Thorium-232					***0.5400***		***J***	***E***				

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 5

BCHOA BELL CREEK SOIL SAMPLING RESULTS

EPA NO	RH016RE				RH025				Intentionally Blank			
OGDEN ID					BCBS06S01							
Date Sampled					6/12/98							
Operational Unit					BCHOA BELL CREEK							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
TOC (MG/KG)												
TOC												
U (pCi/g)												
Uranium-233/234					***0.4900***							
Uranium-235					***0.0300***	*J*	*J*					
Uranium-238					***0.5100***							

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 6

SSFL DRAINAGES SOIL SAMPLING RESULTS

EPA NO	RH021				RH021RE				RH030			
OGDEN ID	BCSS08S01				BCSS08S01				BCBS07S01			
Date Sampled	6/12/98				6/12/98				6/15/98			
Operational Unit	BC RD DRAINAGES				BC RD DRAINAGES				BC RD DRAINAGES			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD	***6.40***								***12.0***			
OCDD	***69.0***								***150***		*J*	*F*
TOTAL HPCDD	***12.0***								***23.0***			
TOTAL HPCDF	***5.60***	*U*		-					***7.10***	*D*	*J*	*F,*10*
TOTAL HXCDD	5.00	U	U						***6.10***	*U*		-
TOTAL HXCDF	5.00	U	U						***7.50***	*U*		-
TOTAL TCDF	0.9900	U	U						0.9900	U	U	
TOTAL TEQ	***0.1330***								***0.2700***			
340.2 (MG/KG)												
Fluoride	***1.70***								1.20	U	U	
ANIONS (MG/KG)												
Chloride	11.0	U	U						12.0	U	U	
GAM (pCi/g)												
Potassium-40	***24.0***								***23.0***			
Radium-226	***0.5800***								***0.8400***			
Thorium-228	***0.7100***								***1.20***			
H3 (pCi/g)												
Tritium	***0.3000***	*J*	*J*		0.1300	U	U		0.0900	U	U	
METALSRT (MG/KG)												
Aluminum	***4,900***								***4,900***			
Barium	***31.0***								***35.0***			
Chromium	***9.00***								***11.0***			
Cobalt	***3.00***								***5.00***			
Copper	***5.00***								***5.00***			
Lead	***6.00***								6.00	U	U	
Nickel	***6.00***								***9.00***			
Vanadium	***17.0***								***19.0***			
Zinc	***30.0***		*J*	*A*					***37.0***		*J*	*A*
PH (PH)												
PH	***8.30***		*J*	*H*					***7.80***		*J*	*H*
TH (pCi/g)												
Thorium-228	***0.8800***								***1.20***			
Thorium-230	***0.8300***								***0.7100***			
Thorium-232	***1.00***								***1.00***		*J*	*E*
U (pCi/g)												
Uranium-233/234	***0.5700***								***0.7300***			
Uranium-235	***0.0300***	*J*	*J*						***0.0400***	*J*	*J*	
Uranium-238	***0.5500***								***0.6800***			

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TABLE 6

SSFL DRAINAGES SOIL SAMPLING RESULTS

EPA NO	RH031				RH032				Intentionally Blank			
OGDEN ID	BCBS08S01				BCSS10S01							
Date Sampled	6/15/98				6/15/98							
Operational Unit	BC RD DRAINAGES				BC RD DRAINAGES							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
1,2,3,4,6,7,8-HPCDD	***12.0***				5.00	U	U					
OCDD	***190***		***J***	***F***	***93.0***							
TOTAL HPCDD	***25.0***				***9.70***	***U***		-				
TOTAL HPCDF	***7.10***	***U***	***J***	****10,-***	5.00	U	U					
TOTAL HXCDD	***5.40***	***U***		-	5.00	U	U					
TOTAL HXCDF	***5.80***	***U***	***J***	****10,-***	5.00	U	U					
TOTAL TCDF	***2.20***				1.00	U	U					
TOTAL TEQ	***0.3100***				***0.0930***							
340.2 (MG/KG)												
Fluoride	1.20	U	U		1.30	U	U					
ANIONS (MG/KG)												
Chloride	12.0	U	U		***13.0***							
GAM (pCi/g)												
Potassium-40	***22.0***				***22.0***							
Radium-226	***0.6700***				***0.5400***							
Thorium-228	***1.10***				***0.8300***							
H3 (pCi/g)												
Tritium	0.0900	U	U		0.0900	U	U					
METALSRT (MG/KG)												
Aluminum	***3,900***				***4,000***							
Barium	***37.0***				***39.0***							
Chromium	***6.00***				***5.00***							
Cobalt	***6.00***				***3.00***							
Copper	***4.00***				***6.00***							
Lead	6.00	U	U		6.00	U	U					
Nickel	6.00	U	U		6.00	U	U					
Vanadium	***15.0***				***14.0***							
Zinc	***28.0***		***J***	***A***	***27.0***		***J***	***A***				
PH (PH)												
PH	***8.00***		***J***	***H***	***8.30***		***J***	***H***				
TH (pCi/g)												
Thorium-228	***1.30***				***0.6600***							
Thorium-230	***1.00***				***0.3500***							
Thorium-232	***1.50***		***J***	***E***	***0.7900***		***J***	***E***				
U (pCi/g)												
Uranium-233/234	***0.7200***				***0.3600***							
Uranium-235	***0.0500***				0.0400	U	U					
Uranium-238	***0.6700***				***0.3700***							

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Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 7

BACKGROUND SOIL SAMPLING RESULTS

EPA NO	RH026				RH026RE				RH033			
OGDEN ID	BCSS09S01				BCSS09S01				BCSS11S01			
Date Sampled	6/12/98				6/12/98				6/15/98			
Operational Unit	BC BACKGROUND				BC BACKGROUND				BC BACKGROUND			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
OCDD	9.90	U	U						***46.0***		***J***	***F***
TOTAL TCDF	0.9900	U	U						***3.10***	***U***	***J***	****10,-***
TOTAL TEQ	***0.000000***								***0.0460***			
340.2 (MG/KG)												
Fluoride	***2.20***								***1.70***			
8270SIM (UG/KG)												
Pyrene	***39.0***								33.0	U	U	
ANIONS (MG/KG)												
Chloride	***12.0***								11.0	U	U	
Nitrate	11.0	U	UJ	H					11.0	U	UJ	H
GAM (pCi/g)												
Cesium-137	0.0330	U	U						***0.0800***			
Manganese-54	0.0320	U	U						0.0700	U	U	
Potassium-40	***23.0***								***22.0***			
Radium-226	***1.10***								***1.50***			
Thorium-228	***1.50***								***1.00***			
H3 (pCi/g)												
Tritium	***0.2400***	***J***	***J***		0.1100	U	U		0.0800	U	U	
METALSRT (MG/KG)												
Aluminum	***5,600***								***13,000***			
Arsenic	***9.00***								5.00	U	U	
Barium	***36.0***								***97.0***			
Beryllium	0.5000	U	U						***0.7000***			
Cadmium	1.00	U	U						***1.00***			
Chromium	***9.00***								***17.0***			
Cobalt	***4.00***								***5.00***			
Copper	***6.00***								***8.00***			
Lead	***7.00***								***10.0***			
Nickel	***7.00***								***14.0***			
Vanadium	***19.0***								***28.0***			
Zinc	***35.0***		***J***	***A***					***32.0***		***J***	***A***
PH (PH)												
PH	***7.20***		***J***	***H***					***7.00***		***J***	***H***
TH (pCi/g)												
Thorium-228	***0.8700***								***0.7100***			
Thorium-230	***0.7000***								***1.20***			
Thorium-232	***0.9800***								***0.6600***		***J***	***E***

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 7

BACKGROUND SOIL SAMPLING RESULTS

EPA NO	RH036				RH041				RH046			
OGDEN ID	BCSS12S01				BCSS13S01				BCBS09S01			
Date Sampled	6/15/98				6/16/98				6/16/98			
Operational Unit	BC BACKGROUND				BC BACKGROUND				BC BACKGROUND			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
OCDD	***17.0***		***J***	***F***	10.0	U	U		20.0	U	U	
TOTAL TCDF	0.9900	U	U		1.00	U	U		2.00	U	U	
TOTAL TEQ	***0.0170***				***0.000000***				***0.000000***			
340.2 (MG/KG)												
Fluoride	***4.30***				***2.70***				***6.70***			
8270SIM (UG/KG)												
Pyrene	33.0	U	U		32.0	U	U		36.0	U	U	
ANIONS (MG/KG)												
Chloride	***15.0***				11.0	U	U		13.0	U	U	
Nitrate	***16.0***		***J***	***H***	11.0	U	U		***37.0***			
GAM (pCi/g)												
Cesium-137	***0.1500***				***0.1000***				0.1800	U	U	
Manganese-54	0.0390	U	U		0.0350	U	U		0.0210	U	U	
Potassium-40	***25.0***				***24.0***				***19.0***			
Radium-226	***1.20***				***1.20***				***1.30***			
Thorium-228	***1.80***				***1.40***				***1.60***			
H3 (pCi/g)												
Tritium	0.0900	U	U		0.0800	U	U		0.0900	U	U	
METALSRT (MG/KG)												
Aluminum	***11,000***				***13,000***		***J***	***A***	***18,000***		***J***	***A***
Arsenic	6.00	U	U		5.00	U	U		***14.0***			
Barium	***82.0***				***84.0***		***J***	***A***	***140***		***J***	***A***
Beryllium	***0.7000***				***1.10***				***1.10***			
Cadmium	1.00	U	U		1.00	U	U		1.00	U	U	
Chromium	***16.0***				***22.0***				***29.0***			
Cobalt	***6.00***				***8.00***				***12.0***			
Copper	***9.00***				***17.0***				***28.0***			
Lead	***14.0***				***25.0***				***29.0***			
Nickel	***12.0***				***17.0***				***29.0***			
Vanadium	***30.0***				***43.0***				***54.0***			
Zinc	***56.0***		***J***	***A***	***78.0***		***J***	***A***	***110***		***J***	***A***
PH (PH)												
PH	***6.20***		***J***	***H***	***7.20***		***J***	***H***	***7.90***		***J***	***H***
TH (pCi/g)												
Thorium-228	***0.4400***		***J***	***F***	***0.5200***				***0.4300***		***J***	***F***
Thorium-230	***0.4200***				***0.4900***				***0.4800***			
Thorium-232	***0.5400***		***J***	***E***	***0.4900***		***J***	***E***	***0.4400***		***J***	***E***

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 7

BACKGROUND SOIL SAMPLING RESULTS

EPA NO	RH036				RH041				RH046			
OGDEN ID	BCSS12S01				BCSS13S01				BCBS09S01			
Date Sampled	6/15/98				6/16/98				6/16/98			
Operational Unit	BC BACKGROUND				BC BACKGROUND				BC BACKGROUND			
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
U (pCi/g)												
Uranium-233/234	***0.7700***				***0.8000***				***0.9400***			
Uranium-235	***0.0300***	***J***	***J***		***0.0500***				***0.0300***	***J***	***J***	
Uranium-238	***0.7400***				***0.8000***				***0.9900***			

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 7

BACKGROUND SOIL SAMPLING RESULTS

EPA NO	RH047				RH048				Intentionally Blank			
OGDEN ID	BCSS14S01				BCSS14D01							
Date Sampled	6/16/98				6/16/98							
Operational Unit	BC BACKGROUND				BC BACKGROUND							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
1613B (NG/KG)												
OCDD	14.0	U	U		***13.0***	***U***	***J***	***F,-***				
TOTAL TCDF	1.40	U	U		1.30	U	U					
TOTAL TEQ	***0.000000***				***0.0130***							
340.2 (MG/KG)												
Fluoride	***3.50***				***4.20***							
8270SIM (UG/KG)												
Pyrene	34.0	U	U		34.0	U	U					
ANIONS (MG/KG)												
Chloride	12.0	U	U		12.0	U	U					
Nitrate	***13.0***		***J***	***H***	12.0	U	U					
GAM (pCi/g)												
Cesium-137	***0.0360***				***0.1000***							
Manganese-54	***0.0240***				0.0370	U	U					
Potassium-40	***21.0***				***21.0***							
Radium-226	***1.10***				***1.20***							
Thorium-228	***1.30***				***1.50***							
H3 (pCi/g)												
Tritium	0.0800	U	U		0.0900	U	U					
METALSRT (MG/KG)												
Aluminum	***16,000***		***J***	***A***	***16,000***		***J***	***A***				
Arsenic	***16.0***				***14.0***							
Barium	***87.0***		***J***	***A***	***91.0***		***J***	***A***				
Beryllium	***1.00***				***1.10***							
Cadmium	1.00	U	U		1.00	U	U					
Chromium	***25.0***				***26.0***							
Cobalt	***10.0***				***11.0***							
Copper	***30.0***				***28.0***							
Lead	***23.0***				***26.0***							
Nickel	***20.0***				***23.0***							
Vanadium	***45.0***				***46.0***							
Zinc	***97.0***		***J***	***A***	***110***		***J***	***A***				
PH (PH)												
PH	***8.30***		***J***	***H***	***8.30***		***J***	***H***				
TH (pCi/g)												
Thorium-228	***0.5000***		***J***	***F***	***1.20***							
Thorium-230	***0.4900***				***1.10***							
Thorium-232	***0.6600***		***J***	***E***	***1.10***		***J***	***E***				

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

TABLE 7

BACKGROUND SOIL SAMPLING RESULTS

EPA NO	RH047				RH048				Intentionally Blank			
OGDEN ID	BCSS14S01				BCSS14D01							
Date Sampled	6/16/98				6/16/98							
Operational Unit	BC BACKGROUND				BC BACKGROUND							
Method Analyte	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE	ANALYTICAL RESULT	LAB QUAL	REV QUAL	QUAL CODE
U (pCi/g)												
Uranium-233/234	***0.9300***				***0.9000***							
Uranium-235	***0.0600***				***0.0500***							
Uranium-238	***0.9000***				***0.9100***							

Results reported only if analytes detected in one or more samples.

Detection limit shown for nondetected result. Qualifiers defined in Appendix E.

Trailing zeros caused by table formatting; does not reflect lab precision.

Table 8 (Page 1 of 2)

SUMMARY OF DETECTED CONCENTRATIONS

Chemical Group	Analytical Method	Analyte Detected	Units	Number of Samples Analyzed[a]	Number of Samples with Detects	Concentration Range[b]	Sample with Maximum Concentration[c]	Location
VOCs	8021A	Acetone	µg/kg	27	1	ND - 470	BCBS03S01	Bell Creek, near Equestrian Center
SVOCs	8270SIM	Pyrene	µg/kg	24	1	ND - 39	BCSS09S01	SSFL, Undeveloped Land (water tank)
TOC	ASTM D1479	TOC	mg/kg	1	1	17,300	BCBS03S01	Bell Creek, near Equestrian Center
Sulfide	376.1	Sulfide, Total	mg/kg	1	1	110	BCBS03S01	Bell Creek, near Equestrian Center
Fluoride	340.2	Fluoride	mg/kg	24	21	ND - 13	BCBS03S01	Bell Creek, near Equestrian Center
Anions	300	Chloride	mg/kg	24	13	ND - 70	BCBS03S01	Bell Creek, near Equestrian Center
Anions	300	Nitrate	mg/kg	24	4	ND - 37	BCBS09S01	Bell Canyon, Undeveloped Land (east)
pH	9045	pH	pH	24	28	6.2 - 8.4	BCBS06S01	Bell Creek, Bell Canyon Park
Dioxins/Furans	1613B	Total TEQ	ng/kg	24	17	ND - 0.55	BCBS05S01	Bell Creek, downstream of NPDES-1
Metals	6010	Aluminum	mg/kg	24	24	3,300 - 18,000	BCSS03S01	Bell Canyon, Resident 3
							BCSS04S01	Bell Canyon, Resident 3
							BCBS09S01	Bell Canyon, Undeveloped Land (east)
	7060	Arsenic	mg/kg	24	8	ND - 16	BCSS14S01	SSFL, Undeveloped Land (east)
	7010	Barium	mg/kg	24	24	22 - 170	BCSS04S01	Bell Canyon, Resident 3
	6010	Beryllium	mg/kg	24	9	0.6 - 1.1	BCSS13S01	Bell Canyon, Undeveloped Land (west)
							BCBS09S01	Bell Canyon, Undeveloped Land (east)
	6010	Cadmium	mg/kg	24	1	ND - 1	BCSS11S01	Bell Canyon, Undeveloped Land (south)
	6010	Chromium (total)	mg/kg	24	24	5 - 30	BCSS03S01	Bell Canyon, Resident 3
	6010	Cobalt	mg/kg	24	22	ND - 12	BCSS03S01	Bell Canyon, Resident 3
							BCSS09S01	Bell Canyon, Undeveloped Land (east)
	6010	Copper	mg/kg	24	24	3 - 30	BCSS14S01	SSFL, Undeveloped Land (east)
	6010	Lead	mg/kg	24	14	ND - 29	BCBS09S01	Bell Canyon, Undeveloped Land (east)
	6010	Nickel	mg/kg	24	17	ND - 30	BCSS03S01	Bell Canyon, Resident 3
	6010	Vanadium	mg/kg	24	24	ND - 54	BCBS09S01	Bell Canyon, Undeveloped Land (east)
	6010	Zinc	mg/kg	24	24	23 - 110	BCSS03S01	Bell Canyon, Resident 3
							BCSS04S01	Bell Canyon, Resident 3
							BCBS09S01	Bell Canyon, Undeveloped Land (east)

Table 8 (Page 2 of 2)

SUMMARY OF DETECTED CONCENTRATIONS

Chemical Group	Analytical Method	Analyte Detected	Units	Number of Samples Analyzed	Number of Samples with Detects	Concentration Range	Sample with Maximum Concentration	Location
Gamma Scan	901.1	Cesium-137	pCi/g	24	10	ND - 0.15	BCSS03S01	Bell Canyon, Resident 3
	901.1	Manganese-54	pCi/g	24	1	ND - 0.02	BCSS14S01	SSFL, Undeveloped Land (east)
	901.1	Potassium-40	pCi/g	24	24	19 - 25	BCSS12S01	SSFL, Undeveloped Land (Wagon Rd)
	901.1	Radium-226	pCi/g	24	24	0.05 - 1.5	BCSS11S01	Bell Canyon, Undeveloped Land (south)
	901.1	Thorium-228	pCi/g	24	24	0.59 - 1.8	BCSS12S01	SSFL, Undeveloped Land (Wagon Rd)
Tritium	960M	Tritium	pCi/g	35	12	ND - 0.35	BCSS01S01	Bell Canyon, Resident 1
Thorium	EERF 00-07	Thorium-228	pCi/g	24	24	0.43 - 1.3	BCBS08S01	SSFL, upstream of NPDES-2
	EERF 00-07	Thorium-230	pCi/g	24	24	0.35 - 1.4	BCBS02S01	Bell Canyon, Resident 2
	EERF 00-07	Thorium-232	pCi/g	24	24	0.44 - 1.5	BCBS08S01	SSFL, upstream of NPDES-2
Uranium	EERF 00-06	Uranium-233/234	pCi/g	24	24	0.36 - 1	BCSS02S01	Bell Canyon, Resident 1
	EERF 00-06	Uranium-235	pCi/g	24	21	ND - 0.07	BCSS04S01	Bell Canyon, Resident 3
	EERF 00-06	Uranium-238	pCi/g	24	24	0.37 - 1.1	BCSS04S01	Bell Canyon, Resident 3

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Concentration ranges given for analytes detected in one or more soil samples; other analytes not detected in any soil samples. For dioxins, only total TEQ shown.
(c) Multiple sample identifiers provided if maximum detected in more than one sample.

mg/kg = milligrams per kilogram
ND = not detected
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
SVOC = semivolatile organic compound
TEQ = toxic equivalent (calculated)
TOC = total organic carbon
VOC = volatile organic compounds
µg/kg = micrograms per kilogram

Table 9

RESIDENT 1 COMPARISON OF DETECTED COMPOUNDS

Analyte Detected	Analytical Method	Units	Number of Samples Analyzed[a]	Sample Concentration Range	Background Concentration Range	Comparison Value[b]
Fluoride	340.2	mg/kg	2	2.7-5.8	1.7 - 6.7	330
Nitrate	300	mg/kg	2	ND - 12	ND - 37	NE
pH	9045	pH	2	7.1 - 7.8	6.2 - 8.3	NE
Total TEQ	1613B	ng/kg	2	ND - 0.02	ND - 0.046	3.8[c]
Aluminum	6010	mg/kg	2	6,800 - 10,000	5,600 - 18,000	75,000
Arsenic	7060	mg/kg	2	ND - 9	ND - 16	0.38
Barium	7010	mg/kg	2	53 - 76	36 - 140	5,200
Beryllium	6010	mg/kg	2	ND - 0.6	ND - 1.1	150
Chromium (total)	6010	mg/kg	2	9 - 15	9 - 29	210
Cobalt	6010	mg/kg	2	4 - 5	4 -12	3,300
Copper	6010	mg/kg	2	8 - 10	6 - 30	2,800
Lead	6010	mg/kg	2	6 - 8	7 - 29	130
Nickel	6010	mg/kg	2	6 - 11	7 - 29	150
Vanadium	6010	mg/kg	2	17 - 26	19 - 54	520
Zinc	6010	mg/kg	2	37 - 47	32 - 110	22,000
Cesium-137	901.1	pCi/g	2	ND - 0.045	ND - 0.15	9.2
Potassium-40	901.1	pCi/g	2	23	19 - 25	27.6
Radium-226	901.1	pCi/g	2	0.85 - 1.3	1.1 - 1.5	5
Thorium-228	901.1	pCi/g	2	0.98 - 1.4	1 - 1.8	5
Tritium	906M	pCi/g	4	ND - 0.35	ND - 0.24	31,900
Thorium-228	EERF 00-07	pCi/g	2	0.83 - 1.2	0.43 - 1.2	5
Thorium-230	EERF 00-07	pCi/g	2	0.73 - 1.1	0.42 - 1.2	NE
Thorium-232	EERF 00-07	pCi/g	2	0.81 - 1.2	0.44 - 1.1	5
Uranium-233/234	EERF 00-06	pCi/g	2	0.65 - 1	0.77 - 0.94	30
Uranium-235	EERF 00-06	pCi/g	2	0.05 - 0.06	0.03 - 0.06	30
Uranium-238	EERF 00-06	pCi/g	2	0.58 - 0.99	0.74 - 0.99	35

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Health-based comparison values for chemicals based on USEPA PRGs and radionuclides based on DHS release criteria (residential land use).
(c) Only PRG established for dioxin and furan congeners (2,3,7,8-TCDD).

mg/kg = milligrams per kilogram
ND = not detected
NE = not established
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
TEQ = toxic equivalent (calculated)

Table 10

RESIDENT 2 COMPARISON OF DETECTED COMPOUNDS

Analyte Detected	Analytical Method	Units	Number of Samples Analyzed[a]	Sample Concentration Range	Background Concentration Range	Comparison Value[b]
Fluoride	340.2	mg/kg	2	2.4	1.7 - 6.7	330
Chloride	300	mg/kg	2	12 - 15	ND - 15	NE
pH	9045	pH	2	7.7 - 8.1	6.2 - 8.3	NE
Total TEQ	1613B	ng/kg	2	0.044 - 0.184	ND - 0.046	3.8[c]
Aluminum	6010	mg/kg	2	3,300 - 4,000	5600 - 18000	75,000
Barium	7010	mg/kg	2	29 - 61	36 - 140	5,200
Chromium (total)	6010	mg/kg	2	6 - 7	9 - 29	210
Cobalt	6010	mg/kg	2	3	4 - 12	3,300
Copper	6010	mg/kg	2	3 - 5	6 - 30	2,800
Nickel	6010	mg/kg	2	8 - 9	7 - 29	150
Vanadium	6010	mg/kg	2	13 - 14	19 - 54	520
Zinc	6010	mg/kg	2	28	32 - 110	22,000
Potassium-40	901.1	pCi/g	2	21 - 24	19 - 25	27.6
Radium-226	901.1	pCi/g	2	0.5 - 0.93	1.1 - 1.5	5
Thorium-228	901.1	pCi/g	2	0.59 - 1	1 - 1.8	5
Tritium	906M	pCi/g	3	ND - 0.14	ND - 0.24	31,900
Thorium-228	EERF 00-07	pCi/g	2	0.67 - 1.1	0.43 - 1.2	5
Thorium-230	EERF 00-07	pCi/g	2	0.47 - 1.4	0.42 - 1.2	NE
Thorium-232	EERF 00-07	pCi/g	2	0.67 - 0.89	0.44 - 1.1	5
Uranium-233/234	EERF 00-06	pCi/g	2	0.41 - 1	0.77 - 0.94	30
Uranium-235	EERF 00-06	pCi/g	2	0.03 - 0.05	0.03 - 0.06	30
Uranium-238	EERF 00-06	pCi/g	2	0.46 - 0.94	0.74 - 0.99	35

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Health-based comparison values for chemicals based on USEPA PRGs and radionuclides based on DHS release criteria (residential land use).
(c) Only PRG established for dioxin and furan congeners (2,3,7,8-TCDD).

mg/kg = milligrams per kilogram
ND = not detected
NE = not established
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
TEQ = toxic equivalent (calculated)

Table 11

RESIDENT 3 COMPARISON OF DETECTED COMPOUNDS

Analyte Detected	Analytical Method	Units	Number of Samples Analyzed[a]	Sample Concentration Range	Background Concentration Range	Comparison Value[b]
Fluoride	340.2	mg/kg	2	5.4	1.7 - 6.7	330
Chloride	300	mg/kg	2	ND - 12	ND - 15	NE
pH	9045	pH	2	7.8	6.2 - 8.3	NE
Total TEQ	1613B	ng/kg	2	ND - 0.01	ND - 0.046	3.8[c]
Aluminum	6010	mg/kg	2	18,000	5,600 - 18,000	75,000
Arsenic	7060	mg/kg	2	14	ND - 16	0.38
Barium	7010	mg/kg	2	140 - 170	36 - 140	5,200
Beryllium	6010	mg/kg	2	1	ND - 1.1	150
Chromium (total)	6010	mg/kg	2	28 - 30	9 - 29	210
Cobalt	6010	mg/kg	2	11 - 12	4 -12	3,300
Copper	6010	mg/kg	2	26 - 28	6 - 30	2,800
Lead	6010	mg/kg	2	22 - 27	7 - 29	130
Nickel	6010	mg/kg	2	27 - 30	7 - 29	150
Vanadium	6010	mg/kg	2	52	19 - 54	520
Zinc	6010	mg/kg	2	110	32 - 110	22,000
Potassium-40	901.1	pCi/g	2	19 - 20	19 - 25	27.6
Cesium-137	901.1	pCi/g	2	0.089 - 0.15	ND - 0.15	9.2
Radium-226	901.1	pCi/g	2	1.1 - 1.2	1.1 - 1.5	5
Thorium-228	901.1	pCi/g	2	1.5 - 1.6	1 - 1.8	5
Tritium	906M	pCi/g	4	ND - 0.16	ND - 0.24	31,900
Thorium-228	EERF 00-07	pCi/g	2	1.0 - 1.1	0.43 - 1.2	5
Thorium-230	EERF 00-07	pCi/g	2	0.92 - 0.97	0.42 - 1.2	NE
Thorium-232	EERF 00-07	pCi/g	2	0.96 - 1.1	0.44 - 1.1	5
Uranium-233/234	EERF 00-06	pCi/g	2	1	0.77 - 0.94	30
Uranium-235	EERF 00-06	pCi/g	2	0.067 - 0.07	0.03 - 0.06	30
Uranium-238	EERF 00-06	pCi/g	2	0.98 - 1.1	0.74 - 0.99	35

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Health-based comparison values for chemicals based on USEPA PRGs and radionuclides based on DHS release criteria (residential land use).
(c) Only PRG established for dioxin and furan congeners (2,3,7,8-TCDD).

mg/kg = milligrams per kilogram
ND = not detected
NE = not established
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
TEQ = toxic equivalent (calculated)

Table 12

BELL CREEK COMPARISON OF DETECTED COMPOUNDS

Analyte Detected	Analytical Method	Units	Number of Samples Analyzed[a]	Sample Concentration Range	Background Concentration Range	Comparison Value[b]
Acetone	8021A	µg/kg	7	ND - 470	ND	1,400,000
TOC	ASTM D1479	mg/kg	1	17,300	NA	NE
Sulfide, Total	376.1	mg/kg	1	110	NA	NE
Fluoride	340.2	mg/kg	7	1.3 - 13	1.7 - 6.7	330
Chloride	300	mg/kg	7	12 - 70	ND - 15	NE
pH	9045	pH	7	8 - 8.4	6.2 - 8.3	NE
Total TEQ	1613B	ng/kg	7	ND - 0.55	ND - 0.046	3.8[c]
Aluminum	6010	mg/kg	7	3,300 - 8,500	5,600 - 18,000	75,000
Arsenic	7060	mg/kg	7	ND - 8	ND - 16	0.38
Barium	7010	mg/kg	7	22 - 110	36 - 140	5,200
Chromium (total)	6010	mg/kg	7	6 - 15	9 - 29	210
Cobalt	6010	mg/kg	7	ND - 5	4 - 12	3,300
Copper	6010	mg/kg	7	3 - 10	6 - 30	2,800
Lead	6010	mg/kg	7	ND - 9	7 - 29	130
Nickel	6010	mg/kg	7	ND - 17	7 - 29	150
Vanadium	6010	mg/kg	7	12 - 30	19 - 54	520
Zinc	6010	mg/kg	7	23 - 40	32 - 110	22,000
Cesium-137	901.1	pCi/g	7	ND - 0.034	ND - 0.15	9.2
Potassium-40	901.1	pCi/g	7	19 - 24	19 - 25	27.6
Radium-226	901.1	pCi/g	7	0.048 - 1.4	1.1 - 1.5	5
Thorium-228	901.1	pCi/g	7	0.68 - 1.4	1 - 1.8	5
Tritium	906M	pCi/g	11	ND - 0.3	ND - 0.24	31,900
Thorium-228	EERF 00-07	pCi/g	7	0.7 - 1	0.43 - 1.2	5
Thorium-230	EERF 00-07	pCi/g	7	0.55 - 0.85	0.42 - 1.2	NE
Thorium-232	EERF 00-07	pCi/g	7	0.54 - 1	0.44 - 1.1	5
Uranium-233/234	EERF 00-06	pCi/g	7	0.43 - 0.88	0.77 - 0.94	30
Uranium-235	EERF 00-06	pCi/g	7	ND - 0.07	0.03 - 0.06	30
Uranium-238	EERF 00-06	pCi/g	7	0.42 - 0.77	0.74 - 0.99	35

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Health-based comparison values for chemicals based on USEPA PRGs and radionuclides based on DHS release criteria (residential land use).
(c) Only PRG established for dioxin and furan congeners (2,3,7,8-TCDD).

mg/kg = milligrams per kilogram
NA = not analyzed
ND = not detected
NE = not established
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
TEQ = toxic equivalent (calculated)
TOC = total organic carbon
VOC = volatile organic compound
µg/kg = micrograms per kilogram

Table 13

SSFL DRAINAGES COMPARISON OF DETECTED COMPOUNDS

Analyte Detected	Analytical Method	Units	Number of Samples Analyzed[a]	Sample Concentration Range	Background Concentration Range	Comparison Value[b]
Fluoride	340.2	mg/kg	4	ND - 1.7	1.7 - 6.7	330
Chloride	300	mg/kg	4	ND - 13	ND - 15	NE
pH	9045	pH	4	7.8 - 8.3	6.2 - 8.3	NE
Total TEQ	1613B	ng/kg	4	0.09 - 0.31	ND - 0.046	3.8[c]
Aluminum	6010	mg/kg	4	3,900 - 4,900	5,600 - 18,000	75,000
Barium	7010	mg/kg	4	31 - 39	36 - 140	5,200
Chromium (total)	6010	mg/kg	4	5 - 11	9 - 29	210
Cobalt	6010	mg/kg	4	3 - 6	4 - 12	3,300
Copper	6010	mg/kg	4	4 - 6	6 - 30	2,800
Lead	6010	mg/kg	4	ND - 6	7 - 29	130
Nickel	6010	mg/kg	4	ND - 9	7 - 29	150
Vanadium	6010	mg/kg	4	14 - 19	19 - 54	520
Zinc	6010	mg/kg	4	27 - 37	32 - 110	22,000
Potassium-40	901.1	pCi/g	4	22 - 24	19 - 25	27.6
Radium-226	901.1	pCi/g	4	0.54 - 0.84	1.1 - 1.5	5
Thorium-228	901.1	pCi/g	4	0.71 - 1.2	1 - 1.8	5
Tritium	906M	pCi/g	5	ND - 0.3	ND - 0.24	31,900
Thorium-228	EERF 00-07	pCi/g	4	0.66 - 1.3	0.43 - 1.2	5
Thorium-230	EERF 00-07	pCi/g	4	0.35 - 1	0.42 - 1.2	NE
Thorium-232	EERF 00-07	pCi/g	4	0.79 - 1.5	0.44 - 1.1	5
Uranium-233/234	EERF 00-06	pCi/g	4	0.36 - 0.73	0.77 - 0.94	30
Uranium-235	EERF 00-06	pCi/g	4	ND - 0.05	0.03 - 0.06	30
Uranium-238	EERF 00-06	pCi/g	4	0.37 - 0.68	0.74 - 0.99	35

Notes:

(a) Includes all quality assurance soil sample and reanalysis results.
(b) Health-based comparison values for chemicals based on USEPA PRGs and radionuclides based on DHS release criteria (residential land use).
(c) Only PRG established for dioxin and furan congeners (2,3,7,8-TCDD).

mg/kg = milligrams per kilogram
ND = not detected
NE = not established
ng/kg = nanograms per kilogram
pCi/g = picoCuries per gram
TEQ = toxic equivalent (calculated)