MULTI-MEDIA SAMPLING REPORT FOR THE BRANDEIS-BARDIN INSTITUTE AND THE SANTA MONICA MOUNTAINS CONSERVANCY

VOLUME I

MARCH 10, 1993

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ABBREVIATIONS

ANOVA	Analysis of variance
BB/BBI	Brandeis-Bardin Institute (also Brandeis-Bardin)
Cal-EPA	California Environmental Protection Agency
CARB	California Air Resources Board
Cs-137	Cesium-137
DC	Duplicate Count
DHS	California Department of Health Services
D.L.	Detection Limit
DOE	Department of Energy
DTSC	Department of Toxic Substances Control
FD	Field Duplicate (Blind)
ft	Foot
g	Gram
GRC	Groundwater Resources Consultants
H-3	Tritium
HCl	Hydrochloric Acid
HNO_3	Nitric Acid
I-129	Iodine-129
kg	Kilograms
L	Liter
LD	Laboratory Duplicate
LS-TI	Laboratory Split from the Teledyne-Illinois Laboratory
LS-TN	Laboratory Split from the Teledyne-New Jersey Laboratory
MCL	Maximum Contaminant Limit
mg	Milligrams
mg/kg	Milligrams per kilogram
M/H	McLaren/Hart
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PAH	Polynuclear Aromatic Hydrocarbon
ppb	Parts per Billion
ppm	Parts per Million
pCi	Picocuries
pCi/kg(dry)	Picocuries per Kilogram of Dried Sample
pCi/kg(wet)	Picocuries per Kilogram of Undried Sample
pCi/L	Picocuries per Liter of Water
Pu-238	Plutonium-238
Pu-239	Plutonium-239
QA/QC	Quality Assurance/Quality Control
R.L.	Reporting Limit
RPD	Relative Percent Difference
RWQCB	Regional Water Quality Control Board
SM	Santa Monica Mountains Conservancy (also the Conservancy)
SMMNRA	Santa Monica Mountains National Recreation Area
Sr-90	Strontium-90
SSFL	Santa Susana Field Laboratory

ABBREVIATIONS

SVOC	Semi-volatile Organic Compound
ug	Micrograms
ug/kg	Micrograms per Kilogram
uR/hr	Microrems per Hour
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
<	Less Than
+/-	Plus or Minus

EXECUTIVE SUMMARY

This document presents the results of a multi-media sampling program which was conducted to determine if chemicals or radionuclides had migrated or had been deposited on two properties adjacent to the north/northwest property line of Rockwell International Corporation, Rocketdyne Division's Santa Susana Field Laboratory (SSFL). The two properties (referred to as study areas) were the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy (hereafter, Brandeis-Bardin and the Conservancy, respectively). In addition to the study areas, six background locations that were from 1.5 to 12.5 miles of the SSFL were sampled to provide data on background concentrations of metals and radionuclides.

Number and Types of Analyses. Eighteen soil samples were collected from background areas and 118 soil/sediment samples were collected from the study areas. All soil/sediment samples were analyzed for: 37 volatile organic compounds (VOCs), 67 semi-volatile organic compounds (SVOCs), 13 priority pollutant metals, 75 naturally occurring and man made radionuclides as a gamma scan as well as, tritium, isotopic plutonium (i.e., plutonium-238 and plutonium-239), iodine-129, and strontium-90. One surface water sample was collected from a background area and seven surface water samples were collected from the study areas. All surface water samples were analyzed for the same chemicals and radionuclides cited for soils/sediments as well as for gross alpha and gross beta radioactivity. Groundwater was sampled from two wells (a minimum of two times each) and analyzed for the same analytes as surface water except for metals. Fifteen fruit samples were collected from background areas. Nine fruit samples were collected at the study areas. All fruit samples were analyzed for the full suite of radionuclides listed above.

Quality Assurance/Quality Control. A rigorous quality assurance/quality control (QA/QC) program was implemented during sampling to assure that the data were valid. Comparison of the QA/QC samples (blind field duplicates, field split samples, and interlaboratory split samples) to their respective scheduled sample showed an overall agreement of approximately 97 percent. This level of agreement (completeness) demonstrated that the data were valid.

Data Evaluation. Soil radionuclide and heavy metal data from the human use areas were evaluated statistically by comparing to background data. Sediment data from the Watersheds were not evaluated statistically because they were not randomly selected. Organic chemical data were not evaluated statistically because organic chemicals are generally not naturally occurring. Fruit and water samples were not evaluated statistically because there were not enough background data points.

Results of Chemical Analyses. No VOCs or SVOCs associated with activities at the SSFL were detected in any of the 118 soil/sediment samples collected in the study areas. Groundwater at an irrigation well (the Well by the Gate at the Conservancy) had trichloroethene (TCE) at 10 micrograms per liter of water (ug/L) and 9 ug/L. It is assumed that the TCE has migrated from the SSFL because elevated levels have been detected beneath the site. The Well by the Gate has been added to Rocketdyne's ongoing groundwater monitoring program. No other chemicals associated with Rocketdyne were detected in the surface water or groundwater samples collected.

Some organic chemicals that were not associated with Rocketdyne activities were also reported in this study. Toluene was detected in two soil samples at the Visitor Center Parking Lot at the Conservancy at 7 and 9 micrograms per kilogram of soil (ug/kg).

Toluene is a component of gasoline and is found in partially combusted gasoline such as car exhaust.

At Brandeis-Bardin, 4-methylphenol, a chemical found in disinfectants and pesticides, was detected in one soil sample at the Dormitory Area at 670 ug/kg; bis(2-ethylhexyl)phthalate, one of the most abundantly produced plasticizers, was found in five soil samples at the Counselor-in-Training Area ranging from 370 to 8,500 ug/kg; and 4,4'-dichlorodiphenyldichloroethene (4,4'-DDE), a breakdown product of 4,4'-dichlorodiphenyldichloroethane (4,4'-DDT), was detected in one soil sample at the Vegetable Garden at 340 ug/kg.

Heavy metals from Rocketdyne activities were reported at two locations: lead in all five soil samples taken from the Former Rocketdyne Employee Shooting Range at the Conservancy ranging from 59 to 280 milligrams per kilogram of soil (mg/kg) and mercury in one of nine sediment samples at the Sodium Burn Pit Watershed at Brandeis-Bardin at 0.35 mg/kg. The Former Rocketdyne Employee Shooting Range was previously used for skeet and trap shooting practice and lead shot was visible on the ground throughout the area. Rocketdyne began cleanup of the lead shot on October 19, 1992. Mercury was known to be contained in the former Sodium Burn Pit, which is currently undergoing excavation and cleanup.

Zinc was detected in one of six sediment samples taken at the Radioactive Materials Disposal Facility (RMDF) Watershed at a concentration of 120 mg/kg, which is greater than the ninety-fifth percentile[1] of the measured background concentration for zinc of 112 mg/kg. Although this value is outside of the criteria established in the report, the concentration is the same as two soil samples collected at one of the background areas.

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[1] The ninety-fifth percentile is equal to the mean of all background area samples plus two times the standard deviation.

Radionuclide Results. Four radionuclides were detected in sediment samples in the watersheds at Brandeis-Bardin which exceeded the ninety-fifth percentile of the measured background concentrations in soil: tritium, strontium-90, cesium-137, and plutonium-238. Two radionuclides were detected in two surface water samples from the RMDF. Radionuclide data from the fruit from the study areas were below background. No radionuclides were detected above measured background in any of the human activity areas at either the Conservancy or Brandeis-Bardin. Radionuclides were not detected in groundwater.

Tritium exceeded the ninety-fifth percentile of the measured background [552 picocuries per liter of water (pCi/L] in seven of the 118 soil/sediment samples. Tritium concentrations in these sediment samples were: 1,100 ±100 picocuries per liter (pCi/L), 990 ±150 pCi/L, 1,300 ±300 pCi/L, 1,300 ±200 pCi/L, and 1,500 ±200 pCi/L in the RMDF Watershed and 10,800 ±300 pCi/L and 9,810 ±330 pCi/L in the Building 59 Watershed. Of the seven surface water samples, tritium was detected in the RMDF Watershed at a concentration of 1,500 ±100 pCi/L. [The maximum contaminant limit (MCL) for tritium in drinking water is 20,000 pCi/L.] It is concluded that the tritium was from off-site migration from the SSFL.

Of the 118 soil/sediment samples collected, strontium-90 was detected in five sediment samples above the ninety-fifth percentile of the measured background [0.07 pCi/g(dry)] at the RMDF Watershed [0.08 ±0.01 pCi/g(dry), 0.09 ±0.01 pCi/g(dry), and 0.15 ±0.02 pCi/g(dry)] and the Sodium Reactor Experiment Watershed [0.08 ±0.002 pCi/g(dry) and 0.09 ±0.02 pCi/g(dry)]. Strontium-90 was also detected in two associated surface water samples at the RMDF at 1.1 ±0.03 pCi/L and 1.8 ±0.05 pCi/L. (The MCL for strontium-90 in drinking water is 8.0 pCi/L).

Cesium-137 and plutonium-238 were also detected in the watersheds at concentrations above the ninety-fifth percentile of the measured background [0.21 pCi/g(dry) and 0.10 pCi/g(dry), respectively]. Cesium-137 was detected in four of the 118 soil/sediment samples collected in this study at a concentration of 0.34 ±0.04 pCi/g(dry) in the RMDF Watershed, 0.24 ±0.06 pCi/g(dry) and 0.30 ±0.05 pCi/g(dry) in the Sodium Reactor Experiment Watershed, and 0.23 ±0.03 pCi/g(dry) in the Building 59 Watershed. Plutonium-238 was detected in two of the 118 soil/sediment samples at 0.19 ±0.06 pCi/g(dry) and 0.22 ±0.07 pCi/g(dry) in the Building 59 and RD-51 Watersheds, respectively. Because the data from the ravines were not statistically evaluated, it could not be definitively concluded whether the concentrations of strontium-90, cesium-137, and plutonium-238 in the sediment above the ninety-fifth percentile of the measured background were due to off-site migration. When the t-tests were run, the concentrations of these radionuclides in the ravines were not different from background.

Conclusions. The purpose of this study was to determine whether chemicals and/or radionuclides near the SSFL property line were present on Brandeis-Bardin or the Conservancy as a result of activities at the SSFL. The study identified the following occurrences of chemicals and radionuclides which were present as a result of the SSFL activities:

- Trichloroethene (TCE) in the groundwater at the Well by the Gate at the Conservancy;
- Lead in the Former Rocketdyne Employee Shooting Range at the Conservancy;
- Mercury in one sediment sample at the Sodium Burn Pit Watershed at Brandeis-Bardin; and

- Tritium in the Radioactive Materials Disposal Facility Watershed and in the Building 59 Watershed at Brandeis-Bardin.

Recommendations. It is recommended that the sediment deposit containing the mercury be removed by Rocketdyne and properly disposed. Additional sampling may be warranted, for example, to monitor the RMDF and Building 59 Watersheds. Recommendations will be solicited by Rocketdyne from the regulatory agencies, the SSFL work group, and the public after review of this report. Appropriate follow-up activities will be conducted after the recommendations are received.

SECTION 1.0

INTRODUCTION

Multi-media sampling was conducted on behalf of Rockwell International Corporation, Rocketdyne Division, to assess if there had been migration and/or deposition of chemicals/radionuclides off-site onto two properties adjacent to the Rocketdyne Santa Susana Field Laboratory (hereafter, SSFL). The two adjacent properties were the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy (hereafter, Brandeis-Bardin and the Conservancy, respectively). A Workplan entitled "Workplan for Multi-Media Sampling at the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy" (hereafter, the Workplan) was prepared in February 1992. Prior to implementation, the Workplan was reviewed and approved by the United States Environmental Protection Agency (USEPA), the California Environmental Protection Agency-Department of Toxic Substance Control (Cal-EPA-DTSC), the Department of Health Services (DHS), the Regional Water Quality Control Board-Los Angeles Region (RWQCB), Brandeis-Bardin, and the Conservancy. Comments and/or suggestions were also solicited from the Community members. Comments and/or suggestions made by these organizations and individuals were addressed and, when appropriate, were incorporated into the Workplan. The Workplan fully described the approach to be used for evaluating Brandeis-Bardin and the Conservancy properties. Figure 1-1 shows the approximate locations of the Rocketdyne SSFL, Brandeis-Bardin, and the Conservancy properties.

The Multi-Media Sampling Program was designed as a screening tool to determine whether chemicals and/or radionuclides from operations at the SSFL were present on the adjacent properties during the period sampled. The study was not intended to reconstruct potential historical off-site impacts (i.e., historical dose reconstruction).

The analytical results of the Multi-media Sampling Program were evaluated in two steps:

1) Background levels of chemicals and radionuclides were documented by collecting representative samples in local background areas. (These levels were strictly applicable only to the random sampled areas but were also used as a qualitative basis of comparison for the watersheds).

2) Analytical results for chemicals and radionuclides associated with operations at the SSFL from samples collected from Brandeis-Bardin and the Conservancy were compared to background levels from similar properties to determine whether the subject properties have significantly elevated levels of chemicals or radionuclides relative to the background levels.

Samples of the soil, groundwater, surface water, and fruit were collected to make the comparisons between the study areas and background. These media were selected because they represent the most likely current or future exposure pathways. For example, soil could be inadvertently ingested and/or inhaled by persons hiking, driving, or camping on the properties. Groundwater could be used for irrigation and surface water could be contacted directly by hikers or campers. Fruits could be impacted by particulate deposition or chemical uptake through the roots. (Vegetable samples were not collected because vegetables were not available during the sampling period). Although the potential for exposure by any of these pathways is low, data were gathered for all these media to determine whether chemicals and/or radionuclides were present in the areas sampled which may have been the result of Rocketdyne's activities.

Three potential sources of chemicals and radionuclides were evaluated as part of the sampling effort:

- Naturally occurring background levels of metals and radionuclides
- Chemicals resulting from activities unrelated to Rocketdyne such as polynuclear aromatic hydrocarbons (PAHs) and other combustion byproducts from campfires, vehicle exhaust, or the use of pesticides
- Chemicals or radionuclides resulting from activities at the SSFL.

Of these three potential sources, chemicals or radionuclides from activities at the SSFL were the primary focus of the sampling effort. A survey of present and historical activities at the Rocketdyne facility was used to characterize potential sources of chemicals and radionuclides.

To meet the stated objectives, this report contains the following information:

- Identification of chemicals and radionuclides associated with operation at the SSFL (Section 2.0)

- Sampling approach and methodologies (Sections 3.0 and 4.0)

- Quality assurance and quality control (QA/QC) methodologies and results, statistical analysis methodologies, and sampling results from Background Areas (Sections 5.0 through 8.0)

- Sample results from Brandeis-Bardin and the Conservancy properties (Sections 9.0 and 10.0).

- A discussion of the results and a summary of the conclusions drawn from this study (Sections 11.0 and 12.0).
- A list of references cited in this report and additional outside reading (Section 13.0).

1.1 Sampling History At Adjacent Properties

This section discusses the results of previous sampling activities at Brandeis-Bardin and the Conservancy.

1.1.1 Brandeis-Bardin Institute

Soil samples were collected by Mr. Joel I. Cehn, C.H.P. (consultant to Brandeis-Bardin) at the Brandeis-Bardin property and analyzed for tritium and other radionuclides (Cehn, 1991). Cesium-137 was detected in one sample at 0.671 picocuries per gram of dry soil (pCi/g(dry)) in the watershed (ravine) leading from the Radioactive Materials Disposal Facility (RMDF). This sample was near sample location BB-16-003 in this report.

Samples of naturally occurring vegetation were also collected by Mr. Cehn. Potassium-40 (K-40) was detected in seven of the eight samples at concentrations ranging from 5.92 to 16 picocuries per gram of undried vegetation (pCi/g(wet)), which were concluded to be within the range of natural background (Cehn, 1991). Three of the eight samples were analyzed for tritium, which was detected in one sample at the detection limit of 0.100 pCi/g(wet). This level was also concluded to be within natural background levels (Cehn, 1991).

Samples from artesian wells OS-1, OS-2, OS-3, OS-4 and OS-10A were collected in May 1991 by Mr. Cehn. The analytical results for tritium and gamma scan were below the detection limits of 200 picocuries per liter of water (pCi/L) for tritium and 4.0 to 5.0 pCi/L for cesium-137 (gamma scan). These samples were not analyzed for volatile organic compounds (Cehn, 1991).

Wells (e.g. artesian wells OS-1, OS-2, OS-3, OS-4, and OS-5) and springs (e.g.,OS-8) on the Brandeis-Bardin property within a one mile radius of the SSFL are currently sampled annually, at a minimum, by Groundwater Resources Consultants, Inc. (GRC) as part of the Rocketdyne Groundwater Monitoring Report. As recently as September 1991, analytical results have been below the limits of detection for volatile organic compounds and radionuclides in these wells and springs. Cal-EPA collected split samples with GRC from the off-site wells and springs during the quarterly sampling in September 1991. Therefore, at the recommendation of the USEPA and the consultant to Brandeis-Bardin, and with the agreement of Mr. Howard Kaplan, Director of Finance and Development of Brandeis-Bardin, these wells were not sampled as part of this survey.

Cluster wells (RD-34 A, B, and C) were constructed in July and August 1991 at Brandeis-Bardin near the SSFL property line in the watershed below the Radioactive Materials Disposal Facility (RMDF). Samples were collected in August 1991 by the Cal-EPA and GRC. Tritium was detected in the shallow well (RD-34 A, open from 16 to 60 feet below ground surface) at concentrations ranging from 3,380 to 5,410 pCi/L, which is below the drinking water standard of 20,000 pCi/L [California Code of Regulations (CCR), Title 22, Section 64443]. Samples taken from the intermediate and deep wells (RD-34 B and RD-34 C, open from 179 to 240 feet and 378 to 450 feet below ground surface, respectively) were below the detection limit of 500 pCi/L. The wells were resampled in October 1991 and March 1992. Tritium was detected in RD-34 A at concentrations ranging from 6,628 to 7,069 pCi/L and in RD-34 B at concentrations ranging from 500 to 637 pCi/L. Tritium was below the detection limit of 500 pCi/L in samples collected from RD-34C. During the most recent sample collection in June 1992, tritium was detected at 2,529 pCi/L in RD-34A and at 534 pCi/L in RD-34B (detection limit of 500 pCi/L). Tritium was below the detection limit of 500 pCi/L in samples collected from RD-34C.

A former water supply well, referred to as the "Old Well," is located in the southeastern portion of the Brandeis-Bardin property. (This is shown as the pump house on Figure 9-14 in this report.) The pump motor was damaged as a result of vandalism and dismantled by the head ranch hand of Brandeis-Bardin; the pump has not been operated since 1973 (Personal Communication, 1992). Since this well was not functional and was not being used, nor were there any plans to reactivate this well in the future, and with the agreement of Mr. Howard Kaplan, Director of Finance and Development of Brandeis-Bardin, groundwater was not sampled from the Old Well as part of this survey.

1.1.2 Santa Monica Mountains Conservancy

Air, soil, and groundwater were sampled in 1989 and 1990 by consultants for the Conservancy.

Air samples were collected at a background location, at the perimeter, in the meadow, and at the residence at the Conservancy by the California Air Resources Board (CARB) from June 5 to June 8, 1990. Samples were analyzed for nine chlorinated hydrocarbons, five of which were quantified above reporting limits. Blank samples contained the following chemicals: perchloroethene [0.05 parts per billion (ppb)] 1,1,1-trichloroethane (0.62 ppb), trichloroethene (0.08 ppb), and chloroform (0.07 ppb), indicating laboratory contamination. In comparison to background samples, only carbon tetrachloride, trichloroethene, and chloroform were present at levels slightly above the two background levels (two measurements from one location). The concentrations of these compounds were less than 0.07 ppb greater than background. As noted by CARB in their cover letter, only 1,1,1-trichloroethane was detected consistently at the site. The range of ambient concentrations of 1,1,1-trichloroethane was 0.23 to 0.98 ppb. Given the limited number of background samples, and the fact that blank samples contained perchloroethene, 1,1,1-trichloroethane, trichloroethene, and chloroform, volatile organic compounds were not detected at levels significantly above background.

Ten soil samples were analyzed by FGL Environmental Analytical Chemists for volatile organics using USEPA Method 8240. All chemicals were below the reporting limits of 5 to 25 micrograms per kilogram of soil (ug/kg). The ten soil samples were also analyzed for gross alpha and gross beta radioactivity. The mean levels of radioactivity ranged from 7 to 23 picocuries per gram of wet soil [pCi/g(wet)] for gross alpha radioactivity and 18 to 32 pCi/g(wet) of soil for gross beta radioactivity.

Three groundwater samples were collected and analyzed for metals and other water quality parameters, such as total dissolved solids, total hardness, specific minerals, color, odor, coliform bacteria, fluoride, and gross alpha and beta radioactivity by Lee and Ro Environmental Laboratory. Only iron at concentrations of 2.31 and 0.51 milligrams per liter (mg/L) in two of the three wells tested exceeded the maximum contaminant level (MCL) for iron established by the State of California for drinking water (0.30 mg/L). A surface water sample was collected near an on-site personnel building and analyzed for the same constituents as the groundwater. The results for all constituents analyzed were below the MCLs.

1.2 Organic Compounds

The organic compounds included in this study are not naturally occurring or may be associated with specific activities, such as campfires or engine exhaust. Any results indicating the presence of organic compounds were not statistically compared to background levels (as described in Section 1.3 for the metals and radionuclides) but were included in the results if they were greater than the reporting limits for volatile and semi-volatile organic compounds for each analysis (refer to section 5.3.1.6 for a discussion regarding reporting limits).

1.3 Naturally Occurring Metals and Radionuclides

Heavy metals and most radionuclides are naturally occurring constituents of soil and rock. Background levels of these chemicals vary widely from location to location based on the type of rock or soil. For this reason, this study uses statistics to compare data from study areas to data from background areas to determine whether the chemicals were typical of measured background or could have originated from activities at the SSFL (see Section 7.0). In addition to background data, Section 8.0 of this report references published studies on naturally occurring and background concentrations of heavy metals and radionuclides.

SECTION 2.0

CHEMICALS AND RADIONUCLIDES

The analyses implemented during the Multi-Media Sampling Program focused on those chemicals that were used or that may have been produced during operations at the SSFL. Based on a review of the environmental monitoring data collected at the SSFL and the historical use of chemicals at the SSFL, the chemicals and radionuclides that were used or that may have been produced are discussed in this section.

2.1 Volatile Organic Compounds (VOCs)

Industrial solvents used for cleaning and degreasing consisting of VOCs have been used at the SSFL. Surface water and groundwater samples were analyzed for VOCs because VOCs were used at the SSFL. VOCs [primarily trichloroethene (TCE) and its degradation products] have been detected in the groundwater at the SSFL. Subsurface soil samples (from 6 to 12 inches) were analyzed for VOCs to provide a comprehensive analysis of the off-site properties.

In this sampling program, samples were analyzed for the complete suite of VOCs using USEPA Method 8240, which includes the solvents used at Rocketdyne, degradation products of these solvents, and other compounds that were never used at this facility. Since these compounds are not considered to be naturally occurring, this report includes a discussion of all of the VOCs that exceed the reporting limit[1] for the analysis. (See Section 5.3.1.6for

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[1] Reporting limit is the minimum amount reported by the laboratories.

a discussion of reporting limits.) Table 2-1 lists the volatile organic compounds included in the Method 8240 analysis.

Several of the chemicals analyzed by Method 8240, such as acetone and methylene chloride, are also used in analytical laboratories for cleaning laboratory glassware and for extracting organic chemicals from soils and sludges. Since these chemicals are very volatile, they sometimes contaminate clean samples and show up in the results. One way to determine whether a VOC is a laboratory contaminant is to send a sample of pure water (a trip blank) along with the sample. If the sample of pure water contains these VOCs, it is assumed that they resulted from chemicals in the laboratory or contamination during transport. If these same VOCs are seen in samples shipped concurrently with the trip blank it is assumed that these, too, are from the laboratory. Trip blanks and other quality assurance samples were included in this study to identify any VOCs that were a result of laboratory contamination. Two common laboratory contaminants that are often detected are acetone and methylene chloride.

2.2 Semi-Volatile Organic Compounds (SVOCs)

Semi-volatile organic compounds are a class of compounds that include chlorinated pesticides and polynuclear aromatic hydrocarbons (PAHs). These chemicals are relatively heavy, have low vapor pressures, and are not readily mobile in the environment. Since these chemicals could have been aerially deposited onto surface soils in dust particles or carried by water as sediments, surface soil samples and water samples were analyzed for SVOCs. The PAHs are potential by-products associated with the experimental coal gasification facility at the SSFL; however, they also occur naturally and may be present as a result of burning wood in campfires or natural fires unrelated to Rocketdyne.

TABLE 2-1

VOLATILE ORGANIC COMPOUNDS (USEPA METHOD 8240)

COMPOUNDS	
1,1-Dichloroethane	Carbon Disulfide
1,1-Dichloroethene	Carbon Tetrachloride
1,1,1-Trichloroethane	Chlorobenzene
1,1,2-Trichloroethane	Chloroethane
1,1,2,2-Tetrachloroethane	Chloroform
cis-1,2,-Dichloroethene	Chloromethane
trans-1,2-Dichloroethene	cis-1,3-Dichloropropene
trans-1,3-Dichloropropane	Dibromochloromethane
1,2-Dichloroethane	Ethylbenzene
1,2-Dichloropropane	Methylene Chloride
2-Butanone	Styrene
2-Chloroethylvinylether	Tetrachloroethene
2-Hexanone	Trichlorofluoromethane
4-Methyl-2-Pentanone	Toluene
Acetone	m-, p-, & o-Xylene
Benzene	trans-1,3-Dichloropropene
Bromodichloromethane	Trichloroethene
Bromoform	Vinyl Chloride
Bromomethane	

Table 2-1 identifies the standard suite of volatile organic compounds analyzed by USEPA Method 8240. Groundwater, surface water, and soil were analyzed for VOCs using USEPA Method 8240.

In this sampling program, soil samples and most associated equipment rinsate samples were analyzed for the complete suite of SVOCs using USEPA Method 8270. Water samples and some equipment rinsate samples were analyzed only for PAHs using USEPA Method 610 because PAHs were the primary semi-volatile organic compound of interest. Table 2-2 lists the compounds that are reported for each analysis using these USEPA methods. Since SVOCs are not normally considered to be naturally occurring, this report includes a discussion of any SVOC that exceeds the reporting limit for the analysis.

2.3 Priority Pollutant Metals

Priority pollutant metals have low vapor pressures and low solubilities and are generally found relatively close to their source. The most likely mode of migration of metals away from a source would be as sediments in surface water runoff or as airborne particulates following rocket engine testing. The major potential source of metals within the study area is at the former Rocketdyne Employee Shooting Range (located on the Conservancy property) which had visual evidence of lead shot on the surface. All priority pollutant metals were analyzed in surface soils and surface water at all locations studied.

Metals are naturally occurring in soils and rocks. Metal concentrations, however, vary with type of soil or rock and it may not necessarily be obvious whether a metal that is detected in soil or water is naturally occurring or from activities at the SSFL. Statistical methods, as described in Section 7.0, are used in this report to determine the concentration of naturally occurring heavy metals and to determine how much, if any, could have come from activities at the SSFL.

Table 2-2 identifies the full suite of semi-volatile organic compounds (SVOCs) analyzed by USEPA Method 8270. Soil and most equipment rinsate samples were analyzed for SVOCs

TABLE 2-2

SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS)
(USEPA METHODS 8270 AND 610)

COMPOUNDS		
1,2-Dichlorobenzene	4-Methylphenol	Dibenzo(a,h)anthracene *
1,2,4-Trichlorobenzene	4-Nitroaniline	Dibenzofuran
1,3-Dichlorobenzene	4-Nitrophenol	Diethylphthalate
1,4-Dichlorobenzene	4,6-Dinitro-2-methylphenol	Dimethylphthalate
2-Chloronaphthalene	Acenaphthene *	Endosulfan sulfate
2-Chlorophenol	Acenaphthylene *	Fluorene *
2-Methylnaphthalene	Anthracene *	Fluoranthene *
2-Methylphenol	Benzo(a)anthracene *	Heptachlor Epoxide
2-Nitroaniline	Benzo(a)pyrene *	Hexachlorobenzene
2-Nitrophenol	Benzo(b)fluoranthene *	Hexachlorobutadiene
2,4-Dichlorophenol	Benzo(g,h,i)perylene *	Hexachlorocyclopentadiene
2,4-Dimethylphenol	Benzo(k)fluoranthene *	Hexachloroethane
2,4-Dinitrophenol	Benzoic Acid	Indeno(1,2,3-c,d)pyrene *
2,4-Dinitrotoluene	Benzyl Alcohol	Isophorone
2,4,5-Trichlorophenol	Bis(2-chloroethoxy)methane	N-Nitroso-di-N-propylamine
2,4,6-Trichlorophenol	Bis(2-Chloroethyl)ether	N-Nitrosodiphenylamine
2,6-Dinitrotoluene	Bis(2-Ethylhexyl)phthalate	Naphthalene *
3-Nitroaniline	Bis-(2-chloroisopropyl)ether	Nitrobenzene
3,3'-Dichlorobenzidine	Butyl benzyl phthalate	Pentachlorophenol
4-Bromophenyl phenyl ether	Chrysene *	Phenanthrene *
4-Chloro-3-methylphenol	Di-n-butylphthalate	Phenol
4-Chloroaniline	Di-n-octylphthalate	Pyrene*
4-Chlorophenyl phenyl ether		

using USEPA Method 8270. Compounds marked with an asterisk (*) are the polynuclear aromatic hydrocarbons (PAHs) analyzed using EPA Method 610. Water samples and some equipment rinsate samples were analyzed for PAHs using USEPA Method 610. The USEPA methods used in this study (6000 and 7000 Series Methods) provided data on 13 priority pollutant metals (Table 2-3). Seven metals associated with Rocketdyne activities were evaluated in this report. These metals were cadmium (Cd), total chromium (Cr), copper (Cu), nickel (Ni), zinc (Zn), lead (Pb), and mercury (Hg). Although not discussed explicitly in the text, the data for the other six priority pollutant metals are included in Appendix D.

2.4 Radionuclides

Radionuclides were used in nuclear power research in Area IV of the SSFL. Based on a review of the available data for Area IV, including the results of the North Slope Runoff Monitoring Program, it was concluded that the best indicators of potential impact of the SSFL activities on the adjacent properties would be strontium-90 (Sr-90), tritium (H-3), and gamma emitting radionuclides. Strontium-90, tritium, cesium-137 (a gamma emitter) and cobalt-60 (a gamma emitter) are isotopic by-products from nuclear fission and neutron activation. Some tritium is also naturally produced in the upper atmosphere. At the request of the SSFL work group, analyses for iodine-129 (a beta emitter) and isotopic plutonium (alpha and beta emitters) were added to the scope of work.

Surface water and groundwater were analyzed for strontium-90, iodine-129, isotopic plutonium, tritium, gamma-emitting radionuclides (a gamma scan), gross alpha radioactivity, and gross beta radioactivity. Soil and fruit samples were analyzed for the same radionuclides as the other media with the exception of gross alpha and gross beta radioactivity, which are not typically analyzed in soil. For each sample, a minimum of 18 commonly detected gamma emitting radionuclides (including cesium-137 and cobalt-60) were reported by the laboratory. The gamma scan actually covered a full suite of 75 gamma-emitting radionuclides which were in the laboratory's analysis library (Table 2-4). The laboratory reported values for any of these other 57 radionuclides if they were detected.

Table 2-3

Priority Pollutant Metals (USEPA Method 6000 and 7000 Series)

Compounds	
Antimony	Mercury*
Arsenic	Nickel*
Beryllium	Selenium
Cadmium*	Silver
Chromium*	Thallium
Copper*	Zinc*
Lead*	

Table 2-3 Identifies the full suite of priority pollutant metals analyzed for this project. The asterisk (*) identifies the seven metals associated with activities at Rocketdyne.

TABLE 2-4

GAMMA EMITTING RADIONUCLIDES IN THE GAMMA SCAN LIBRARY

COMPOUNDS		
Actinium-228	Iodine-134	Silver-110
Americium-241	Iodine-135	Sodium-22
Antimony-125	Iron-51	Sodium-24
Argon-41	Iron-59 *	Strontium-85
Barium-140 *	Krypton-85	Strontium-91
Beryllium-7 *	Krypton-87	Strontium-92
Bismuth-207	Krypton-88	Tellurium-129
Bismuth-214	Lanthanum-140	Thallium-208
Bromine-141	Lead-210	Thorium-228 *
Cerium-139	Lead-212	Thorium-234
Cerium-141 *	Lead-214	Tin-113
Cerium-143	Manganese-54 *	Tungsten-187
Cerium-144 *	Manganese-56	Uranium-235
Cesium-134 *	Mercury-203	Xenon-131M
Cesium-136	Molybdenum-99	Xenon-133
Cesium-137 *	Neptunium-239	Xenon-133M
Cesium-138	Nickel-65	Xenon-135
Chlorine-38	Niobium-95	Yttrium-88
Chromium-51	Nobelium-147	Yttrium-91
Cobalt-57	Potassium-40 *	Yttrium-92
Cobalt-58 *	Radium-226 *	Yttrium-93
Cobalt-60 *	Radium-228	Zirconium-95 *
Copper-64	Rhodium-105	Zirconium-97
Iodine-131 *	Ruthenium-103 *	Zinc-65 *
Iodine-133	Ruthenium-106 *	Zinc-69

Table 2-4 identifies the full suite of 75 radionuclides in the laboratory's analysis library for the gamma scan. The asterisk (*) identifies the 18 gamma emitting radionuclides reported for every sample. Only man-made radionuclides reported above detection limits are discussed in this report.

SECTION 3.0

SAMPLING APPROACH

This section presents the selection criteria for the sampling areas and the sampling approach for soil, sediments, surface water, groundwater, and fruits at these locations. This sampling plan was designed as a screening effort to determine whether any chemicals or radionuclides from Rocketdyne activities were present off-site, particularly in areas that could result in human exposure. The purpose of the sampling was to collect samples from the off-site locations where the potential for human exposure would be highest ("human use areas") and where the potential for chemical concentrations would be the greatest (the "ravines" or "watersheds" closest to Area IV of the SSFL). The data from these "study areas" were then compared to data from the background areas to determine whether the chemicals could have originated from Rocketdyne or from other human activities.

3.1 Sampling Areas

This section describes the areas that were sampled and the rationale for their selection. For the purposes of clarity in this discussion, the following terms are defined:

Study Areas: This term is used to refer to the two properties which were sampled: Brandeis-Bardin and the Conservancy.

Background Areas: This term is used to refer to the six locations at least 1.5 miles away from the SSFL that were sampled to establish background levels of the chemicals and radionuclides.

Sampling Area: This term refers to an area within one of the study or background areas from which samples were collected.

Sampling Block: This term refers to the randomly selected blocks within a sampling area grid or from the non-random sample locations in the ravine areas from which discrete soil samples were collected. (Refer to Section 4.3.1 for a complete description.)

Sampling Location: This term refers to a specific point where a soil/sediment sample or surface water sample was collected. The term also refers to the specific tree or well from which fruit or groundwater samples were obtained.

3.1.1 Background Sampling Areas

Background areas were sampled to provide a basis of comparison to distinguish naturally occurring concentrations of heavy metals and radionuclides from heavy metals and radionuclides that may have originated from Rocketdyne. The source of heavy metals and some radioactive elements in background areas is the rock from which the soil is derived. The deposition of airborne material (e.g., world-wide fallout from nuclear weapons testing) and subsequent surface runoff is another source of certain radionuclides.

Several factors were considered in selecting the background sampling locations: soil type, surface geology, slope, exposure, similarity of vegetation, wind direction, accessibility, and distance from Rocketdyne. Recommendations from the regulatory agencies, local citizens, and the Committee to Bridge the Gap were received and accepted for background study areas.

It should be noted that the background soil samples were from areas that were generally open and level. Radionuclides from airborne deposition on surface soils would be expected to be evenly distributed in the open, level background areas, and comparisons between background and the randomly sampled study areas are accurate comparisons. Sediments in the ravines are composed of clay, silt, and sand that have eroded from the surrounding hillsides. Radionuclides from weapons testing (Sr-90, Cs-137, and Co-60) and other soil-borne chemicals could be at slightly higher concentrations in the ravine sediments. Therefore, comparing sampling results from the ravines to the results of the selected background areas would be conservative and could result in some ravine samples being declared different than background because of the accumulation of chemicals and radionuclides in sediments deposited by run-off.

In addition to soil and surface water samples, fruit samples were collected from trees at orchards near Happy Camp (BG-05) and from a local supermarket in the San Fernando Valley. The purpose of the samples from the orchards near Happy Camp was to compare fruit grown outside the area of potential impact around the SSFL to fruit grown in the study areas. The purpose of the samples from the local supermarket was to provide a basis of comparison of fruit presumably grown on soil outside of the study areas, but still consumed by the members of local communities. The Background Areas are:

▸Rocky Peak (BG-01)
▸Santa Susana Park (BG-02)
▸Bell Canyon (BG-03)
▸Western Sampling Site (BG-04)
▸Happy Camp (BG-05)
▸Santa Monica Mountains National Recreation Area (BG-06)
▸Orchards near Happy Camp (BG-07)
▸Ralph's Supermarket (BG-08)

Soil samples were collected from six background areas (BG-01 through BG-06). One surface water sample was collected at Rocky Peak (BG-01). Fruit samples (avocados and lemons) were collected from the orchards near Happy Camp (BG-07) and oranges, avocados, and tangerines were purchased from Ralph's Supermarket (BG-08). Figure 3-1 shows the locations of the background sampling areas.

3.1.2 *Study Area Sampling Areas*

Two types of sampling areas were selected. Sampling areas in the ravines nearest the SSFL were selected because they are closest to Rocketdyne and are most likely to have been affected. Since this is rugged terrain and not easily accessible, humans are not likely to be exposed to the soil/sediments or surface water in these ravines. These sampling areas are referred to as "ravines" or "watersheds".

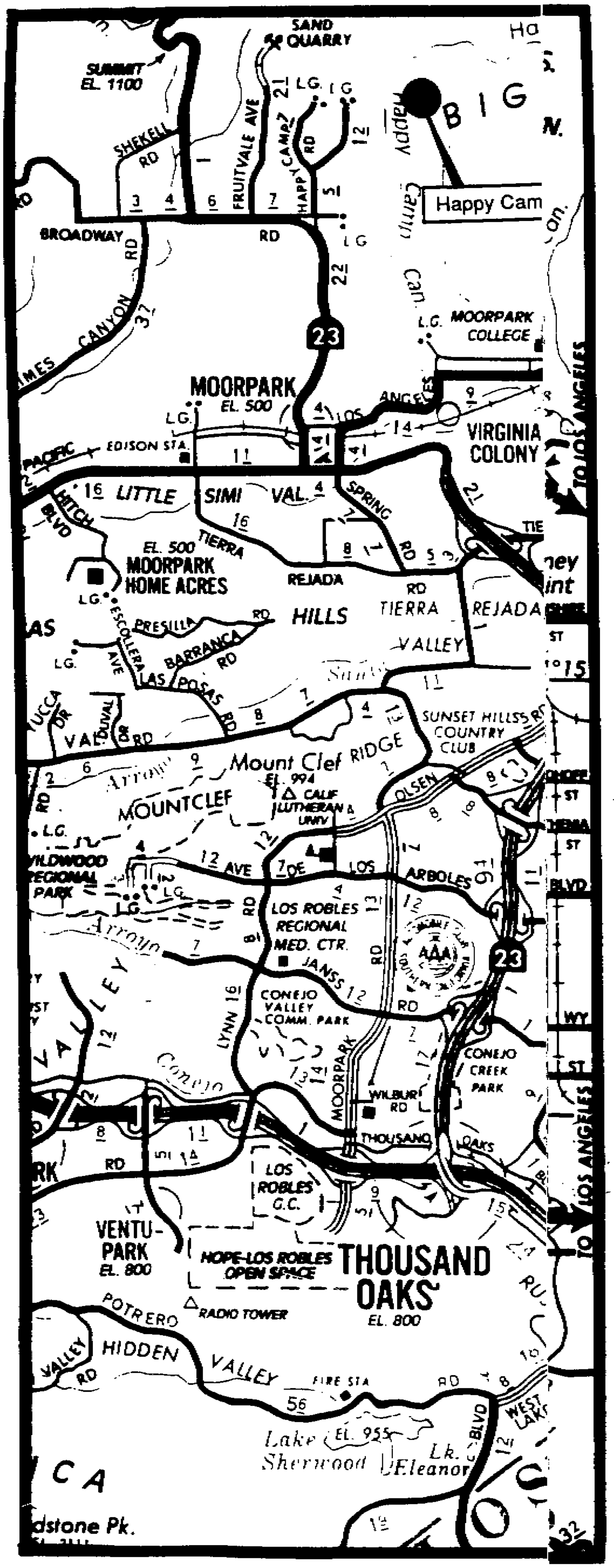
A second type of sampling area was selected based on the frequency of human use, which could result in human exposure if chemicals or radionuclides from the SSFL were present at high concentrations. These areas included playgrounds, parking lots, campgrounds, or other areas where humans are likely to be. Samples were also collected of fruit, surface water, and groundwater that may result in exposure, by eating the fruit or using the water for drinking or irrigation. The areas where a potential for human exposure exists were referred to as "Human Activity Sampling Areas."

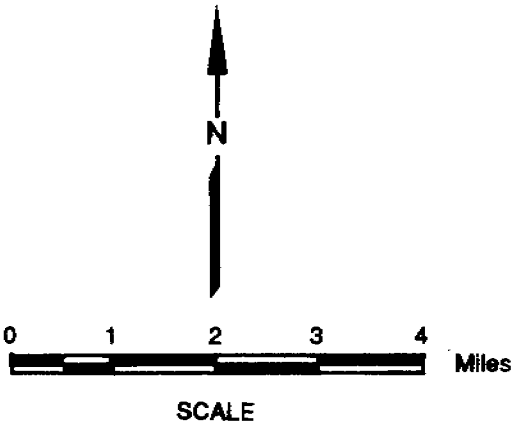
Each of the sampling areas within the study areas is discussed below.

3.1.2.1 Brandeis-Bardin Institute

The following sampling areas were identified after consultation with Mr. Howard Kaplan (Director of Finance and Development at Brandeis-Bardin), Mr. Joel Cehn (a private consultant to Brandeis-Bardin), and Rocketdyne personnel.

FIGURE 3-1
LOCATION OF BACKGROUND
SAMPLING AREAS





The locations are shown with the location designations used in this sampling effort:

HUMAN ACTIVITY SAMPLING AREAS

- Perimeter of the Playground (BB-01)
- Dormitory Area (BB-02)
- Campsite Area 1 (BB-03)
- Campsite Area 2 (BB-04)
- Picnic Area (BB-05)
- House of the Book (BB-06)
- Counselor-In-Training Area (BB-07)
- Potential Development Site 1 (BB-08)
- Potential Development Site 2 (BB-09)
- Potential Development Site 3 (BB-10)
- Vegetable Garden (BB-11)
- Main House Orchard (BB-12)
- Avocado Grove (BB-13)
- Old Well Campsite (BB-14)

RAVINE SAMPLING AREAS

- RD-51 Watershed (BB-15) [1]
- Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16)
- Building 59 Watershed (BB-17)
- Sodium Burn Pit Watershed (BB-18)
- Sodium Reactor Experiment (SRE) Watershed (BB-19) [1]

Soil/sediment samples were collected at all of the above locations. Surface water was collected at five of these locations (BB-03, BB-04, BB-16, BB-18, BB-19). Tangerines and lemons were sampled from the main house orchard (BB-12) and avocados were sampled from the avocado groves (BB-13). Figure 3-2 shows the locations of the sampling areas on the Brandeis-Bardin property.

---

[1] The location designations for the RD-51 Watershed and the Sodium Reactor Experiment Watershed were reversed in the Workplan.

LEGEND

▬ ▪ ▬ BRANDEIS–BAF 'TE PROPEF

— · — DRAINAGE

— — FENCE

ROCK

▬ PAV

▪▪▪▪▪▪▪ UNPAVE

▨ RAVINE SAM

HOUSE OF THE BOOK
(88–06)
▦ HUMAN ACTIVITY G AREA

1993_0310_McLHort - MultMedSiRep V1

RPT-S3G-I3S-015-V1

0 400

APPROXIMATE SCALE 1" = 400'

NOTE: BUILDINGS SHOWN ON FIGURE ARE
USED AS REFERENCE POINTS ONLY
AND ARE NOT INTENDED TO IDENTIFY
POTENTIAL SOURCES.

3.1.2.2 Santa Monica Mountains Conservancy

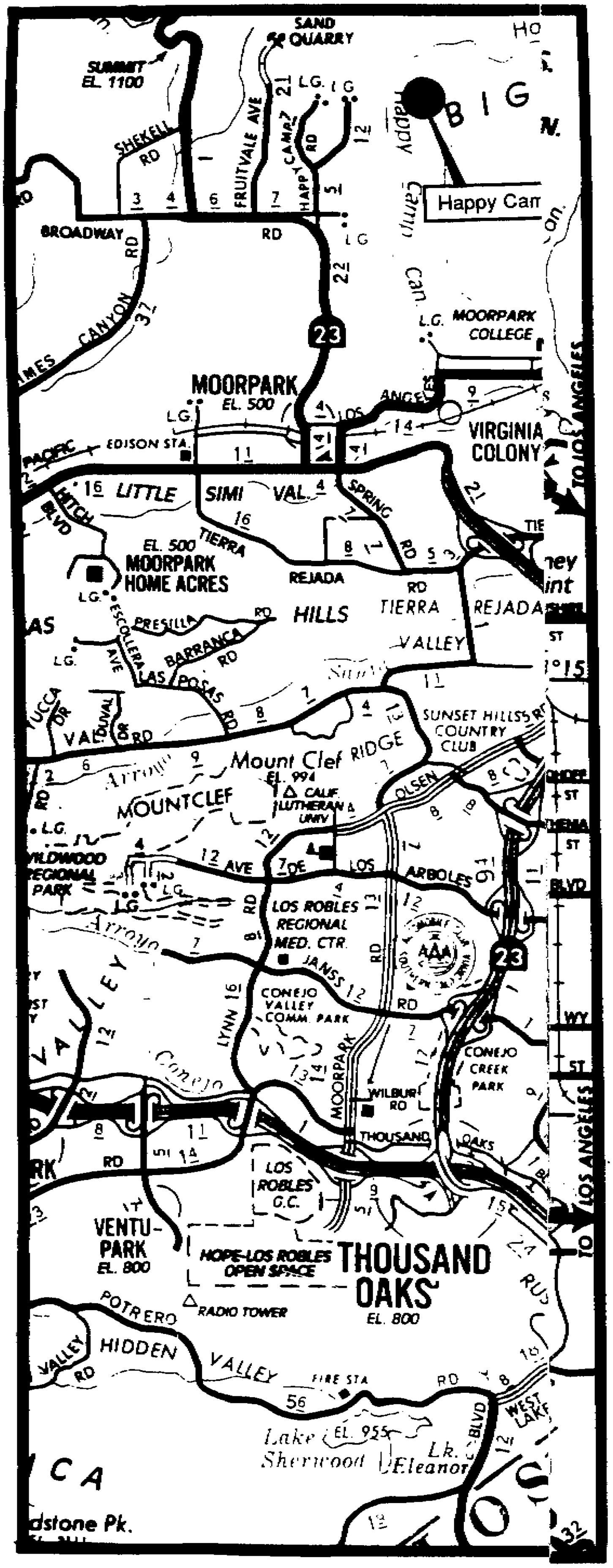
Based on the frequency of human use, the following eight sampling areas were identified after consultation with Ms. Rorie Skei, the Conservancy Program Manager:

HUMAN ACTIVITY SAMPLING AREAS

- ►Visitor Center Parking Lot (SM-01)
- ►Existing Road System (SM-02)
- ►Former Rocketdyne Employee Shooting Range (SM-03)
- ►Orange Groves (SM-04)
- ►Antenna Well (SM-05)
- ►Well by the House (SM-06)
- ►Well by the Gate (SM-07)
- ►A Spring (SM-08)

Soil samples were collected from four areas (SM-01, SM-02, SM-03, and SM-04). Fruit samples (oranges) were collected from the Orange Groves (SM-04). Groundwater was sampled from two groundwater wells (SM-05 and SM-07) and spring water was sampled from one location (SM-08). The Well by the House (SM-06) was not sampled because the Conservancy was not planning to use the well for drinking water or irrigation. Figure 3-3 shows the locations of the Conservancy sampling areas.

FIGURE 8-1
LOCATION OF BACKGROUND SAMPLING AREAS



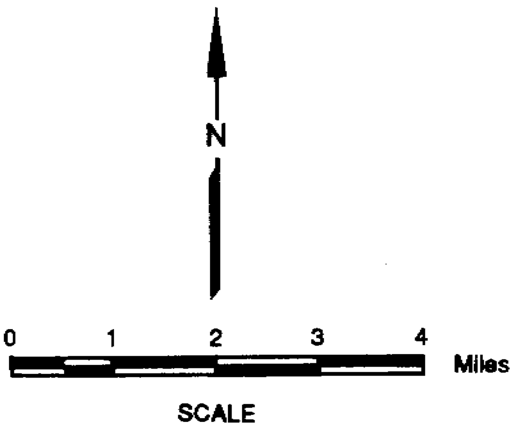
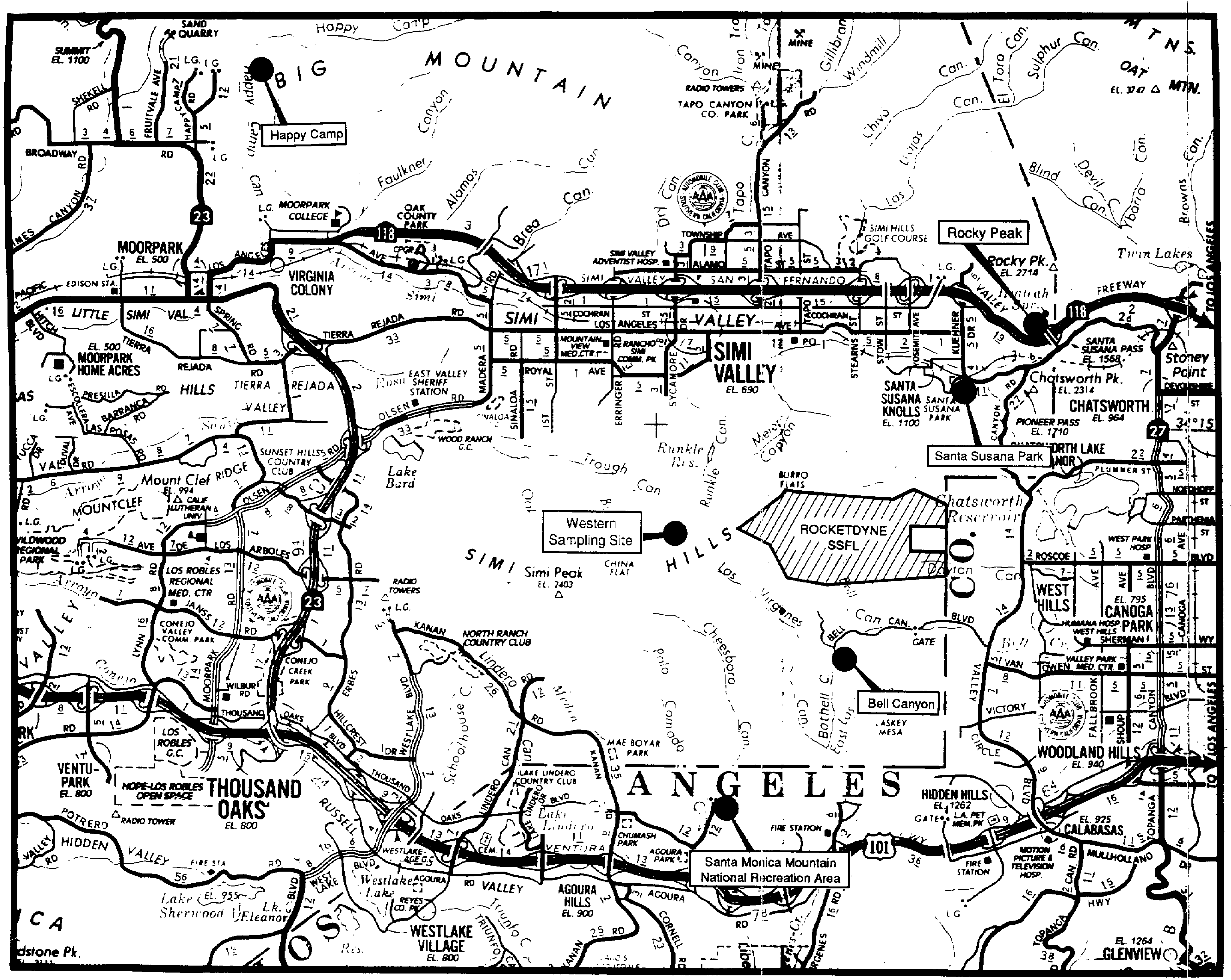
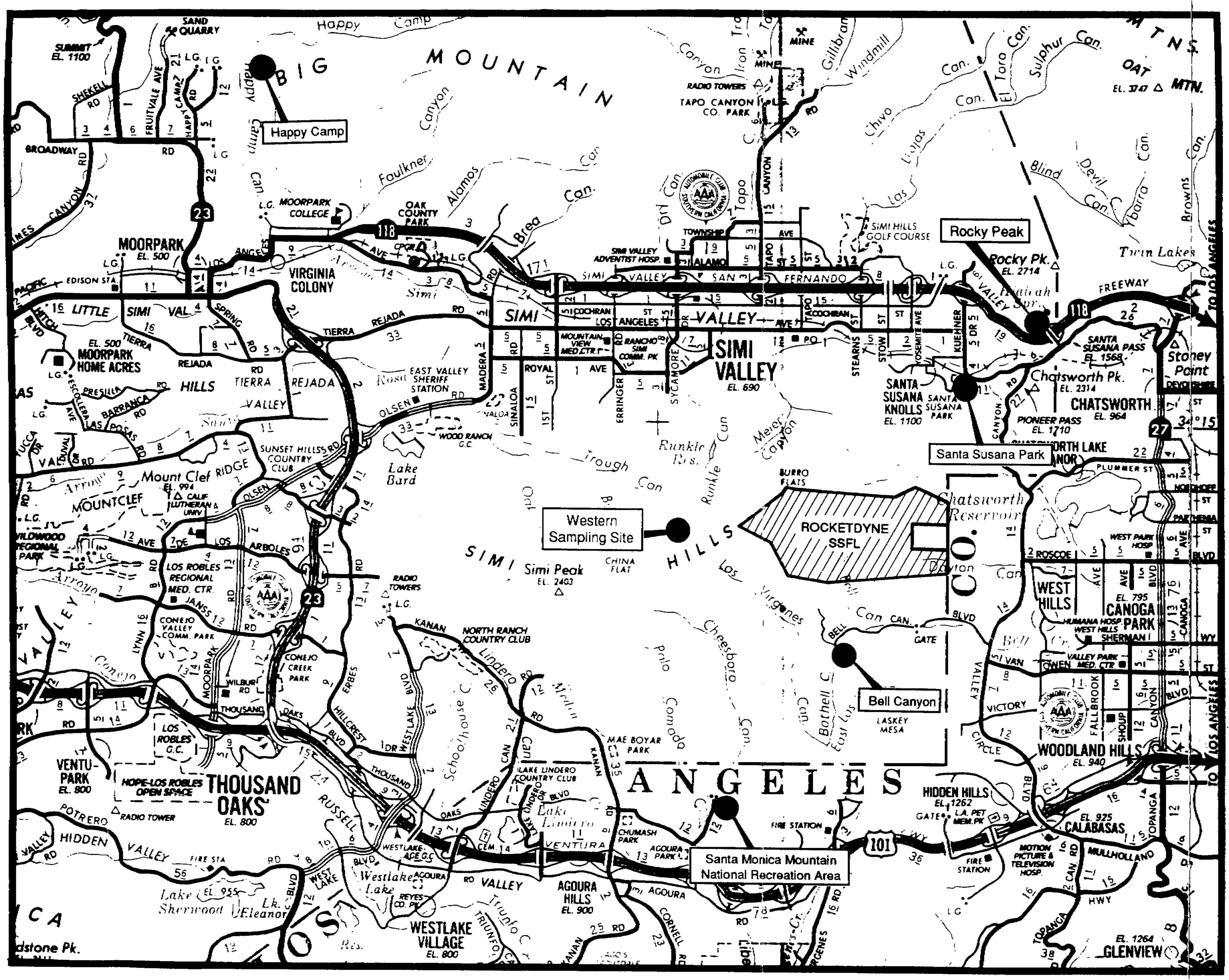


FIGURE 3-1
LOCATION OF BACKGROUND
SAMPLING AREAS

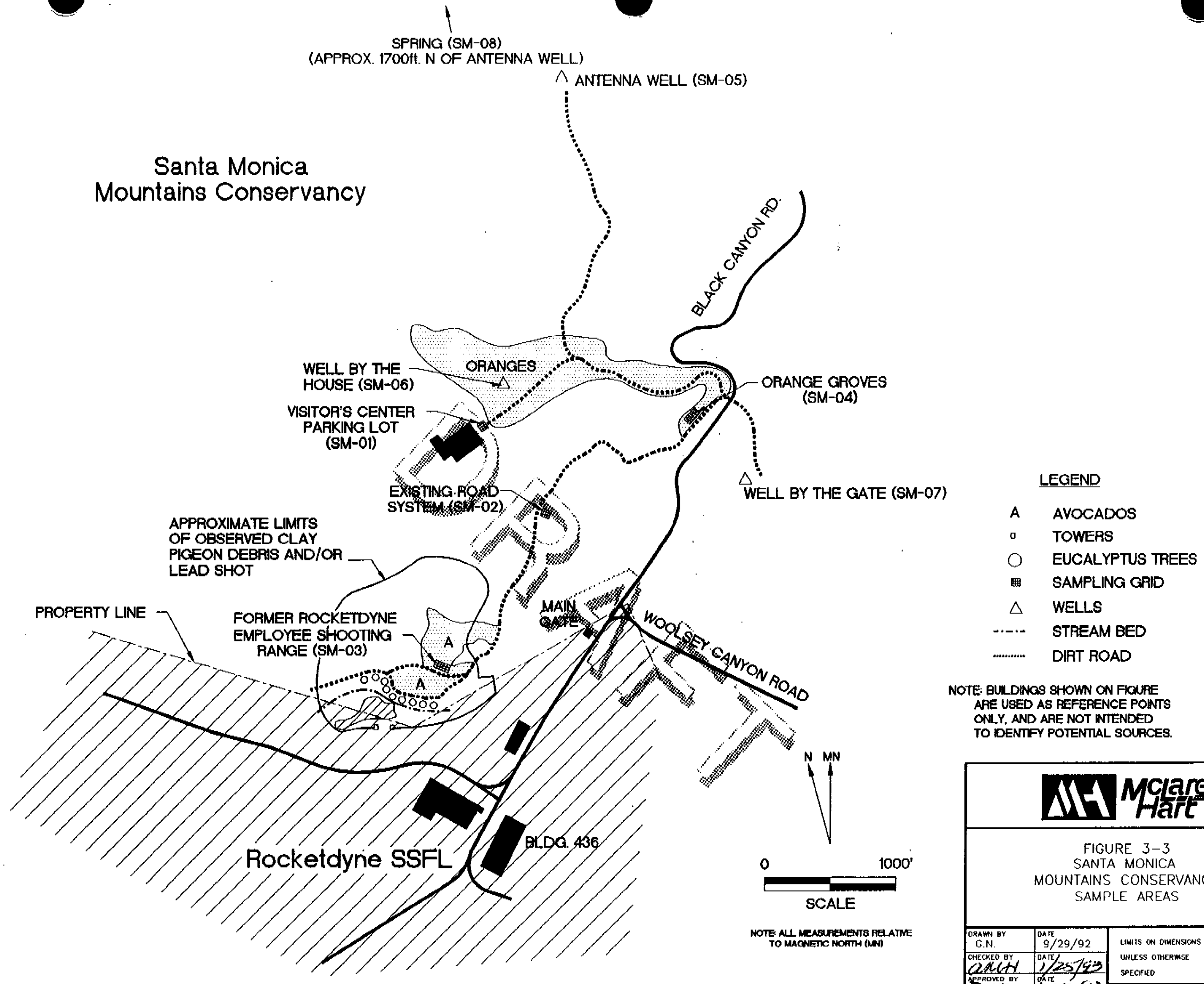


Mclaren Hart

FIGURE 8-1
LOCATION OF BACKGROUND SAMPLING AREAS



McLaren Hart



NOTE: BUILDINGS SHOWN ON FIGURE ARE USED AS REFERENCE POINTS ONLY, AND ARE NOT INTENDED TO IDENTIFY POTENTIAL SOURCES.

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FIGURE 3-3
SANTA MONICA
MOUNTAINS CONSERVANCY
SAMPLE AREAS

DRAWN BY G.N.	DATE 9/29/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY QMCH	DATE 1/25/93		
APPROVED BY DXD	DATE 1-25-93	ISSUE	DRAWING NUMBER CONSERV
SCALE	REFER		

3.2 Sampling Approach Overview

This section provides a brief overview of the sampling approach used for each medium being sampled. Additional details are presented in Sections 4.0 and 5.0.

3.2.1 Soil/Sediment

This section discusses the approach used to select soil or sediment sample locations.

3.2.1.1 Background Sampling Areas

Soil samples were collected from each of the Background Sampling Areas using a stratified random sampling method. A sampling grid (100 square feet) was marked off over an area that was as pristine as possible. Each grid consisted of 100 sampling blocks, each 10 feet by 10 feet. Three blocks were randomly selected in each of the study sampling areas. Each selected sampling block was then sampled at a randomly determined location. In this way, samples were obtained that would be considered representative of the area. Variations of the method were used if the sampling area was too small in either dimension to accommodate the 100-square foot sampling grid. Discrete, undisturbed soil samples were collected in brass tubes using a drive sampler from each sampling location at a depth of 0 to 6 inches and analyzed as follows: (1) semi-volatile organic compounds (SVOCs); (2) priority pollutant heavy metals (metals); (3) gamma scan and tritium; (4) strontium-90 (Sr-90) and iodine-129 (I-129); and (5) isotopic plutonium (Pu-238 and Pu-239). An additional sample was taken at a depth of 6 to 12 inches and analyzed for volatile organic compounds (VOCs).

3.2.1.2 Human Activity Sampling Areas

The approach to the human activity sampling areas was identical to the background sampling areas except that each human activity sampling area was sampled at five discrete locations rather than three. The 100-square foot sampling grid was marked off over an area that is used, or could potentially be used, for human activity. The same analyses were conducted as in the background sampling areas.

3.2.1.3 Ravine Sampling Areas

Sediment samples were collected from five ravine sampling areas (Brandeis-Bardin sampling areas BB-15 through BB-19) using a purposeful sampling approach. In the purposeful approach, sample locations were selected from those areas most likely to contain chemicals or radionuclides rather than a random sampling of a uniform area. Locations within the drainage pathways where sediment deposition was observed were selected for sampling.

The determination of which areas most likely contained chemicals or radionuclides was based on the expected behavior of chemicals and radionuclides in the environment and is somewhat subjective given variations in geology and terrain. The cationic radionuclides of concern (Sr-90, Pu-238, Cs-137, Co-60) and the heavy metals generally bind to soil particles and move as suspended sediments along with surface water. When the rate of water movement slows, as would be expected at the bottom of a hill or the bend of a stream, the sediments settle out of the water and are deposited at the bottom of the stream bed or at the inner margin of the bend (Muller, 1978; Sprugel, 1978). Consequently, by sampling at low points in the ravines in areas with deposits of sediments, any residual accumulation of radionuclides or heavy metals would most likely be detected. Radionuclides from fallout from nuclear weapons testing and most heavy metals would be subject to accumulation in sediments as surface clays, silts, and sands containing these compounds eroded and were deposited as sediments (Sprugel, 1978; Muller, 1978).

Chemicals that are less tightly bound to soil particles (such as tritium, iodine-129, and volatile organic compounds) would be expected to move along with the water with far less attenuation as they pass through the soil. The areas "most likely" to contain these chemicals and radionuclides would be in emergent water and associated stream beds closest to the source, as their potential for migration once released is great.

Each of the ravines was walked to verify the connection with Rocketdyne facilities and to select those locations within the drainages that contained sufficient sediments for sample collection. Four to nine sample locations were identified in each drainage area; locations were approximately 50 to 60 feet apart.

Samples were collected for VOC analysis by using the brass tube and pressing it by hand into the sediments. The remainder of the tube was filled, as necessary, using a hand trowel. Samples for the remaining analyses were collected in the ravine sampling areas using a hand trowel because the depth of sediments was too shallow, or the sediments were too saturated to use the drive sampler.

3.2.2 Surface Water

Surface water was collected at locations where sufficient flowing surface water was available to obtain a representative sample. For the purposes of this project, surface waters included emergent groundwater (springs) and streams. Surface water samples were analyzed for: (1) VOCs, (2) SVOCs, (3) priority pollutant metals, (4) strontium-90, (5) iodine-129, (6) gamma scan, (7) isotopic plutonium, (8) tritium, and (9) gross alpha and gross beta radioactivity. Ms. Jennifer Schroll, from the California Environmental Protection Agency, Department of Toxic Substances Control (Cal-EPA-DTSC) suggested that one round of surface water samples would provide sufficient information; therefore, only one round of surface water was collected rather than two as proposed in the Workplan. The decision was then made to sample more areas once rather than to sample fewer areas twice. Thus, data could be obtained from a greater number of sampling areas.

3.2.3 Groundwater

Groundwater was sampled from two wells at the Conservancy rather than three as originally proposed. The Well by the House (SM-06) was not sampled because the well was non-functional and was no longer used. Groundwater was analyzed for: (1) VOCs, (2) SVOCs, (3) strontium-90, (4) iodine-129, (5) gamma scan, (6) isotopic plutonium, (7) tritium, and (8) gross alpha and gross beta radioactivity. A minimum of two rounds of sampling were conducted one week apart and the results of the groundwater sampling were compared to drinking water standards established by the State of California.

3.2.4 Fruits

Samples were taken from fruit trees that were bearing fruit at the time of sampling (lemons, oranges, tangerines, and avocados). Three samples were collected from each orchard sampling area. Three trees within each sampling area were randomly selected and the fruit was collected from the side of the tree facing the SSFL. The three fruit samples from each sampling area were analyzed for: (1) strontium-90, (2) iodine-129, (3) gamma scan, (4) isotopic plutonium, and (5) tritium.

Background samples were collected from two sources: lemons and avocados from the Orchards near Happy Camp (BG-07) and avocados, oranges, and tangerines from Ralph's Supermarket in the San Fernando Valley (BG-08). Three samples of each fruit type were collected.

SECTION 4.0

SAMPLING METHODOLOGY

This section provides an outline of each component of the sampling protocol.

4.1 Decontamination Procedures

All sampling equipment was decontaminated prior to use in the field to prevent or minimize cross-contamination between field samples and contamination from external sources. In the Workplan, decontamination procedures were set up as follows:

1) Wash and scrub in a non-phosphate detergent
2) Rinse in tap water
3) Rinse or soak in 10% nitric acid (trace metal or higher grade nitric acid diluted with distilled/deionized water)
4) Rinse in distilled/deionized water
5) Air dry
6) Wrap in clean aluminum foil (shiny side out) and seal with custody tape

Decontamination in the field was conducted in accordance with the following procedure:

1) Washed and scrubbed in trisodium phosphate detergent
2) Rinsed or soaked in 1% nitric acid (trace metal or higher grade nitric acid diluted with distilled water)
3) Rinsed in distilled water
4) Air dried
5) Wrapped in clean aluminum foil

Four steps described in the Workplan (formerly steps 1, 2, 3, and 6) were altered in the field. Trisodium phosphate detergent was used rather than a non-phosphate detergent. Sampling equipment was not washed in tap water because there was no source of tap water in most of the remote areas. The nitric acid solution was a 1% solution rather than a 10% solution. The sampling equipment was not wrapped in aluminum foil if it was used immediately after washing and air drying; custody tape was not used to wrap sample equipment if sampling equipment did not leave the sampling teams' possession between decontamination and sample collection.

Disposable gloves were worn at all times when handling cleaned sampling equipment. Trip blanks, field rinsate samples, and field blanks were collected to detect any contamination associated with handling the sample or sampling equipment. Sampling equipment that was reused at different sampling locations was decontaminated between sampling locations. Sampling equipment was not decontaminated between sample cores at a single sample location, because these cores were taken adjacent to each other and represented a single sample.

Decontamination waste water was placed in 5-gallon buckets and transferred to 55-gallon Department of Transportation approved drums at the end of each day. The drums were appropriately labeled, characterized by chemical and radionuclide analyses, and properly disposed by Rocketdyne after the laboratory results for the chemical and radionuclide analyses were received.

4.2 Sample Identification and Labeling

4.2.1 Sample Identification

Soil, sediment, surface water, groundwater, and fruit samples were identified using a sample register number and a site-specific sample identification code. A register number was a preprinted, sequential number assigned to each individual sample linking the sample to descriptive information recorded in the sample register book. The site-specific sample identification code was a 9-digit code designed to provide a clear indication of the sample location from which the sample was collected and the intended chemical or radionuclide analyses. The site-specific sample identification codes consisted of the following components:

Digits 1 and 2:	A two-letter code described the sample's origin:	
	BG:	Background Sampling Area
	BB:	Brandeis-Bardin Institute
	SM:	Santa Monica Mountains Conservancy
Digits 3 and 4:	A two-digit number described the sampling area of origin. Table 4-1 summarizes the codes for digits 1 through 4.	
Digits 5, 6, and 7:	A three-digit code described the medium being sampled:	
SOIL/SEDIMENT -	code indicated the sampling block number for the grid samples or the sample location number for Ravine Sampling Areas.	
SURFACE WATER -	code indicated the number of the sample in the order of collection (i.e., 001, 002, 003, etc.)	
GROUNDWATER -	code indicated the number of the sample in the order of collection (i.e., 001, 002, 003, etc.)	

TABLE 4-1

SAMPLE AREA IDENTIFICATION CODES

FACILITY	AREA DESCRIPTION	SAMPLE AREA CODE
Background (BG)	Rocky Peak	01
	Santa Susana Park	02
	Bell Canyon	03
	Western Sampling Site	04
	Happy Camp	05
	Santa Monica Mountains National Recreation Area	06
	Orchards Near Happy Camp	07
	Ralph's Supermarket	08
Brandeis-Bardin (BB)	**Human Activity Sample Areas**	
	Perimeter of the Playground	01
	Dormitory Area	02
	Campsite Area 1	03
	Campsite Area 2	04
	Picnic Area	05
	House of the Book	06
	Counselor-in-Training Area	07
	Potential Development Site 1	08
	Potential Development Site 2	09
	Potential Development Site 3	10
	Vegetable Garden	11
	Main House Orchard	12
	Avocado Grove	13
	Old Well Campsite	14

TABLE 4-1

SAMPLE AREA IDENTIFICATION CODES

FACILITY	AREA DESCRIPTION	SAMPLE AREA CODE
Brandeis-Bardin (BB)	**Ravine Sampling Areas**	
	RD-51 Watershed	15
	Radioactive Materials Disposal Facility Watershed	16
	Building 59 Watershed	17
	Sodium Burn Pit Watershed	18
	Sodium Reactor Experiment Watershed	19
Santa Monica Mountains Conservancy (SMMC)	**Human Activity Sampling Areas**	
	Visitor Center Parking Lot	01
	Existing Road System	02
	Former Rocketdyne Employee Shooting Range	03
	Orange Groves	04
	Antenna Well	05
	Well By The House	06
	Well By The Gate	07
	Spring	08
BG, BB, SMMC	**Blind Field Duplicates All Areas**	00

FRUITS -	code indicated the number assigned to the soil sampling block within which the fruit was taken or the number of the sample in the order of collection for store bought background samples (001 to 012).
BLIND FIELD DUPLICATES -	blind field duplicates were designated by sequential numbers reflecting the order in which they were collected. The relationship to the original sample was documented in the field log book. The purpose of blind field duplicate samples is discussed in Section 5.1.2.
Digits 8 and 9:	This two-letter code indicated the medium sampled and the analysis to be conducted. In some cases, a single sample was used for more than one type of analysis and the designations for soil/sediment, groundwater, and surface water were not necessarily the same. In this report, the analysis and the medium sampled will be identified in the headings of the tables rather than relying on this code. Table 4-2 summarizes these codes.

4.2.2 Sample Labeling

All samples received two sample identification numbers: (1) the register number, which was the serial number printed on the register sample label, and (2) a site-specific sample identification code. Additional information such as project name, date and time of collection, the requested analytical method, and the sampler's initials were also recorded in the sample register book and on the sample labels (Figure 4-1).

4.2.3 Sample Documentation

In addition to the sample register books, other information was recorded in bound field log books. Daily entries documented the date, the names of the field teams, weather conditions, location-specific entries for grid setup and sample locations, locations of split samples, and miscellaneous entries. The field log book remained in the possession of the sampling team

TABLE 4-2

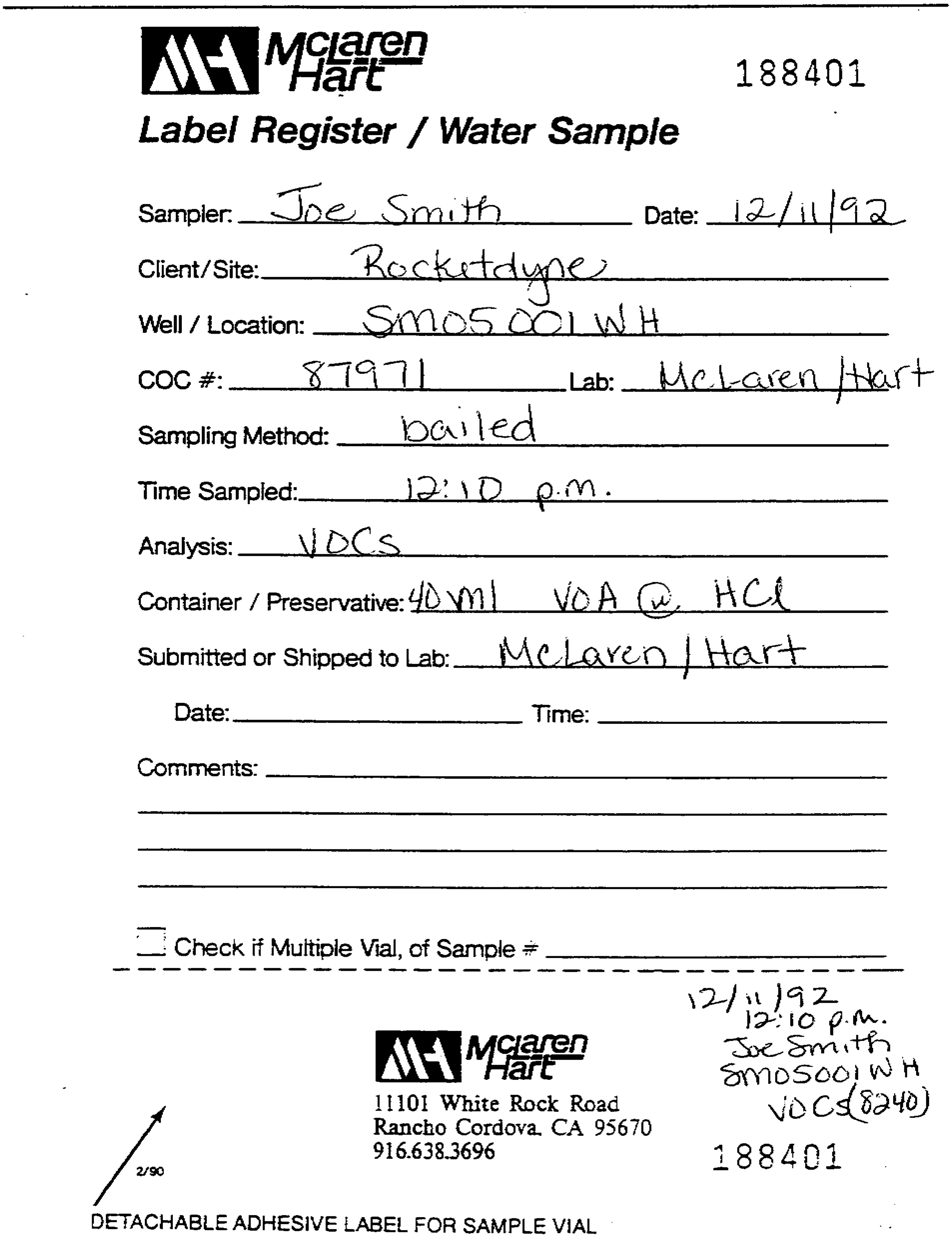
SUMMARY OF SAMPLE IDENTIFICATION CODES

	STRONTIUM-90	IODINE-129	ISOTOPIC PLUTONIUM	GAMMA SCAN	GROSS ALPHA/ BETA	TRITIUM	SVOC	METAL	VOC
Soil/Sediment	SA	SA	SB	SC	--	SC	SD	SF	SE
Surface Water	WA	WC	WB	WD	WI	WE	WG	WF	WH
Groundwater	GA	GC	GB	GD	GE	GF	GG	--	GH
Oranges	OA	OA	OA	OA	OA	OA	--	--	--
Avocados	AA	AA	AA	AA	AA	AA	--	--	--
Lemons	LA	LA	LA	LA	LA	LA	--	--	--
Tangerines	TA	TA	TA	TA	TA	TA	--	--	--

-- - Not applicable
Gamma scan - Analysis for gamma-emitting radionuclides
Gross alpha/beta - Analysis for alpha- and beta-emitting radionuclides
SVOC - Semi-volatile organic compound
VOC - Volatile organic compounds

FIGURE 4-1

REGISTER LABEL EXAMPLE



McLaren Hart

188401

Label Register / Water Sample

Sampler: Joe Smith Date: 12/11/92

Client/Site: Rocketdyne

Well / Location: SMOS001WH

COC #: 87971 Lab: McLaren/Hart

Sampling Method: bailed

Time Sampled: 12:10 p.m.

Analysis: VOCs

Container / Preservative: 40 ml VOA @ HCl

Submitted or Shipped to Lab: McLaren/Hart

Date: Time:

Comments:

☐ Check if Multiple Vial, of Sample #

McLaren Hart

11101 White Rock Road
Rancho Cordova, CA 95670
916.638.3696

12/11/92
12:10 p.m.
Joe Smith
SMOS001WH
VOCs(8240)

188401

2/90

DETACHABLE ADHESIVE LABEL FOR SAMPLE VIAL and at the end of the sampling activities, the sampling team leader reviewed all entries for accuracy and completeness.

4.2.4 Sample Handling, Shipping, and Storage

Samples were sealed, labeled, and placed in plastic coolers for shipment to the appropriate analytical laboratory. Glass containers were packed in foam shipping blocks. Glass and plastic water sample containers were wrapped in bubble wrap and packed securely in ice chests. The coolers destined for the McLaren/Hart laboratory were lined with double-bagged crushed ice or blue ice packs. Coolers with samples for radioactivity analyses were shipped without ice. The chain of custody forms were placed in a sealed plastic bag inside the cooler. The coolers were sealed with a custody seal and shipped via overnight courier. Samples were shipped via courier to the McLaren/Hart laboratory on a daily basis.

Samples collected after the courier departed were stored on ice and shipped the following day. Radionuclide samples were held for up to three days before shipment to the appropriate Teledyne Laboratory. Appropriate quality assurance/quality control (QA/QC) samples were shipped with the field samples.

4.3 Soil/Sediment Sampling

Soil samples were collected from six background areas, fourteen areas at Brandeis-Bardin, and four areas at the Conservancy. Sediment samples were collected from five areas at Brandeis-Bardin. Three locations were sampled in each of the background sampling areas and at least five locations were sampled in each of the sampling areas at Brandeis-Bardin [except at the Building 59 Watershed (BB-17) and the Sodium Reactor Experiment Watershed (BB-19) where only four sediment samples were collected] and the Conservancy.

This subsection presents the protocols for the grid sampling and purposeful (deterministic) sampling approaches, as well as the protocol for the collection and handling of soil/sediment samples and documentation of soil/sediment sampling. Soil/sediment sample containers, container size, appropriate preservatives and holding times are presented in Table 4-3. Appendix A lists the reporting and detection limits for the various analyses (refer to Section 5.3.1.6for a discussion of reporting and detection limits).

4.3.1 Soil/Sediment Sampling Strategies

This subsection presents the methods that were used to select the soil/sediment sample locations. Grid sampling was conducted in the Background Areas and Human Activity Areas at Brandeis-Bardin and the Conservancy. Purposeful sampling was conducted in the Ravine Sampling Areas at Brandeis-Bardin.

4.3.1.1 Grid Sampling Approach

A grid sampling approach was used in areas where surface conditions were relatively uniform. Sampling locations were selected from the grid on a random basis. The random sampling was expected to provide an unbiased measure of the mean chemical or radionuclide concentration in the sampling area.

Sampling locations were randomly selected prior to going into the field and plotted on figures that were included in the Workplan. Each figure was accompanied by the corresponding table that contained the complete list of randomly selected sample blocks. This list was used in the field to select alternate sampling blocks if any of the original blocks could not be sampled. The sample grids also included the precise sample location (randomly selected X- and Y-coordinates) which identified the sample location down to the

TABLE 4-3

SOIL/SEDIMENT SAMPLE CONTAINER AND PRESERVATION SPECIFICATIONS

ANALYTICAL PARAMETER	CONTAINER SIZE	CONTAINER TYPE	PRESERVATIVE	HOLDING TIME[a]
MCLAREN/HART LABORATORY				
VOCs	2 inch x 3 inch	brass tube	4°C [b]	14 days
SVOCs	2 inch x 3 inch	brass tube	4°C	14 days
Priority Pollutant Metals	1 gallon	plastic resealable bag	4°C	6 months
TELEDYNE, NEW JERSEY				
Gamma scan	1 gallon	plastic resealable bag	none	N/A
Tritium	1 gallon	plastic resealable bag	none	N/A
Isotopic Plutonium	1 gallon	plastic resealable bag	none	N/A
TELEDYNE, ILLINOIS				
Strontium-90	1 gallon	plastic resealable bag	none	N/A
Iodine-129	1 gallon	plastic resealable bag	none	N/A

N/A = Not Applicable
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds

[a] Holding time from day of collection to extraction.
[b] 4°C = 4 degrees centigrade temperature in the cooler.

nearest foot. The sampling grids were generally 10,000 square feet in area and divided into 100 sampling blocks, each 100 square feet in area (10 feet by 10 feet). The grid sampling blocks were assigned numbers starting with the number "001" in the southwest corner and numbered sequentially so that the lowest number in any given row was always in the western end of the row. Individual sites varied if the standard grid did not fit in the layout of the sampling area. Figure 4-2 is an example of a sampling grid. The random number tables used to identify sampling locations are included in Appendix B.

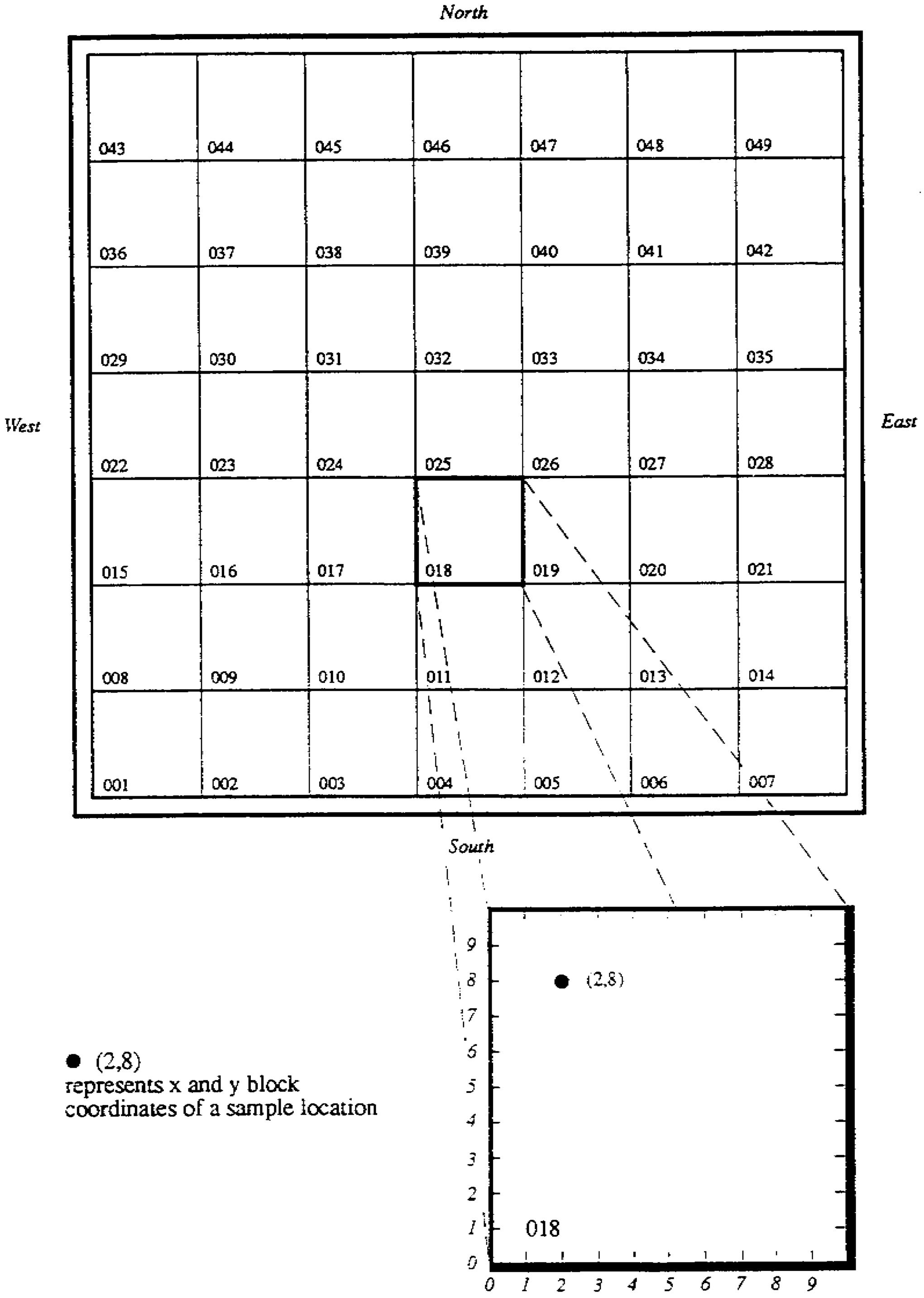
4.3.1.2 Purposeful (Deterministic) Sampling Approach

Sediment samples were collected from those locations where transported clay, silt, and sand had accumulated, most likely biasing the sampling toward higher concentrations of chemicals or radionuclides than those in the gridded areas.

Prior to conducting sampling activities in the ravines, the sampling crew and regulators familiar with the facility hiked the ravines to identify and record the drainage pathways and to select sampling locations most likely to be subject to runoff. With two exceptions at the Building 59 (BB-17) and Sodium Reactor Experiment (BB-19) Watersheds, a minimum of five sampling locations were selected in each ravine and marked with a wooden stake and a red plastic ribbon. Detailed descriptions of the sampling location, compass coordinates of visible landmarks and/or distance to the location from a known point were recorded in the log book. A representative from the USEPA, the California DHS, Cal-EPA, and the consultant to Brandeis-Bardin participated in selecting the sampling locations immediately prior to sampling.

FIGURE 4-2

SAMPLING BLOCK NUMBERING SCHEME



● (2,8)
represents x and y block
coordinates of a sample location

The ravine sampling locations met the following criteria:

- The sampling points were within the natural drainage below the SSFL;
- The sampling points were at a location where sediment containing chemicals or radionuclides was likely to accumulate;
- The sampling points contained enough sediment to supply the quantity necessary for all analytical requirements;
- The sampling points were accessible without exceptional risk to the sampling crew.

4.3.2 Soil/Sediment Sample Location Identification

This subsection discusses the format used to identify soil/sediment samples.

4.3.2.1 Grid Set Up and Sample Location Identification

The procedures described in the Workplan were followed to implement the sampling grids at the designated sampling areas. The maps, grid diagrams, sample block numbers, and sample location coordinates were obtained from the Workplan for each area. The sampling team conducted the following steps to establish the sampling grid and mark the appropriate sampling locations.

1) The southwest corner of the sampling area, the grid origin, was established. The southwest corner was always the starting point for all sampling grids and the origin of the X and Y axes for designating the sample locations within the sample blocks with the exception of the Dormitory Area (BB-02) at Brandeis-Bardin, and the Visitor Center Parking Lot (SM-01) at the Conservancy. Whenever possible, the grids were oriented in a north-south (y-axis)/east-west (x-axis) fashion.

2) Two visual landmarks (e.g., trees, physical structures) were established and noted in the field log book. The distances from a grid corner to the landmarks were measured using a 500-foot tape. Distances and compass readings were recorded in the field log book.

3) The four corners of the predetermined sampling grid were measured and marked with wooden stakes tied with red ribbon. The stakes were marked with their orientation to the origin (e.g., north, east, northeast). A compass was used to ensure the grid was square.

4) Each of the predetermined (randomly identified) sampling blocks was located on the ground by measuring the appropriate footage along the X and Y axes starting at the grid origin. The origin of the block was marked with a wooden stake, tied with a red ribbon and labeled with the block number. A compass was used to ensure the blocks were located in the appropriate orientation to the grid.

5) Each predetermined (randomly identified) sampling location within a sampling block was located using the values for the X and Y coordinates (increments of 1 foot). The sample location was measured and marked with a wooden stake, tied with an orange ribbon, and labeled with the block number and the location coordinates (i.e., block number, X-coordinate, Y-coordinate).

6) When the sampling location fell on an obstruction smaller than the grid block (e.g., small rock, plant) the sample was collected at the nearest point south of the obstruction, towards the SSFL. When the sampling location fell on an obstruction larger than the grid block (e.g., a large rock outcrop), the next grid block from the random numbers table was selected.

7) The placement of the grid and the sampling locations was documented photographically, and an entry in the field log book was made describing each photograph.

4.3.2.2 Purposeful Sampling Location Identification

Sampling locations within the Ravine Sampling Areas were selected using the following steps:

1) The team leader consulted the sampling plan to determine the building location and the drainage areas onto Brandeis-Bardin.

2) Initial sample locations were selected as close as possible to the property line in locations where sediment in surface runoff was most likely to have accumulated (i.e., depressions, pools, or bends in the stream bed). These locations were marked with wooden stakes and red ribbon was tied to nearby bushes or trees. Plants were cleared from an area about three feet around the sample location.

3) Sediment samples were collected as described in Section 4.3.3. The sample location was marked with a stake that had a red or orange ribbon tied to it, and labeled with the sample location code.

4) The location of the sample collected was documented in the field log book and photographed.

4.3.3 Soil/Sediment Sampling Procedure

A soil/sediment sample was defined as the total of six 6-inch soil cores that were collected at each sampling location. Five cores were collected from 0 to 6 inches in depth within one foot of the staked sampling location. These samples were analyzed for SVOCs, metals, and radionuclides (strontium-90, iodine-129, isotopic plutonium, tritium, and a gamma scan). Each sample collected for radionuclide analyses was extruded into a clean resealable plastic bag and mixed for one minute. After mixing, the bag was sealed for transport to the analytical laboratory. The sample taken for SVOC analyses was extruded into a glass bowl and mixed for one minute. One-half of the soil/sediment to be analyzed for SVOCs was packed into a clean 3-inch brass tube. The remaining soil/sediment (for metals analysis) was placed in a resealable plastic bag and sealed for transport to the analytical laboratory. For those sample locations where split samples were requested (see subsection 4.3.4), additional cores were collected from the same sampling radius (i.e., within one foot of the location stake) and mixed for one minute with the core(s) taken for the McLaren/Hart samples. After mixing, the contents were divided between McLaren/Hart, the consultant to Brandeis-Bardin, the DHS, or the USEPA, as appropriate.

A sixth soil sample (analyzed for VOCs) was collected from a depth of 6 to 12 inches below ground surface in two 2-inch by 3-inch brass tubes. The upper 3-inch tube was analyzed at the McLaren/Hart Analytical Laboratory and the lower tube was available for use as a split sample. It was acknowledged in the Workplan that this adjacent sample was not a true split sample. However, this sampling method was agreed upon by all participants in the study and was utilized to avoid loss of volatile organic compounds as a result of mixing the sample in the field.

Soil samples were collected using an impact driven hand coring sampler. The coring head contained two-inch diameter brass tubes: one 6-inch long tube for surface samples (0 to 6 inches) or two 3-inch long tubes for the 6 to 12 inch deep samples. Soil samples were collected in the following manner:

1) A pre-cleaned coring head and brass tube(s) were assembled and connected to the coring device. Clean latex gloves were worn by the samplers at all times.

2) The sampling location was cleared of surface rocks, sticks and other loose debris.

3) The cutting head was placed directly on the surface soil and the impact hammer was dropped on the coring head repeatedly until the top of the coring head was flush with the soil surface.

4) The corer was pulled from the ground and the coring head disassembled.

5) For surface samples (0 to 6 inches), the brass tube was removed and the soil extruded into a resealable plastic bag (radionuclides) or into a glass bowl (SVOCs and metals). The sample was mixed for one minute to blend the soil in an attempt to homogenize the sample. When split samples were requested, the soil from the necessary number of cores was placed into the same plastic bag or glass bowl and mixed for one minute. The mixed soil was then divided into the appropriate number of separate plastic bags (radionuclides and metals) or 3-inch brass tubes (SVOCs). The plastic bags were sealed with tape and placed in a second sealed bag. The ends of each brass tube were covered with a clean piece of teflon film, capped with clean plastic endcaps, sealed with duct tape, and placed in a sealed plastic bag.

6) For subsurface samples (6 to 12 inches), the two brass tubes (2 inch x 3 inch) were removed from the coring head and placed on a clean sheet of aluminum foil. The ends of the brass tube were immediately covered with a clean piece of teflon film and capped with clean plastic end caps. The end caps were sealed with teflon tape and then wrapped with duct tape.

7) Prior to sealing the plastic bags or brass tubes, each sample was surveyed for radioactivity according to the procedures outlined in Appendix F of the Workplan. The results for samples above 0 millirems per hour were recorded in the field log book. The USEPA also surveyed their samples at the microroentgen range; all samples were the same as the general background level measured in the area (USEPA, 1992).

8) A label was filled out for each sample as described in Section 4.3.2and placed on the brass tube or plastic bag. Clear plastic tape was placed over the label to prevent water damage. The soil samples were put into secondary, separate, clean, resealable plastic bags and placed in the ice filled cooler for the McLaren/Hart laboratory or the cooler without ice for the Teledyne laboratories.

9) The sample identification number, the location, time, date, depth of sampling, analyses requested, and name of sampler were recorded in the McLaren/Hart sample register book.

Sediment samples were collected using a hand trowel in the following manner:

1) A hand trowel was decontaminated and, thereafter, handled by persons wearing clean latex gloves.

2) The sampling location was cleared of rocks, sticks, and other loose debris.

3) For surface samples (0 to 6 inches), a sufficient amount of sample (estimated visually based on volume) was scooped into a resealable plastic bag (radionuclides and metals). For SVOCs the sample was scooped into a glass bowl. The sample was mixed for one minute in an attempt to homogenize the sample. When split samples were requested, the amount of sediment necessary was placed into the same plastic bag or glass bowl and mixed for one minute. The mixed sediment was then divided into the appropriate number of separate plastic bags (radionuclides and metals) or 3-inch brass tubes (SVOCs). The plastic bags were sealed with plastic tape and double-bagged. The ends of each brass tube were covered with a clean piece of teflon film, capped with clean, plastic end caps, and sealed with teflon tape, and then wrapped with duct tape.

4) For subsurface sediment samples (6 to 12 inches), soil was scooped from beneath the area previously sampled. The sediment was collected directly into a 2 inch by 3 inch brass tube that was sealed on one end with teflon film, capped with a clean plastic end cap, and sealed with teflon tape. A piece of teflon film and a plastic end cap were placed on the other end, the cap was sealed with teflon tape and then both ends were wrapped with duct tape.

5) See steps 7, 8, and 9 as described for soil sampling.

4.3.4 Split Samples

The USEPA, the DHS, and the Brandeis-Bardin consultant were invited to collect and analyze split samples. Whenever possible, the sampling protocols allowed for true split samples to be collected, i.e., the medium being sampled was mixed and the split samples were sent to different laboratories for analysis. (For samples being analyzed for VOCs, field mixing would have resulted in the loss of these analytes through volatilization. In these cases, two adjacent samples were used instead of true splits.) Ideally, the results of the analyses can be compared to give an indication of the variability between laboratories. However, environmental media, especially soil/sediment, are very difficult to truly homogenize in the field and the results may differ due to the variability of the media rather than the laboratories.

The USEPA, the DHS, and/or the Brandeis-Bardin consultant determined the number and locations of the split samples they collected. For the USEPA and the DHS split samples collected, the location, date, time, depth of sampling, sample identification number, analyses requested and name of sampler was recorded in the soil register book. The Brandeis-Bardin consultant opted to label his own samples.

After field work was completed and the original samples were analyzed, additional splits of selected samples were made by sending samples from one laboratory to another. These were considered true splits because the sample remaining after the initial analysis by the first lab was sent to the second laboratory for analysis. In some cases the remaining sample, after the initial analysis, at one laboratory was split between two laboratories and analyzed. However, since splitting of samples after submittal to the laboratory was not in the Workplan, we have identified these as "interlaboratory splits" or "laboratory splits" to distinguish them from the other quality assurance/quality control (QA/QC) samples discussed in the Workplan.

4.4 Water Sampling

Water samples were collected from surface streams and groundwater wells. For each sampling event, separate samples were collected for VOCs [four 40-milliliter (ml) glass vials with 4 drops of 12 molar (M) hydrochloric acid as a preservative], SVOCs (one 1-liter amber glass bottle), priority pollutant metals (1-liter plastic bottle with 4 ml of one to one nitric acid solution as a preservative), gamma scan (two 1-liter plastic bottles with 4 ml of a 16M, one to one nitric acid), gross alpha/beta scan (one 1-liter plastic bottle with 4 ml of a 16M, one to one nitric acid), iodine-129 (two 1-liter plastic bottles with 4 ml of a 16M, one to one nitric acid solution), isotopic plutonium (one 0.5-liter plastic bottle with 4 ml of a 16M, one to one nitric acid solution), strontium-90 (two 1-liter plastic bottles without preservative), and tritium (one 1-liter glass bottle without preservative). Table 4-4 summarizes information on sample containers. Appendix A lists the reporting and detection limits for each analysis.

4.4.1 Surface Water Sampling Procedure

Surface water was collected from flowing streams which were deep enough to submerge a 1-liter bottle or 5-gallon stainless steel pail. Care was taken to ensure that the bottom sediments at the sample location or upstream were not disturbed in the area where the surface water was collected. If sediment samples and surface water were collected at the same location, the water was collected first and the sediment was collected afterward. The location was marked with a wooden stake tied with an orange or red ribbon and labeled with the sample location code. The distances to nearby landmarks were recorded in the field log book.

4.4.2 Groundwater Sampling Procedure

The groundwater wells were purged to remove standing water and sampled twice within a two week period. The objective of the groundwater sampling was to obtain a volume of water that was as representative (i.e., chemically similar) to the water in the aquifer as possible. To meet this objective, the following minimum guidelines were implemented:

TABLE 4-4

WATER SAMPLE CONTAINER AND PRESERVATION SPECIFICATIONS

ANALYTICAL PARAMETER	CONTAINER SIZE	CONTAINER TYPE	SAMPLE HANDLING	PRESERVATIVE	HOLDING TIME[a]
MCLAREN/HART LABORATORY					
Surface Water					
VOCs	40 milliliter	glass vial	N/A	4°C[b]; 4 drops HCl[c]	14 days
SVOCs	1 liter	glass bottle, amber	N/A	4°C	7 days
Priority Pollutant Metals	1 liter	plastic bottle	filtered[d]	4 ml HNO_3 [e]	6 months
Groundwater					
VOCs	40 milliliter	glass vial	N/A	4°C[b]; 4 drops HCl[c]	14 days
SVOCs	1 liter	glass bottle, amber	N/A	4°C[b]	7 days
TELEDYNE, NEW JERSEY					
Surface Water and Groundwater Samples					
Gamma Scan	1 liter	plastic bottle	filtered[d]	4 ml HNO_3[e]	N/A
Gross Alpha and Beta Scan	1 liter	plastic bottle	filtered[d]	4 ml HNO_3[e]	N/A
Tritium	1 liter	glass bottle	filtered[d]	none	N/A
Isotopic Plutonium	0.5 liter	plastic bottle	filtered[d]	4 ml HNO_3[e]	N/A
TELEDYNE, ILLINOIS					
Surface Water and Groundwater Samples					
Strontium-90	1 liter	plastic bottle	filtered[d]	none	N/A
Iodine-129	1 liter	plastic bottle	filtered[d]	2 ml HNO_3[e]	N/A

N/A = Not Applicable
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds

[a] Holding time from day of collection to extraction.
[b] 4°C = 4 degrees centigrade temperature in the cooler.
[c] 12 molar hydrochloric acid.
[d] Samples were filtered in the field using a 0.45 micron Whatman glass fiber filter.
[e] 1:1 solution of 16 molar nitric acid and distilled/deionized water.

- All stagnant water in the casing was pumped from the well so that fresh water from the aquifer was entering the well at the time of sample collection.

- The sample was extracted from the well with as little disturbance and as little exposure to the atmosphere as possible.

- The sample was not allowed to come in contact with any materials which may influence or alter the chemicals or radionuclides of potential concern in any way.

- Aliquots of the sample were treated to preserve those analytes that would otherwise be altered in transport to the laboratory.

An estimate of the well casing volume was made using the available documentation on groundwater depth and well casing diameter to calculate the volume of water in the well and determine the volume to be purged. The time required to purge three well casing volumes of water was calculated using standard well sampling tables. Each well was purged prior to sample collection using the dedicated pump inside the well.

The standing water was drawn down from the surface to ensure that fresh water from the aquifer moved into the well. At least three well volumes were evacuated prior to sample collection until field parameters were stabilized. Stabilization was defined by the following parameters: 1) pH was constant to within 0.1 pH units; 2) conductivity did not vary by more than 10 percent from the previous reading; and 3) the temperature was within 1 degree centigrade of the previous reading.

The wells scheduled for sampling on the Conservancy property were used for irrigation, therefore, the purged water, consistent with its normal use, was discharged to irrigated land.

4.4.3 Surface Water And Groundwater Sample Collection

The following procedures were followed for the collection of surface water and groundwater samples.

4.4.3.1 Volatile Organic Compound Sample Collection

1) The 40 ml glass sample vials contained 4 drops of 12 molar hydrochloric acid. The caps were removed and the vials were filled by submerging the bottles into the surface water or by filling them directly from the sample port on the well.

2) After the sample bottle was filled completely, the bottle was checked to make sure that no air bubbles were present and the cap containing a teflon septum was carefully replaced. The vial was then inverted to mix the preservative with sample and to verify that no air bubbles were visible in the sample.

3) The bottles were dried and the sample label was attached. The bottle was then packed in foam and put into the ice chest cooled with ice to approximately four degrees centigrade (4 °C).

The sample identification number, the location, time, date, analyses requested, and the name of the sampler were then recorded in the McLaren/Hart sample register book. Split samples consisted of randomly selecting four of eight vials as the split sample.

4.4.3.2 Other Sample Collection

1) A clean stainless steel pail was used to collect all surface water samples to be analyzed for radionuclides, SVOCs, or metals. Groundwater wells were sampled by placing a clean stainless steel pail below the sample port.

2) The stainless steel pail and sample bottle were rinsed thoroughly with sampling source water which was discarded away from the sampling point. Surface water was either collected in the sample bottle and poured into the pail or collected directly in the pail until a minimum of two liters of water were in the stainless steel pail.

3) Water for SVOC analysis was mixed in the stainless steel pail and poured into two 1-liter amber bottles through a funnel. One sample was dried, labeled and placed into a foam case in a cooled ice chest (4 °C). The second sample was given to the USEPA as a split.

4) Other samples were also collected in the stainless steel pail but were filtered in the field. A clean 0.45 micron Whatman glass fiber filter was placed into the clean filter apparatus using a pair of tweezers. A small quantity (5 mls) of the sample water was sprinkled onto the filter.

5) Approximately 1 liter of the water in the bucket was poured into the filtering apparatus. The hand pump was attached to the filtering apparatus and the sample that passed through the filter paper was collected into a clean 5-gallon stainless steel pail.

6) Pressure was continually applied to the filtering apparatus with the hand pump until all of the water passed through the filter.

7) The apparatus was disconnected and a new filter and additional sample was added. After sufficient sample was filtered, the filtered sample was divided into two sample bottles for split samples.

8) The sample bottle(s) was capped and the process repeated until all samples were collected.

9) The sample identification number, the location, time, date, analyses requested and the name of the sampler were recorded in the sample register log book.

4.5 Fruit Sampling

Fruit was sampled from orchards near Happy Camp, from the Conservancy, and from Brandeis-Bardin. Fruit purchased at a Ralph's Supermarket in the San Fernando Valley was also sampled.

For avocados, the edible portions of the fruit samples were analyzed for radionuclides to evaluate the uptake of radionuclides into the fruit through the root system. For citrus fruits (lemons, oranges, and tangerines), the entire fruit was analyzed to evaluate the deposition of dust containing radionuclides on the surface of the fruit as well as root uptake. Table 4-5 summarizes sample collection information. Appendix A lists the reporting and detection limits for each analysis.

It was assumed that some people eat the peel of citrus fruit such as oranges. Therefore, for citrus samples, both the skin and the pulp were processed together for analysis. The skin and pit of avocados typically are not eaten and only the meat was processed for analysis.

4.5.1 Fruit Sample Location Identification

Following soil sampling, the first three grid blocks on the random number table containing a fruit-bearing tree were selected to be sampled, these usually corresponded to the same soil sampling blocks. The trees were assigned the sample block number associated with the soil sampling grid. Detailed sketches of the orchards were recorded in the field log book, noting the location of the selected trees and their orientation to the soil sampling block numbering scheme.

TABLE 4-5

FRUIT SAMPLE CONTAINER AND PRESERVATION SPECIFICATIONS

ANALYTICAL PARAMETER	CONTAINER SIZE	CONTAINER TYPE	SAMPLE HANDLING	PRESERVATIVE	HOLDING TIME[a]
TELEDYNE, NEW JERSEY					
Fruits					
Gamma scan	1 gallon	plastic resealable bag	N/A	none	N/A
Tritium	1 gallon	plastic resealable bag	N/A	none	N/A
Strontium-90	1 gallon	plastic resealable bag	N/A	none	N/A
Iodine-129	1 gallon	plastic resealable bag	N/A	none	N/A
Isotopic Plutonium	1 gallon	plastic resealable bag	N/A	none	N/A

N/A = Not Applicable

[a] Holding time from day of collection to extraction.

4.5.2 Fruit Sample Collection

Only ripe or nearly ripe fruit was collected to ensure that the fruit had been exposed for the maximum amount of time possible. Fruit was collected from the outer branches on the southern side of the designated trees at approximately mid-height to ensure consistency between trees and to reduce the variability between samples due to deposition of dust related to the position of the fruit on the tree. Since there were few ripe avocados, fruits were taken from the entire tree. A minimum of four kilograms of fruit per sample were taken for the required radionuclide analyses. This sample weight corresponded to approximately 18 to 20 large oranges, 38 to 40 lemons or tangerines, and 28 to 30 large avocados per sample.

Fruit samplers wore latex gloves during all fruit sampling activities. The fruit collected from each tree was placed in individual, clean resealable plastic bags. The sample bags were sealed, assigned appropriate sample identification codes, sample register codes, and labeled (see Section 4.2.2). The sample identification number, the location, time, date, analyses requested and the name of the sampler were recorded in the sample register book.

4.5.3 Split Samples

The USEPA collected split samples at some of the fruit sample locations. At each selected location, sufficient fruit for two samples was collected from a single tree or a sufficient amount of fruit for all samples was purchased, placed in a large bag, mixed, and split into appropriate number of split samples. Split samples were collected at the same time and treated using the same handling, shipping, and storage protocols as previously noted. Notation was made in the field log book for all split samples collected.

SECTION 5.0

QUALITY ASSURANCE/QUALITY CONTROL METHODOLOGY

The previous section discussed the methodology used to sample the environmental media for chemicals and radionuclides. This section describes the Quality Assurance/Quality Control (QA/QC) procedures that were used. The QA/QC sample results are discussed in Section 6.0.

The purpose of the QA/QC samples was to identify any discrepancies in the analytical data and to provide the basis for establishing that the data are a valid representation of the conditions in the study areas. Six different types of QA/QC samples were collected throughout this project, each of which is described below. In addition, routine laboratory QA/QC protocol and the internal laboratory data verification procedures were conducted. Subsection 5.1 presents the types of QA/QC samples. Subsection 5.2 presents sample collection frequency and location. Subsection 5.3 presents internal laboratory QA/QC procedures.

5.1 Field QA/QC Sample Types

The six types of QA/QC samples which were collected during the field sampling are described in this section. The number and purpose of each type of QA/QC sample is discussed here.

5.1.1 Field Rinsate Samples

Field rinsate samples provided a check on possible cross contamination from sampling equipment. After the equipment was decontaminated, field rinsate samples were collected by rinsing the equipment with distilled water and collecting the rinse water for analysis. Field rinsate samples were collected at a rate of one per 20 sample locations for each medium and for each analysis. Field rinsate samples were not collected for fruit samples because no equipment was used to collect the fruit.

Each field rinsate sample for soil/sediment, surface water and groundwater was analyzed for one of the following: VOCs, SVOCs, priority pollutant metals, tritium, gamma scan, isotopic plutonium, iodine-129, and strontium-90. For SVOC analysis, rinsate samples were analyzed using the method corresponding to the appropriate media: soil rinsate samples for SVOCs were analyzed using USEPA Method 8270; water rinsate samples were analyzed using USEPA Method 610. All water field rinsate samples were also analyzed for gross-alpha and gross-beta emitting radionuclides. The following protocol was implemented to collect field rinsate blanks:

1) All sampling equipment was decontaminated as described in Section 4.1.

2) Distilled water was poured over the cleaned sampling equipment into a clean stainless steel bucket or directly into the sample bottles. Preservatives for rinsate samples were the same as those discussed in Section 4.4.

3) Rinsate samples were assigned a water sample register identification number, sealed, and stored in a sample storage cooler at approximately 4 °C.

4) The sample identification, the date, the time, and the sampler's initials for each of the rinsate samples were recorded in the sample register book. The samples were shipped consistent with the methods for other field samples.

5.1.2 Blind Field Duplicate Samples

Blind field duplicate samples were collected to provide an evaluation of the laboratory's performance by comparing analytical results for two identical or nearly identical samples.

As such, all blind field duplicate samples were collected as described for split samples in Section 4.0. As described previously, collecting true split samples for volatile organic compounds is not practical due to potential losses from volatilization. However, samples taken immediately adjacent to (or below) one another provided a sufficient measure of consistency.

The blind duplicate samples were placed in separate containers and given distinct sample numbers to allow for "blind" receipt by the analytical laboratory. The true identity was concealed from the laboratory, but the identity of the samples was thoroughly documented in the field log books and sample register books. Blind field duplicates were designated by the number "00" in the 3rd and 4th digit of the site-specific sample identification code. Blind field duplicates were numbered successively in the 5th, 6th, and 7th digits in the order they were collected from the sampling areas. Blind field duplicates were collected at a rate of one per 20 samples for all analyte groups.

5.1.3 Trip Blanks

Trip blanks were collected for the purpose of evaluating the cross-contamination from volatile organic compounds during transport or in the laboratory. One trip blank was shipped to the McLaren/Hart laboratory each day samples were shipped. Trip blanks consisted of distilled water that was poured into a 40-milliliter vial at the staging area near the Rocketdyne gate, at the beginning of each day. The sample was taken into the field and placed in a cooler on ice, but was not opened. The sample was then shipped to the McLaren/Hart laboratory with the field samples for volatile organic analysis. Trip blanks were not given location specific identification, but were given water sample register numbers. Appropriate notations regarding date, time, and sample were made in the field log book and sample register book.

5.1.4 Field Blanks

Field blanks were used to evaluate the cleanliness of the sample collection bottles and possible sources of contamination related to the field sampling environment. Field blanks consist of sample bottles that were filled with distilled water in the field. The sample bottles were then capped, sealed, and shipped to each of the appropriate analytical laboratories along with the other field samples. Field blanks were collected for all analyte groups at a rate of one for every 20 surface water, groundwater, and rinsate samples. Field blanks were assigned sample identification numbers from the water sample register book only. Appropriate notation regarding date, time, and sample were made in the field log book and sample register book.

5.1.5 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD) samples are QA/QC analyses performed by the analytical laboratory using material (soil/sediment or water) from the field. The matrix spike is a sample to which one or more of the chemicals or radionuclides or a surrogate [1] (spike) is added by the analytical laboratory. Matrix spike duplicates were analyzed for chemicals at McLaren/Hart using a second aliquot of the same sample, spiked separately. The results of the spike and duplicate spike analyses are expressed in terms of the percent recovery of the added chemical. The results of the spike and the duplicate analyses are compared by the relative percent difference between the results. These results

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[1] Surrogate chemicals are not reported as part of the standard analyses, but are chemically similar to the analytes of interest and are used to identify problems with the analytical method, due to matrix interferences.

are used to evaluate the laboratory's precision[2] and accuracy[3] in the analysis of samples, respectively.

The MS/MSD samples were collected at a rate of one per 20 samples (including other QA/QC samples) for each analyte group. The MS/MSD samples were assigned sample register identification numbers only. The McLaren/Hart laboratory performed matrix spike and matrix spike duplicate analyses for soil and water samples. Teledyne Isotopes in New Jersey conducted matrix spike analyses for fruit, water and soil/sediment samples. Teledyne Isotopes in Illinois conducted matrix spike analyses for soil and water samples. Additionally, all laboratories performed laboratory matrix spike/matrix spike duplicate control samples.

5.1.6 Split Samples

The USEPA, the DHS, and the consultant to Brandeis-Bardin were invited to collect and analyze split samples for QA/QC purposes. Whenever possible, the medium being sampled was mixed so that split samples analyzed at different laboratories were representative of the same sample. Only the samples analyzed for volatile organic compounds were not true splits but adjacent samples (soil/sediment) or consecutive samples (water). The decision was made to collect adjacent or consecutive samples rather than mixing in the field because mixing may have resulted in the loss of organic compounds by volatilization.

The results of the analyses from split samples were compared to provide an indication of the variability between laboratories when analyzing the same sample. However, since

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[2] Precision refers to the consistency of the laboratory's results.

[3] Accuracy refers to the proximity of the laboratory's results to the concentration.

environmental media, especially soil, are very difficult to homogenize, some differences between samples may be due to variability of the medium rather than the laboratories. In those cases where the field split or adjacent sample results appear to be different, the laboratory duplicates, the laboratory spikes, and when appropriate the statistical variability of the data were evaluated to determine whether the apparent difference in split samples was significant.

5.2 Quality Assurance/Quality Control (QA/QC) Sample Selection

Six types of quality assurance and quality control (QA/QC) samples were included in the sampling program to provide quality control over the collection, handling, and analysis of the soil/sediment, water, and fruit samples. This section discusses the numbers of QA/QC samples and how the sample locations were selected.

The project QA/QC goal was to have one QA/QC sample of every type (e.g., blind field duplicates, field rinsate blanks, etc.) for every 20 samples analyzed. For example, a total of 136 soil/sediment samples were collected for priority pollutant metals in this study, representing six groups of 20 and one group of 16 samples. Blind field duplicates were collected for priority pollutant metals at seven sample locations throughout the project, thereby achieving the project QA/QC goal of one QA/QC sample for blind duplicates for every 20 priority pollutant metal analyses performed. Tables 5-1, 5-2, and 5-3 summarize the number of QA/QC samples by analyses for soil/sediment, water, and fruit, respectively.

TABLE 5-1

QUALITY ASSURANCE/QUALITY CONTROL SUMMARY FOR SOIL/SEDIMENT SAMPLES

ANALYSIS (METHOD) [# OF SAMPLES]	VOLATILE ORGANIC COMPOUNDS (EPA 8240) [136]		SEMI-VOLATILE ORGANIC COMPOUNDS (USEPA 8270 OR 610)* [136]		METALS PRIORITY POLLUTANT METALS [136]		STRONTIUM-90 [136]		IODINE-129 [136]		GAMMA SCAN [136]		TRITIUM [136]		ISOTOPIC PLUTONIUM [136]	
	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES
Field Rinsates	7	5.1	7	5.1	7	5.1	7	5.2	7	5.1	7	5.1	7(6)**	5.1	7	5.1
Blind Field Duplicates	7	5.1	7	5.1	7	5.1	8	5.9	8	5.9	7	5.1	7	5.1	7	5.1
Trip Blanks	13	9.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Matrix Spikes†	27	19.8	29	21.3	24	17.6	7	5.1	7	5.1	7	5.1	7	5.1	7	5.1
USEPA Split	21	15.4	21	15.4	20	14.7	20	14.7	21	15	24	17.8	27	21	20	14.7
DHS Split	---	---	---	---	---	---	---	---	---	---	6	4.4	6	4.7	---	---
BBI Split	---	---	---	---	---	---	13	9.6	--	--	13	9.6	2	1.5	---	---

--- - Not applicable

* - USEPA Method 8270 was used for soil samples and associated rinsates. USEPA Method 610 was used for water samples and associated rinsates.

** - One sample was misplaced by the lab, therefore, only 6 samples were analyzed.

† - Only the McLaren/Hart laboratory conducted matrix spike duplicate analyses.

BBI - Brandeis-Bardin Institute
DHS - Department of Health Services (California)
USEPA - United States Environmental Protection Agency

Table 5-2

Quality Assurance/Quality Control Summary for Surface Water And Groundwater Samples

Analysis (Method) [# of Samples]	Volatile Organic Compounds (USEPA 8240) [14]		Semi-Volatile Organic Compounds (USEPA 8270 or 610) [13]		Metals Priority Pollutant Metals* [8]		Strontium-90 [13]		Iodine-129 [13]		Gamma Scan [13]		Isotopic Plutonium [13]		Tritium [13]		Gross α/ Gross β** [13]	
	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples	Total	% of Samples
Field Rinsates	1	7.1	1	7.7	1	12.5	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7
Blind Field Duplicates	2	14	1	7.7	1	12.5	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7
Trip Blanks	3	100	---	---	---	---	---	---	---	---	----	---	---	---	---	---	---	---
Field Blanks	1	7.1	1	7.7	1	12.5	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7
Matrix Spikes	16	114	16	123	14	175	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7	1	7.7
USEPA Split	8	57	7	54	5	62	8	62	7	54	8	62	8	62	8	62	8	62
DHS	---	---	---	---	---	---	---	---	---	---	1	7.7	---	---	1	7.7	1	7.7

--- - Not applicable
* - Metals analyses were conducted for surface water samples only; all other analyses were conducted for both surface water and groundwater.
** - Gross alpha and gross beta analyses for radionuclides
USEPA - United States Environmental Protection Agency
DHS - Department of Health Services

TABLE 5-3

QUALITY ASSURANCE/QUALITY CONTROL SUMMARY FOR FRUIT SAMPLES

ANALYSIS [# OF SAMPLES]	STRONTIUM-90 [24]		IODINE-129 [24]		GAMMA SCAN [24]		ISOTOPIC PLUTONIUM [24]		TRITIUM [24]	
	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES	TOTAL	% OF SAMPLES
Blind Field Duplicates	5	21	5	21	5	21	5	21	5	21
Matrix Spikes	3	12.5	3	12.5	2	8.3	2	8.3	3	12.5
USEPA Split*	5	21	5	21	5	21	5	21	5	21

* - USEPA was the only agency to collect fruit sample splits
USEPA - United States Environmental Protection Agency

One field rinsate sample was collected for each group of analytes at separate locations for soil/sediment samples. For water samples, the field rinsate blanks for each analysis were collected at the same location. Prior to field activities, sample locations were grouped by sets of 20 and field rinsate samples were collected at the first eight locations in each group (one for each analysis type). Blind field duplicate sample locations for soil/sediment and fruit were selected randomly prior to field activities. Prior to field activities, sample locations were grouped into sets of 20 based on the sampling order. A random number generator was used to select seven sample locations from each group of twenty sample locations. For analyses requiring smaller volumes of soil, more than one analysis was conducted on the same volume of soil/sediment (e.g.,strontium-90 and iodine-129, gamma scan and tritium). Blind field duplicate samples for water were collected from one location and analyzed for the full suite of water analyses (i.e., VOCs, SVOCs, priority pollutant metals, strontium-90, iodine-129, isotopic plutonium, gamma scan, and gross alpha/beta scan).

Matrix spike and matrix spike duplicate (MS/MSD) samples were collected from one sampling location within a group of 20. Samples were collected from that location for all soil analyses. The location was chosen once the locations of all other QA/QC samples were known. The MS/MSD sample locations were selected to spread the QA/QC sample collection evenly throughout all sample blocks.

Trip blanks were prepared at the beginning of each day that VOC samples were collected for shipment. Based on the number of groundwater, surface water, and rinsate samples, only one set of field blank samples for all water analyses was required. The field blank sample was collected at the staging area. Split samples were collected at locations designated by the appropriate representative in the field.

Table 5-4 is the QA/QC sample collection schedule used for soil/sediment samples collected for this project. Table 5-5 and 5-6 are the QA/QC sample collection schedules used for surface water, groundwater, and fruit samples, respectively.

5.3 Laboratory QA/QC

Soil/sediment and water samples for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and priority pollutant metals (metals) were submitted to the McLaren/Hart Analytical Laboratory, a State of California certified laboratory in Rancho Cordova, California. Soil/sediment and water samples analyzed for gamma-emitting radionuclides, tritium, and isotopic plutonium as well as fruit samples analyzed for gamma-emitting radionuclides, tritium, isotopic plutonium, strontium-90, and iodine-129 were submitted to Teledyne Isotopes in Westwood, New Jersey. Groundwater and surface water samples for gross alpha and gross beta radioactivity were also sent to Teledyne Isotopes, New Jersey. Soil/sediment and water samples for strontium-90 and iodine-129 were analyzed by Teledyne Isotopes in Northbrook, Illinois to expedite sample analysis by using more than one laboratory.

Both the McLaren/Hart and Teledyne laboratories followed standard internal quality assurance/quality control (QA/QC) procedures to ensure that the data presented in this report are accurate and to provide the basis for identifying any discrepancies in the data. These procedures covered all aspects of laboratory procedures from sample identification and tracking through the analytical procedures to data entry. The following sections provide a detailed description of the steps taken by each laboratory to ensure the quality of the data.

TABLE 5-4

SOIL/SEDIMENT QUALITY ASSURANCE/QUALITY CONTROL SAMPLE COLLECTION SCHEDULE

SAMPLE AREA	SAMPLE LOCATION	DATE (1992)	SAMPLE BLOCK #
Santa Susana Park	BG-02	3/10	076^{RA}, $007^{RB,USEPA,X}$, 074^{RC}
Rocky Peak	BG-01	3/10	$100^{RD,FDE}$, 005^{RE}, 008^{RF}
The Existing Road System	SM-02	3/11	044^{RG}, 004^{RH}, 032^{FDB}, 021, 019^{USEPA}
The Orange Groves	SM-04	3/11	041^{FDA}, 003^{FDD}, 028, 026, 024^{FDF}
Near The Former Rocketdyne Employee Shooting Range	SM-03	3/11	012, 015, 009, 001^{USEPA}, $014^{RA,FDE,FDC}$
The Visitor Parking Lot	SM-01	3/23	008^{RB}, 021^{RC}, 020^{RD}, $004^{RE,USEPA}$, 007^{RF}
Santa Monica National Recreation Area	BG-06	3/12	$096^{RG,FDA,FDB}$, $089^{RH,FDD}$, 033^{X}
Bell Canyon	BG-03	3/12	001, 019, 059^{USEPA}
Western Site	BG-04	3/13	025^{FDF}, 090, 029^{USEPA}
Happy Camp	BG-05	3/13	074^{FDC}, 026^{X}, 016
Western Site	BB-04	3/16	021^{USEPA}, 023, $097^{RA,DHS}$, 082^{RB}, 026^{RC}
Old Well Campsite	BB-14	3/16	037^{RD}, $041^{RE,FDF}$, $079^{RF,FDE,USEPA}$, 094^{RG}, $044^{RH,FDA}$
Santa Monica National Recreation Area	BB-06	3/17	017, 007, 092^{USEPA}, 066, 013
Campsite Area 1	BB-03	3/17	025, 092^{X}, 079^{RF}, 017^{FDC}, 005^{USEPA}
Avocado Grove	BB-13	3/17	$024^{FDB,USEPA}$, 037^{FDD}, $039^{RA,FDD}$, 011^{RB}, 010^{RC}
Picnic Area	BB-05	3/18	$003^{RD,FDB}$, 089^{RE}, 006^{RF}, 057^{RG}, $077^{RH,USEPA}$
Main House Orchard	BB-12	3/18	006^{FDE}, 019, 023^{BBI}, $020^{FDF,USEPA}$, 003
Perimeter Of The Playground	BB-01	3/18	056^{USEPA}, 041, 001^{FDC}, 027, 038^{FDA}
Vegetable Garden	BB-11	3/18	018^{BBI}, 061^{USEPA}, $057^{RA,FDD}$, 032^{RB}, 006^{RC}
Potential Development Site 1	BB-08	3/19	$034^{RD,FDE}$, $035^{RE,X}$, 003^{RF}, $022^{RG,BBI}$, 038^{RH}
Dormitory Area	BB-02	3/19	071^{BBI}, 045, 060^{FDC}, 075, 078
Potential Development Site 2	BB-09	3/19	070^{FDB}, 092^{BBI}, 031^{FDF}, 051^{X}, 100^{FDA}
Counselor-In-Training Area	BB-07	3/19	035^{BBI}, 036^{X}, 058^{RA}, 012^{RB}, 038^{RC}
Potential Development site 3	BB-10	3/19	$067^{RD,FDD,FDF,}$ $079^{RE,FDC}$, $081^{RF,BBI}$, 023^{RG}, 029^{RH}
Sodium Burn Pit Watershed	BB-18	4/21	$001A^{DHS}$, 002A, 003A, 001B, 002B, $003B^{FDE}$, $001^{USEPA,BBI}$, 002, 003

TABLE 5-4

SOIL/SEDIMENT QUALITY ASSURANCE/QUALITY CONTROL SAMPLE COLLECTION SCHEDULE

SAMPLE AREA	SAMPLE LOCATION	DATE (1992)	SAMPLE BLOCK #
Building 59 Watershed	BB-17	4/21	001^{USEPA}, 002, 003^{DHS}, $004^{\text{FDB,BBI}}$
Radioactive Materials Disposal Facility Watershed	BB-16	4/22	001A, $001\text{B}^{\text{USEPA}}$, 002^{FDA}, $003^{\text{RA,FDE}}$, $004^{\text{RB,DHS}}$, $005^{\text{RC,BBI}}$
RD-51 Watershed	BB-15	4/22	$001^{\text{RD,FDA,DHS}}$, $002^{\text{RE,FDD,FDC}}$, 003^{RF}, $004^{\text{RG,BBI}}$, $005^{\text{RH,USEPA}}$
Sodium Reactor Experiment Watershed	BB-19	4/23	001, $002^{\text{FDF,DHS}}$, 003^{USEPA}, $004^{\text{FDB,BBI}}$, 005

Note: This table is organized in order of date sampled. The only exception is the Visitor's Center Parking Lot (SM-01) which was sampled out of order, but the QA/QC analyses were not adjusted.

Superscripts indicate an additional sample (split, duplicate, matrix spike, or rinsate) was collected at the specified location. The superscripts are defined below. No superscript indicates that only the scheduled sample was collected.

SOIL SAMPLING SCHEDULE EXPLANATION OF CODES

Field Rinsate Blanks		**Sample Volume and Container**	**Lab**
RA	Strontium-90	2, 1 liter plastic	Teledyne,IL
RB	Isotopic Plutonium	0.5 liter plastic	Teledyne, NJ
RC	Iodine-129	2, 1 liter plastic	Teledyne,IL
RD	Gamma Scan	2, 1 liter plastic	Teledyne, NJ
RE	Tritium	1 liter glass (clear)	Teledyne, NJ
RF	Metals USEPA 6000&7000	1 liter plastic	McLaren/Hart
RG	SVOCs USEPA 610	3, 1 liter glass (amber)	McLaren/Hart
RH	VOCs USEPA 8240	4, 40 milliliter vials	McLaren/Hart

Blind Field Duplicates			**Lab**
FDA	Strontium-90/Iodine-129	1 quart ziplock bag	Teledyne, IL
FDB	Isotopic Plutonium	1 quart ziplock bag	Teledyne, NJ
FDC	Gamma Scan/Tritium	1 gallon ziplock bag	Teledyne, NJ
FDD	SVOCs USEPA 8270	3-inch brass tube	McLaren/Hart
FDE	VOCs USEPA 8240	3-inch brass tube	McLaren/Hart
FDF	Metals USEPA 6000&7000	1 quart ziplock bag	McLaren/Hart

Split Samples

USEPA - Additional set of samples were split with the United States Environmental Protection Agency for entire suite of soil/sediment analyses.

DHS - Additional soil/sediment samples split for gamma scan and tritium analyses.

BBI - Additional soil/sediment samples split for strontium-90, gamma scan, and selected tritium analyses.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

X - Additional set of samples collected for entire suite of soil/sediment analyses for matrix spike and matrix spike duplicate for McLaren/Hart contracted labs.

TABLE 5-5

GROUNDWATER AND SURFACE WATER ANALYSES QUALITY ASSURANCE/QUALITY CONTROL SAMPLE COLLECTION SCHEDULE

SAMPLE AREA	SAMPLE LOCATION	DATE	QA/QC SAMPLES
SURFACE WATER			
Rocky Peak	BG-01-002	3/12	USEPA
Campsite Area 2	BB-04-001	3/16	USEPA
Campsite Area 1	BB-03-001	3/17	USEPA
Spring	SM-08-001	3/18	USEPA
Sodium Burn Pit Watershed	BB-18-003	4/21	USEPA, DHS, Rinsate, Field Duplicate
Radioactive Materials Disposal Facility Watershed	BB-16-001A	4/22	
	BB-16-001B	4/22	USEPA
	BB-16-RD30	4/22	USEPA
Sodium Reactor Experiment Watershed	BB-19-003	4/23	Field Blank
GROUNDWATER			
Antenna Well	SM-05-001	3/11	USEPA
Well By The Gate	SM-07-001	3/11	USEPA
Well By The Gate	SM-07-002	3/18	
Antenna Well	SM-05-002	3/18	
Antenna Well	SM-05-003	3/23	

Note: Sample locations are organized in order of date sampled. Superscripts indicate an additional sample (split, duplicate, matrix spike, or rinsate) was collected at the specified location. The superscripts are defined below. No superscript indicates that only the scheduled sample was collected.

Field Blank -	A field blank sample was collected for analysis of the entire suite of water analyses, including metals.
Field Duplicate -	A blind field duplicate was collected for the entire suite of water analyses, including metals.
Rinsate -	A rinsate sample was collected for analysis of the entire suite of water analysis, including metals.
USEPA -	Additional water samples were collected and split with the United States Environmental Protection Agency for analysis of the entire suite of water analyses, including metals.
DHS -	Additional water samples were collected and split with the Department of Health Services for analysis of gamma-emitting radionuclides, gross alpha and gross beta radioactivity, and tritium.

TABLE 5-6

FRUIT ANALYSES QUALITY ASSURANCE/QUALITY SAMPLE COLLECTION SCHEDULE

SAMPLE AREA	SAMPLE LOCATION	FRUIT	DATE	SAMPLE BLOCK #
Orange Groves	SM-04	Orange	3/11	003^{FD}, 026^{FD}, 028^{FD}
Orchards Near Happy Camp	BG-07	Avocado Lemon	3/13 3/13	001^{USEPA},002, 003 004^{USEPA}, 005, 006
Avocado Grove	BB-13	Avocado	3/17	024, 011, 039
Ralph's Supermarket	BG-08	Orange	3/18	001, 002, 003^{X}
Main House Orchard	BB-12	Tangerine Lemon	3/18 3/18	020 026^{FD}, 006^{USEPA}
Local Supermarket	BG-08	Tangerine Avocado	3/23 3/23	004^{USEPA},005,006 007, 008, 009^{FD}

Note: Sample locations organized in the order of date sampled.

Field Duplicate -	A bind field duplicate sample was collected for analysis of the entire suite of fruit analyses.
X -	A matrix spike sample was collected for analysis of the entire suite of fruit analyses.
USEPA -	Additional fruit samples were collected and split with the United States Environmental Protection Agency for analysis of the entire suite of fruit analyses.

5.3.1 McLaren/Hart Analytical Laboratory

The McLaren/Hart Analytical Laboratory (laboratory) has prepared a detailed document outlining the standard operating procedures that were used for this project (McLaren/Hart, 1992). A summary of the information contained in the McLaren/Hart Laboratory Operating Procedures is presented in this section. Additional detail and/or documentation of these procedures can be found in the laboratory document.

5.3.1.1 Sample Receipt and Distribution

Samples are received by the laboratory Sample Control Department, which is responsible for entering each sample into the laboratory's computerized and manual tracking system. The tracking system ensures that the sample is properly stored and verifies that the number and type of samples received corresponds to the chain-of-custody (COC) forms. Any discrepancies in the COCs are resolved by contacting the sampler prior to distribution and analysis. Any changes to the COCs are made in ink and are initialed and dated by the person making the change.

Each shipment of samples is assigned a laboratory project (LP) number. A separate laboratory folder is created for each type of analysis (e.g., volatile organic compounds, priority pollutant metals). Any special requirements are noted on a Project Notification Form. Each folder is then distributed to the appropriate laboratory section leader.

5.3.1.2 Sample Preparation and Analysis

Each laboratory section has established procedures for tracking a sample through sample preparation and analysis. Depending on the type of instrumentation, sample numbers are either handwritten on each container or entered into a computer software program. A second reviewer verifies that the sample identification numbers are correct. Each laboratory section is responsible for retrieving the sample from the sample control department. Any time a sample is moved within the laboratory, its movement is tracked by check-in/check-out sheets located at each potential storage location.

All samples are prepared and analyzed according to Standard Operating Procedures (SOPs) written by the laboratory. Each SOP contains detailed instructions regarding sample handling, analytical equipment, and laboratory QA/QC samples or procedures (e.g., laboratory spikes/spike duplicates, method blanks, calibration, surrogate compounds). Any special requirements noted on the Project Notification Form are communicated directly to the technician performing the sample preparation or chemist performing the analysis. Any problems that are encountered during preparation or analysis are documented on a laboratory communication form. The communication form is routed to the Laboratory Operations Manager who discusses the problem and resolution with the appropriate analytical section lead. This form is then retained in the appropriate analysis folder.

Following the analysis, the chemist transcribes the data from the instrument to the analysis tracking sheet. The method blank and reference quality control information are also copied and placed in the analysis folder. The chemist reviews the entire folder for accuracy and completeness, and then forwards it to the laboratory section leader for review. The section leader then performs a complete review of the analysis folder. This review verifies that all data have been calculated and/or transcribed correctly and that all of the required information is included. The tracking sheets are initialed and dated, and a Project Assignments and Quality Control Checklist is completed and initialed. The entire folder is then forwarded to the Laboratory Quality Control department.

5.3.1.3 Laboratory Quality Control Department Review

Each analysis folder is reviewed in detail by a chemist in the Laboratory Quality Control (QC) Department. This process entails:

- Review of all COC forms
- Review of the Project Notification Form for any special requirements
- Verification that all required data for all samples requested are present
- Review of the analysis tracking sheets for batch number, date analyzed and extracted (to ensure that hold times were met), correct sample identification number, appropriate method (as stated on the COC form), appropriate units and matrix, correct number of significant figures, proper documentation of dilutions and associated changes in reporting limits, all applicable surrogates and internal standards to ensure they were within control limits and all final results were entered.
- Review of the method blank for batch number, date analyzed, positive results, appropriate method, units and matrix, and all applicable surrogates and internal standards to ensure they were within control limits.
- Review of the Laboratory Control Spike/Laboratory Control Spike Duplicate (LCS/LCSD) and/or Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples for batch number, date analyzed, appropriate method, units and matrix, correct spike identification number, results that are out of specified limits, the use of proper comments, and that the sample concentrations correspond to those reported on the analysis tracking sheet (MS/MSD samples only).

Any problems are noted on the previously described communication form. If necessary, the analysis folder is returned to the chemist for revisions. The chemist returns the revised folder to the QC chemist for final review.

The QC chemist creates a case narrative for each LP number. The case narrative consists of a cover sheet describing the contents of the data package (e.g., number and type of samples, analyses performed), quality control definitions, quality control reports for method blanks, LCS/LCSD and MS/MSD samples, a list of abbreviations, and a summary of the comments. Once the final review and case narrative have been completed, the QC chemist signs the Folder Cover Sheet and forwards the folder to the Data Control Department.

5.3.1.4 Data Entry

All analysis folders are logged, typed, and proof read according to the laboratory SOP. When the final report is complete, it is routed to the Quality Control Department for review and signature.

5.3.1.5 Signing Reports and Final Review

The QC chemist reviews the case narrative and each typed data sheet for appropriate method, units and matrix, correct sample identification number, description, date received, date extracted, batch number, date analyzed, positive values, reporting limits where appropriate, and the use of proper comments. If necessary, the report is returned to the Data Control Department for revisions. The QC chemist signs all reviewed data sheets and the folder is routed to the Laboratory Director for final review.

The Laboratory Director reviews the project for positive results, quality control samples outside of limits, and comments. Following this review, the Laboratory Director signs the first page of the case narrative. The folder is then returned to the Data Control Department for distribution.

5.3.1.6 Reporting Limits and Detection Limits

Chemicals and radionuclides are reported by the laboratories when the concentration of the chemical or radionuclide is sufficient to be detected by the analytical equipment. The minimum detectable concentration varies with many factors including the extraction method, matrix, and the analytical equipment.

For chemical analyses, each analysis has both a detection limit and a reporting limit. The detection limit is the minimum concentration that can be observed. However, because the minimum detectable concentrations vary with factors such as extraction method, the matrix, and analytical equipment, these minimum levels are not necessarily reproducible. The minimum detectable concentration that is reproducible is called the reporting limit. A recent directive by the DHS made after the analyses for this project were completed requires analytical laboratories, participating in the California State DHS laboratory certification program, to report only those values that exceed the reporting limit. Values exceeding the reporting limits are presented in the text of this report.

In radionuclide laboratories, there is no concept analogous to the reporting limit used in chemistry laboratories. For radionuclide analyses, the minimum concentration reported is the minimum detectable activity, henceforth referenced as the detection limit or the method detection limit. All radionuclides detected above the detection limit are presented in the text of this report.

5.3.2 Teledyne Isotopes Laboratory

Teledyne Isotopes has developed a series of quality control and quality assurance manuals to ensure the quality of measurements of radioactive materials in environmental media. The primary document in this series is the Quality Control Manual, which describes the organization of the laboratory, the overall quality assurance program, and each step taken to track samples, reagents, equipment performance, and the integrity of results. In addition, the procedures for corrective action and internal laboratory audits are discussed. A summary of this information is provided in the following sections.

5.3.2.1 Laboratory Organization

The position of Quality Assurance Manager was established by Teledyne Isotopes to develop, implement, and update quality control programs. The responsibilities of the Quality Assurance Manager include approving all data prior to computer entry and all data reports prior to release, evaluating the results of spiked, blank and replicate samples, conducting internal audits, and, if necessary, recommending corrective actions and establishing or revising quality assurance programs.

The quality assurance functions of the Quality Assurance Manager are supported by the Technical Vice President whose primary responsibilities are to perform the final check of all analytical results, inform the contractor of all results not within limits, and take actions to correct problems within the laboratory.

5.3.2.2 Quality Assurance Program

The quality assurance program is designed to provide the procedures that will ensure the results obtained are accurate, precise and valid. The objectives of this program are to:

- Assure that technical personnel are qualified and adequately trained,

- Provide assurance that methods and procedures are documented and approved,
- Ensure that the required QA/QC documentation is generated and the records are adequate and complete.
- Assure prompt corrective action measures are implemented to correct conditions of unacceptable quality, and
- Provide a quality assurance documentation file which is identifiable and traceable to all items.

Each of these objectives is met through implementation of the following standards.

5.3.2.3 Qualification of Personnel

Teledyne Isotopes has established minimum education and work history requirements for each job classification. All personnel are required to complete a training program that is specific to their respective job classifications and the proficiency of each employee is monitored by periodic performance reviews. These reviews may entail the analysis of standards or spiked samples, observations of the actual procedures by a qualified analyst and demonstration of competence by attaining specified precision and accuracy.

5.3.2.4 Sample Receipt and Report Control

Following receipt of a shipment of samples, a sample receipt technician verifies that all samples listed on the Chain-of-Custody form have been received. Any discrepancies are immediately reported to a supervisor for resolution. Samples are entered onto a Sample Receipt form, logged into an appropriate notebook, and assigned a Teledyne Isotopes number. A computer generates a work order from the sample receipt form, which is sent to each laboratory manager.

After receiving the sample receipt form, a laboratory technician or supervisor processes the sample according to approved procedures. All pertinent information is reported in a laboratory notebook, which is checked for accuracy at least once per month. Following analysis, determination of activity level from counting results is performed by a computer. All computer programs are verified before being put in use, and are re-verified following any modifications.

5.3.2.5 Acceptance of Sample Results

All results are checked to ensure that they meet the specified requirements and that all calculations are correct. Before a work sheet is approved by the Quality Assurance Manager or a qualified designate, at least 5% of the results are recalculated. The yields of the analytes being monitored must be within the limits specified in the procedure. If the work sheet is approved, the data are transferred from a computer disk to the main computer. Any edits that are required as a result of the QA review are made on the computer disk and an accompanying printout prior to being entered into the main computer. A printout of any data that are being transferred to the main computer directly from tape is examined for errors and is initialed by a qualified technician.

If the results are not approved, the sample is returned to the laboratory for a recount. If a longer count, decay check, recount on another system, or recalculation does not give acceptable results, a new aliquot of the same sample is analyzed.

When all required data have been entered, a completed report for that work order is generated by the computer. The completed report is examined for errors and signed by the Quality Assurance Manager or a designated representative prior to release. Any revision to a report containing final data are also signed by the Quality Assurance Manager or a designated representative.

5.3.2.6 Analysis of Quality Control Samples

Blank, spiked, and replicate samples are analyzed at a frequency of at least one of each type of quality control sample for every group of 20 samples (i.e.,5%). The results of blank and spiked samples are reported to and evaluated by the Quality Assurance Manager who recommends corrective action, if necessary. The acceptance criteria depend on the particular analysis, but should fall within three normalized deviations of the spiked sample with a known concentration. Teledyne Isotopes participates in a nationwide monitoring program in which samples received from the USEPA are analyzed and reported back to the USEPA. All USEPA cross-check results are documented in the Quality Control Manual.

5.3.2.7 Audits

Comprehensive periodic audits are conducted to verify the implementation of the quality assurance program. Audits are conducted in accordance with procedures outlined in Teledyne Isotope's quality assurance and quality control manuals. Audits are conducted by the Quality Assurance Manager or a qualified designee.

Following an audit, a review form citing any adverse findings is submitted to the laboratory supervisor. A copy of the audit check list and review form is maintained by the Quality Assurance Manager. All recommendations require action within 30 days of the audit. Audit findings and recommendations are accepted when the conditions cited have been corrected. A re-audit will be conducted until corrective action is satisfactory.

SECTION 6.0

QUALITY ASSURANCE/QUALITY CONTROL SAMPLING RESULTS

This section discusses the results of the Quality Assurance/Quality Control (QA/QC) sampling. The results are presented for each QA/QC sample type and conclusions are drawn regarding the validity of all data presented in this report.

The QA/QC sampling was designed to validate the analytical results and to identify discrepancies within the data set. When anomalous results were identified, the reason for the anomaly was determined. Samples with inexplicable anomalies were tagged and the sample (or a sample from another laboratory) was reanalyzed.

A summary of all sample results organized by media and analysis type, including results for split samples, can be found in Appendix C.

6.1 Quality Assurance/Quality Control Results Summarized by Sample Type

The results for the six types of quality assurance/quality control samples are discussed in this section.

6.1.1 Trip Blanks

Trip blanks were collected to evaluate potential cross-contamination of volatile organic compound samples during shipment to the laboratory. The results of the trip blank analyses are shown in Table 6-1. These results show that methylene chloride (a commonly used laboratory chemical often found to be a contaminant) was detected in one sample at 12

TABLE 6-1

SUMMARY OF TRIP BLANK RESULTS

DATE	SOIL REGISTER #	CHEMICAL	ANALYTE CONCENTRATION ug/L (ppb)	REPORTING LIMIT ug/L (ppb)
03/10/92	196894		< R.L.	
03/11/92	196667		< R.L.	
03/12/92	196895-96		< R.L.	
03/13/92	196899-900		< R.L.	
03/16/92	170731-30		< R.L.	
03/16/92	170733-32		< R.L.	
03/18/92	196832-35		< R.L.	
03/19/92	197962-63		< R.L.	
03/19/92	197964-65		< R.L.	
03/23/92	171058-59		< R.L.	
04/21/92	171813		< R.L.	
04/22/92	171815	Methylene Chloride	12	5
04/23/92	171833		< R.L.	

Trip blanks are distilled water samples collected prior to sampling which travel with the samples from the field to the laboratory. Trip blanks are analyzed for volatile organic compounds to ensure sample integrity was maintained throughout transport.

< R.L. -- No analytes were found to be above reporting limits
ug/L -- micrograms per liter
ppb -- parts per billion

reviewed for contamination with methylene chloride.

Methylene chloride was detected in the rinsate sample for the water sample collected at the Sodium Burn Pit Watershed (BB-18-003) and in the field duplicate sample collected at the RD-51 Watershed (BB-15-005) at 17 ug/kg. Based on the trip blank results, the methylene chloride in these samples was attributed to contamination during transport or handling at the laboratory.

6.1.2 Field Rinsate Samples

Field rinsate samples were composed of distilled water used to rinse the sampling equipment after the decontamination procedure. The rinsate samples contained a reportable level of chemicals and/or radionuclides in seven cases. Table 6-2 is a summary of the field rinsate samples for all analytes in which chemicals and/or radionuclides were above reporting or detection limits, respectively. Positive values were obtained for six different analytes at seven locations. Copper and zinc [up to 170 micrograms per liter of water (ug/L) and 120 ug/L, respectively] were attributed to leaching from the brass sampling tubes. Methylene chloride was identified in the trip blank associated with the rinsate sample in which methylene chloride was detected. Lead (8 ug/L), chromium (11 ug/L), and potassium-40 [49.7 picocuries per liter of water (pCi/L)] may have resulted from soil particles which adhered to the equipment after decontamination. The concentrations of metals and potassium-40 were 800 to 1,000 times less than the mean background concentrations in soil. Since the naturally occurring background levels in soil are so much higher than the concentrations in the rinsate, the levels detected would not result in false positives or interfere with the statistical analysis of the data.

TABLE 6-2

RINSATE SAMPLES ABOVE REPORTING OR DETECTION LIMITS*

AREA	SAMPLE ID	CHEMICAL	VALUE
Rocky Peak	BG-01-100-RD	Potassium-40	49.7 pCi/L
Picnic Area	BB-05-006-RF	Copper Zinc	120 ug/L 37 ug/L
Potential Development Site 1	BB-08-003-RF	Copper Zinc	53 ug/L 180 ug/L
Potential Development Site 3	BB-10-081-RF	Copper Zinc	29 ug/L 38 ug/L
Old Well Campsite	BB-14-079-RF	Copper Zinc	170 ug/L 120 ug/L
RD-51 Watershed	BB-15-005-RD	Methylene Chloride	14 ug/L**
Visitor Center Parking Lot	SM-01-007-RF	Chromium Copper Lead	11 ug/L 33 ug/L 8 ug/L

* - Reporting limits for chemicals and detection limits for radionuclides.
** - Methylene chloride was detected in the associated trip blank at 12 ug/L and is a laboratory contaminant. (Refer to Table 6-1)
pCi/L - Picocuries per liter of water
ug/L - Microgram per liter of water

Rinsate samples were collected to ensure proper rinsing of field equipment. After sampling equipment was decontaminated, rinsate samples were collected, by pouring distilled water over the equipment (e.g., sample driver and brass sleeve) and collecting the water in appropriate sample containers.

6.1.3 Field Blanks

Field blanks were used to evaluate the cleanliness of the water sample collection bottles and possible sources of contamination related to the field sampling environment. The results of the field blank samples are shown in Table 6-3. These results indicated that the sample containers for water samples did not contribute measurable levels of chemicals or radionuclides, since no chemicals or radionuclides were found in the field blanks.

6.1.4 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD) samples are QA/QC analyses used to determine whether the sample matrix (i.e., the soil/sediment or water) interfered with the extraction or analysis. MS/MSD samples were prepared in the laboratory by injecting a known amount of a chemical or radionuclide into the sample matrix and measuring how much of the injected chemical or radionuclide was recovered in the analysis. The matrix spike duplicate is an analysis conducted for chemical analyses which consists of a second aliquot of the same sample matrix, spiked separately. The results of the spike analyses are expressed as percent recovery of the added chemical. The results of the MS and the MSD are indicators of accuracy (how closely the results reflect the actual amount of the chemical(s) or radionuclide(s) injected). The results of the MS and the MSD analyses are compared and expressed as the relative percent difference (RPD). The RPD is then used to evaluate the precision (consistency) of a particular analysis. The MS/MSD samples were collected at a rate of one per 20 samples (including other QA/QC samples) for each analyte group.

Each analyte has an acceptable range of recovery (for both chemical and radionuclide analyses) and an acceptable RPD (for chemical analyses only). All radionuclide analyses

TABLE 6-3

FIELD BLANK SAMPLE RESULTS

ANALYSES	RESULTS
Volatile Organic Compounds	<R.L.
Semi-Volatile Organic Compounds	<R.L.
Priority Pollutant Metals	<R.L.
Gamma Scan	<D.L
Gross Alpha	<D.L.
Gross Beta	<D.L.
Iodine-129	<D.L
Strontium-90	<D.L.
Tritium	<D.L.

<R.L. - Less than reporting limit (See Appendix A)
<D.L. - Less than detection limit (See Appendix A)

Field blank samples were collected to ensure sample containers (bottles), used for water samples did not affect sample results. Water sample bottles containing the appropriate preservative(s) (refer to Table 4-3) were filled with distilled water and analyzed for the analytes noted above.

were within the acceptable percent recovery. Some of the results for organic chemicals and priority pollutant metals were outside the acceptable range (control limits) of percent recovery and/or RPD. For soil/sediment samples, the MS/MSD analyses beyond control limits are summarized in Tables 6-4, 6-5, and 6-6 for VOCs, SVOCs, and metals, respectively. One of a total of 27 MS/MSD samples was beyond control limits for one of the VOCs in soil. In that sample, toluene, which exhibited a low recovery (43%) in the MSD sample, was below the lower control limit of 59% (Table 6-4).

Five of the 29 MS/MSD samples analyzed for SVOCs in soil/sediment were beyond the control limits for 6 compounds: pentachlorophenol, tribromophenol, phenol, 1,4-dichlorobenzene, N-Nitroso-di-N-propylamine, and 1,2,4-trichlorobenzene (Table 6-5). Since none of these compounds were found in the soil samples collected for this project, these results do not impact the validity of the SVOC data.

Results for metal analyses in soil/sediments show matrix interference in 19 of the 168 MS/MSD samples (24 samples analyzed for seven metals). As shown in the Table 6-6, matrix interference was also apparent in five other metals analyzed. For water samples, matrix interference was observed in five of 98 MS/MSD samples for water (Table 6-7). Only matrix samples showing interference are presented in Tables 6-6 and 6-7.

Results from the other McLaren/Hart laboratory QA/QC analyses, laboratory control samples [1] and laboratory blanks [2], were acceptable. Matrix interference in soil/sediment and

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[1] Laboratory control sample is similar to a matrix spike except the spike is injected onto a clean sand or distilled water (media which don't result in interference).

[2] Laboratory blanks are, aliquots of distilled water, run between samples to ensure laboratory equipment does not affect sample results.

TABLE 6-4

SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR VOLATILE ORGANIC COMPOUNDS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	TOLUENE		
		SPIKE REC%	DUP REC%	RPD
5727-009	3/18/92	125	43	13
Control Limits (Acceptance Limits)		59-139	59-139	≤21

Spike Rec% - Percent of spike recovered by analysis
Dup Rec% - Percent of duplicate spike recovered by analysis
RPD - Relative percent difference

Matrix spike samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical is an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to its true value.

TABLE 6-5

SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR SEMI-VOLATILE ORGANIC COMPOUNDS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	PENTACHLOROPHENOL			TRIBROMOPHENOL*		PHENOL		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	Spike Rec%	Dup Rec%	RPD
LCSS26/LCSDS26	3/25/92	144	131	9	130	127	--	--	--
5745-001	3/25/92	170	154	9	153	136	--	--	--
LCSS30/LCSD530	3/30/92	--	--	--	--	--	99	87	12
5868-002	4/27/92	101	113	11	--	--	--	--	--
Control Limits (Acceptance Limits)		17-109	17-109	≤47	19-22	19-22	26-90	26-90	≤35

SPIKE SAMPLE ID	DATE ANALYZED	1,4-DICHLOROBENZENE			N-NITROSO-DI-N-PROPYLAMINE			1,2,4-TRICHLOROBENZENE		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD
5761-001	3/31-4/1/92	64	35	58	83	54	41	69	43	46
Control Limits (Acceptance Limits)		28-104	28-104	≤27	41-126	41-126	≤38	38-107	38-107	≤23

"--" - Sample was within control limits
Spike Rec% - Percent of spike recovered by analysis
Dup Rec% - Percent of duplicate spike recovered by analysis
RPD - Relative percent difference

*Surrogate analytes are compounds which are not reported as part of the method; surrogates are used to test method quality assurance/quality control.

Matrix spike samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical is an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to its true value.

TABLE 6-6 (LEGAL) SEE THE END OF REPORT FOR ACTUAL TABLE

TABLE 6-6
SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR METALS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	ARSENIC			ANTIMONY			CADMIUM			CHROMIUM			COPPER		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD
5727-012	3/18/92	2730	90	150	30	26	17	--	--	--	--	--	--	--	--	--
5745-003	3/19/92	0	0	0	27	24	12	72	68	3	--	--	--	163	121	16
5745-063	3/19/92	292	0	200	26	22	15	--	--	--	195	171	7	--	--	--
5784-002	4/3/92	4390	7980	58	--	--	--	--	--	--	--	--	--	--	--	--
5761-003	3/25/92	--	--	--	37	32	14	--	--	--	--	--	--	--	--	--
5756	3/21/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5756-003	3/21/92	315	268	16	14	14	0	76	96	23	67	78	4	--	--	--
5758-062	3/26/92	48	61	23	24	29	20	--	--	--	--	--	--	--	--	--
5758	3/25/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5758-003	3/26/92	45	60	18	14	14	0	--	--	--	28	31	1	68	68	0
5868	5/1/92	--	--	--	--	--	--	80	74	7	--	--	--	--	--	--
5868-004	5/1/92	--	--	--	41	41	0	70	84	18	--	--	--	--	--	--
5868-079	5/1/92	--	--	--	53	50	6	92	73	23	--	--	--	--	--	--
5879	5/1/92	--	--	--	--	--	--	80	74	7	--	--	--	--	--	--
Control Limits (Acceptance Limits)		75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20

Matrix spike (MS) samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical was an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to the amount of chemical that was injected into the matrix. Only those samples showing matrix interference are presented in this table. Only samples showing matrix interference are presented in Table 6-6.

"--" - Sample was within control limits
Spike Rec% - Percent of spike (MS) recovered by analysis (control limits 75-125%)
Dup Rec% - Percent of duplicate spike (MSD) recovered by analysis (control limits 75-125%)
RPD - Relative percent difference (control limits ≤20)

TABLE 6-6
SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR METALS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	LEAD			MERCURY			SELENIUM			SILVER			THALLIUM			ZINC		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD %	Spike Rec%	Dup Rec%	RPD %	Spike Rec%	Dup Rec%	RPD
5727-012	3/18/92	89	55	11	--	--	--	12	84	194	--	--	--	72	112	43	--	--	--
5745-003	3/19/92	--	--	--	--	--	--	40	44	10	--	--	--	--	--	--	148	135	4
5745-063	3/19/92	--	--	--	--	--	--	38	26	38	76	72	5	--	--	--	--	--	--
5784-002	4/3/92	--	--	--	84	104	21	--	--	--	72	68	6	--	--	--	--	--	--
5761-003	3/25/92	972	388	32	--	--	--	10	18	57	--	--	--	--	--	--	--	--	--
5756	3/21/92	--	--	--	--	--	--	--	--	--	72	80	10	--	--	--	--	--	--
5756-003	3/21/92	--	--	--	--	--	--	0	0	0	60	64	6	112	106	6	62	77	5
5758-062	3/26/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5758	3/25/92	--	--	--	72	80	10	--	--	--	--	--	--	--	--	--	--	--	--
5758-003	3/26/92	--	--	--	72	104	36	36	0	200	--	--	--	--	--	--	52	53	0
5868	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5868-004	5/1/92	--	--	--	--	--	--	52	44	16	--	--	--	--	--	--	--	--	--
5868-079	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5879	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Control Limits (Acceptance Limits)		75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20

Matrix spike (MS) samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical was an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to the amount of chemical that was injected into the matrix. Only those samples showing matrix interference are presented in this table. Only samples showing matrix interference are presented in Table 6-6.

"--" - Sample was within control limits
Spike Rec% - Percent of spike (MS) recovered by analysis (control limits 75-125%)
Dup Rec% - Percent of duplicate spike (MSD) recovered by analysis (control limits 75-125%)
RPD - Relative percent difference (control limits ≤20)

TABLE 6-7

SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR METALS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - WATER SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	ARSENIC			CADMIUM			TELLURIUM		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD
5715-041	3/16-3/18/92	--	--	--	--	--	--	40	41	2
5727-003	3/24-3/25/92	--	--	--	88	76	15	--	--	--
5868-018	5/1/92	143	140	2	--	--	--	163	156	4
Control Limits (Acceptance Limits)		80-120	80-120	≤20	80-120	80-120	≤20	80-120	80-120	≤20

SPIKE SAMPLE ID	DATE ANALYZED	MERCURY			LEAD			SELENIUM		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD
5715-041	3/16-3/18/92	228	228	0	--	--	--	--	--	--
5727-003	3/24-3/25/92	--	--	--	135	133	1	69	61	12
5761-016	3/30/92	--	--	--	68	74	8	--	--	--
5868-018	5/1/92	--	--	--	--	--	--	74	82	10
Control Limits (Acceptance Limits)		80-120	80-120	≤20	80-120	80-120	≤20	80-120	80-120	≤20

Spike Rec% - Percent of spike recovered by analysis (control limits 80-120%)
Dup Rec% - Percent of duplicate spike recovered by analysis (control limits 80-120%)
RPD - Relative percent difference (control limits ≤20)

Matrix spike samples were collected in the field and analyzed by the laboratory. A known amount (spike) of the chemical(s) of interest was added to the sample. The percent recovery of the chemical is an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to its true value. Only MS/MSD samples showing matrix interference are presented in Table 6-6.

water samples is not uncommon due to the effects of the media on the analysis. Because matrix interference is the result of highly variable soil/sediment and water chemistry, the sample results reported by the laboratory were not adjusted to account for the interference. It would not be appropriate to assume that the percent recovery for one sample would be applicable to a second sample. Since the percent recoveries are within an order of magnitude of the control limit, the conclusions of this study would remain the same if the sample results were adjusted to account for the recoveries outside the control range.

6.1.5 Blind Field Duplicate and Split Samples

Blind field duplicate samples were evaluated by comparing the results of the duplicate sample with the scheduled sample. Split samples collected by the USEPA (USEPA, 1993), the consultant to Brandeis-Bardin (Cehn, 1993), and the DHS (DHS, 1993) were evaluated in the same manner as blind field duplicate samples. The values for radionuclide analyses were not in agreement if the difference between the two sample results was greater than the sum of the standard deviations for the analyses. The values for the chemical analyses were not in agreement if the sample results differed by greater than 50 percent. Tables 6-8 A and B , 6-9, and 6-10 summarize the results of the blind field duplicates and split samples that were not in agreement with the scheduled sample for soil/sediment, water, and fruit, respectively.

Differences between duplicate soil/sediment samples were observed in 14 samples (Table 6-8 A and B). The compounds that showed differences were methylene chloride, copper, plutonium-238, cesium-137, and tritium. Eleven of the 14 differences occurred in samples that both results were below background levels or above the ninety-fifth percentile of the measured background; therefore, the differences have no impact on conclusions or

Table 6-8A

Significant[1] Differences Between The Scheduled Sample And The Respective Duplicate And/Or Split Soil/Sediment Sample

Sample Location	Grid Block	Laboratory (Remarks)	Chemical/ Radionuclide	Quantity
Happy Camp	BG05074	Teledyne Teledyne (FD)	Tritium Tritium	490 ±184 pCi/L 140 ±80 pCi/L
Santa Monica Mountains National Recreation Area	BG06096	Teledyne Teledyne (DC) Teledyne (LD) Teledyne (FD) Teledyne (DC) Teledyne (LD)	Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238	0.13 ±0.03 pCi/g(dry) 0.11 ±0.04 pCi/g(dry) < 0.02 pCi/g(dry) 0.012 ±0.002 pCi/g(dry) < 0.04 pCi/g(dry) < 0.01 pCi/g(dry)
Campsite Area 2	BB04097	Teledyne (LS-TI) DHS USEPA (LS-TI)	Tritium Tritium Tritium	< 200 pCi/L 2470 ±197 pCi/L** < 192 pCi/L
Picnic Area	BB05077	Teledyne USEPA	Cesium-137 Cesium-137	0.155 ±0.036 pCi/g(dry) 0.0864 ±0.0137 pCi/g(dry)
Main House Orchard	BB12020	Teledyne Teledyne (LD) USEPA	Cesium-137 Cesium-137 Cesium-137	0.149 ±0.03 pCi/g(dry) 0.091 ±0.03 pCi/g(dry) 0.084 ±0.017 pCi/g(dry)
Old Well Campsite	BB14079	Teledyne USEPA Teledyne (LD) Teledyne (DC) M/H USEPA	Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238 Copper Copper	0.12 ±0.03 pCi/g(dry) < 0.021 pCi/g(dry) < 0.08 pCi/g(dry) 0.10 ±0.03 pCi/g(dry) *22 mg/kg 9.5 mg/kg
	BB14041	M/H M/H (FD)	Copper Copper	*6 mg/kg *14 mg/kg

(DC) - Duplicate count of sample immediately above
(FD) - Field duplicate of original sample
(LD) - Laboratory duplicate using original sample
(LS-TI) - Lab split-Teledyne, Illinois
DHS - Department of Health Services
M/H - McLaren/Hart Analytical Laboratory
mg/kg - Milligrams per kilogram
pCi/g(dry) - Picocuries per gram of dried sample
pCi/L - Picocuries per liter of water
Teledyne - Teledyne Isotopes (Illinois or New Jersey)
USEPA - United States Environmental Protection Agency
* - Matrix spike samples analyzed during the same period showed evidence of matrix interference.
** - A second analysis was conducted 3 months later by DHS with a result of 392 ±153 pCi/L, which was lower than the initial analysis possibly due to long-term storage

[1] Significant means that the sum of the standard error did not account for the difference between the two analytical values for radionuclide samples. For chemical samples, significant means the values differed by greater than 50%.

± - Plus or minus
< - Less than

TABLE 6-8B

SIGNIFICANT[1] DIFFERENCES BETWEEN THE SCHEDULED SAMPLE AND THE RESPECTIVE DUPLICATE AND/OR SPLIT SOIL/SEDIMENT SAMPLE

SAMPLE LOCATION	GRID BLOCK	LABORATORY (REMARKS)	CHEMICAL/ RADIONUCLIDE	QUANTITY
RD-51 Watershed	BB15005	Teledyne USEPA	Methylene Chloride Methylene Chloride	<5 ug/kg 17 ug/kg
Radioactive Materials Disposal Facility Watershed	BB16004	Teledyne DHS Teledyne (LS-TI) Teledyne DHS	Tritium Tritium Tritium Cesium-137 Cesium-137	1300 ±200 pCi/L 1902 ±186 pCi/L 1600 ±200 pCi/L 0.34 ±0.04 pCi/g(dry) 0.60 ±0.03 pCi/g(dry)**
Building 59 Watershed	BB17001	Teledyne Teledyne (DC) USEPA Teledyne (LD)	Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238	0.19 ±0.06 pCi/g(dry) 0.15 ± 0.05 pCi/g(dry) 0.027 ± 0.03 pCi/g(dry) < 0.009 pCi/g(dry)
	BB17004	Teledyne Teledyne (FD) Teledyne (LD) Teledyne (DC)	Plutonium-238 Plutonium-238 Plutonium-238 Plutonium-238	< 0.04 pCi/g(dry) 0.33 ±0.08 pCi/g(dry) < 0.06 pCi/g(dry) 0.27 ±0.07 pCi//g(dry)
Sodium Reactor Experiment Watershed	BB19002	Teledyne DHS	Tritium Tritium	< 100 pCi/L 444 ±153 pCi/L

(DC) - Duplicate count of sample immediately above
(FD) - Field duplicate of
(LD) - Laboratory duplicate using original sample
(LS-TI) - Lab split-Teledyne, Illinois
DHS - Department of Health Services
M/H - McLaren/Hart Analytical Laboratory
mg/kg - Milligrams per kilogram
pCi/g(dry) - Picocuries per gram of dried sample
pCi/L - Picocuries per liter of water
Teledyne - Teledyne Isotopes (Illinois or New Jersey)
USEPA - United States Environmental Protection Agency
* - Matrix spike samples analyzed during the same period showed evidence of matrix interference
** - Reanalysis of a second aliquot by the DHS detected cesium-137 at a concentration of 0.48 ±0.02 pCi/g(dry).
< - Less than
± - Plus or minus

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[1] Significant means that the sum of the standard error did not account for the difference between the two analytical values for radionuclide samples. For chemical samples, significant means the values differed by greater than 50%.

TABLE 6-9

SIGNIFICANT DIFFERENCES BETWEEN THE SCHEDULED SAMPLE AND THE RESPECTIVE DUPLICATE AND SPLIT WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (REMARKS)	CHEMICAL	QUANTITY
Radioactive Materials Disposal Facility Watershed	BB16001B	M/H USEPA	Strontium-90 Strontium-90	1.8 ±0.5 pCi/L 7.8 ±0.5 pCi/L
Sodium Burn Pit Watershed	BB18003	M/H M/H (FD)	Methylene chloride Methylene chloride	< 5 ug/L *16 ug/L
		Teledyne Teledyne (FD)	Strontium-90 Strontium-90	< 0.3 pCi/L 1.0 ±0.4 pCi/L

ug/L.
(FD) - Field duplicate of original sample
M/H - McLaren/Hart Analytical Laboratory
ug/L - Micrograms per liter of water
pCi/L - Picocuries per liter of water
Teledyne - Teledyne Isotopes (Illinois or New Jersey)
USEPA - United States Environmental Protection Agency
* - Methylene chloride is a typical laboratory contaminant which was detected in the associated trip blank at 12
< - Less than
± - Plus or minus

[1] Significant means that the sum of the standard error did not account for the difference between the two analytical values for radionuclide samples. For chemical samples, significant means the values differed by greater than 50%.

TABLE 6-10

SIGNIFICANT DIFFERENCES BETWEEN THE SCHEDULED SAMPLE AND THE RESPECTIVE DUPLICATE AND SPLIT FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (REMARKS)	CHEMICAL	QUANTITY
Ralph's Supermarket	BG08004T*	Teledyne	Tritium	<100 pCi/L
		USEPA	Tritium	400 ±200 pCi/L
		Teledyne	Strontium-90	0.021 ±0.005 pCi/g(wet)
		USEPA	Strontium-90	<0.004 pCi/g(wet)

pCi/g(wet) - Picocuries per gram of undried sample
pCi/L - Picocuries per liter of water
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency
*T - Tangerines
< - Less than
± - Plus or minus

[1] Significant means that the sum of the standard error did not account for the difference between the two analytical values for radionuclide samples.

recommendations made in this report. The remaining three differences (tritium and plutonium-238) are significantly different and are above the ninety-fifth percent upper confidence limit of the measured background if the higher of the two results are used.

The first difference was at Campsite Area 2, sample block BB-04-097. The DHS sample for tritium was over 10 times higher at this location (2,470 ±197 pCi/L) than either the scheduled sample (<200 pCi/L)[3] or the split sample sent to the USEPA (<192 pCi/L). A second analysis was conducted three months later by the DHS with a result of 392 ±153 pCi/L, which was lower than the initial analysis. This was attributed to the long term storage by the DHS (DHS, 1993). None of the other scheduled samples, including the originally scheduled split by the USEPA, had elevated levels of tritium. Additionally, there was no documented upgradient source of tritium. Campsite Area 2 and the drainage system into Campsite Area 2 was not associated with Area IV of the SSFL where radionuclides were handled.

The second difference was in the Radioactive Materials Disposal Facility (RMDF) Watershed, sample block BB-16-004. In this location, the DHS sediment sample for tritium was slightly higher than the scheduled sample (1,902 ±186 pCi/L compared to 1,300 ±200 pCi/L). Analysis of a second aliquot of the sediment taken from the same sample block produced results that were midway between these two results (1,600 ±200 pCi/L), suggesting that the differences between the two were normal variations. In the same sample, the DHS reported a value for cesium-137 (Cs-137) of 0.60 ±0.03 pCi/g compared to the scheduled sample of 0.34 ±0.04 pCi/g(dry). A reanalysis of a second aliquot by the DHS of their original sample showed cesium-137 at a concentration of 0.48 ±0.02 pCi/g (DHS, 1993). In both the case of tritium and Cs-137, the scheduled sample and the duplicate concentrations were above the ninety-fifth percent upper confidence limit of the measured background.

The third difference occurred at the Building 59 Watershed. The field duplicate for plutonium-238 was 0.33 ±0.08 pCi/g(dry) while the original sample result was less than 0.04 pCi/g(dry).

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[3] This result was for a laboratory split sample for both the USEPA and the scheduled sample because the original sample was inadvertently dried.

A duplicate count of the field duplicate sample agreed with the 0.33 value [0.27 ± 0.07 pCi/g(dry)] while the laboratory duplicate result [less than 0.06 pCi/g(dry)] agreed with the original sample. Another scheduled sample at a different sampling location at the Building 59 Watershed showed plutonium-238 at 0.19 ±0.06 pCi/g (dry) compared to the USEPA split sample result of 0.027 ±0.03 pCi/g (dry). This difference is attributed to the relatively small quantities of plutonium-238 present making true homogenization (complete mixing) prior to sample analysis difficult.

No differences were observed between split groundwater samples. Three differences were observed between duplicate surface water samples (Table 6-9). Surface water results from the Sodium Burn Pit Watershed (Sample Block BB18-003) were different for methylene chloride and strontium-90 (Sr-90). The difference in methylene chloride was attributed to laboratory contamination since methylene chloride was also detected in the associated trip blank at 12 ug/L (refer to Table 6-1). The difference in Sr-90 (<0.3 pCi/L compared to 1.0 ± 0.4 pCi/L) was attributed to normal variation and not to laboratory contamination. Surface water results from the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16) differed for strontium-90 between the McLaren/Hart sample (1.8 ± 0.5 pCi/L) and the USEPA sample (7.8 ±0.5 pCi/L). This was attributed to an inexplicable laboratory anomaly.

Two differences were observed between duplicate fruit samples (Table 6-10). Tangerines (BG-08-004) from the local Ralph's Supermarket showed small differences in tritium and strontium-90. The USEPA analysis for tritium (400 ±200 pCi/L) was higher than the scheduled sample (<100 pCi/L) for tritium. The scheduled sample analysis for strontium-90 (0.021 ±0.005 pCi/g) was higher than the USEPA split (<0.004 pCi/g). Both of these differences were attributed to normal variation in the samples. Since the sample was a background sample and since the values were very low, when compared to literature values (Section 8.0) these differences did not significantly impact the conclusions or recommendations in this report.

In general, the blind field duplicate, interlaboratory duplicate, and split sample results for all compounds confirmed the scheduled sample laboratory results (Table 6-11). Many of the comparisons were made between as many as four different laboratories each with different

TABLE 6-11

SUMMARY OF DATA CONSISTENCY BETWEEN SAMPLES, BLIND FIELD DUPLICATE SAMPLES, AND SPLIT SAMPLES

ANALYSIS		SOIL			SURFACE WATER AND GROUNDWATER			FRUIT		
		# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE	# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE	# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE
Chemicals	Volatile Organic Compounds	1	28	4	0	10	0	NA	NA	NA
	Semi-Volatile Compounds	0	28	0	0	8	0	NA	NA	NA
	Priority Pollutant Metals†	4*	182	2	0	63	0	NA	NA	NA
Radionuclides	Cesium -137 (gamma scan)	3	50	6	0	10	0	0	10	0
	Gross Alpha	NA	NA	NA	0	10	0	NA	NA	NA
	Gross Beta	NA	NA	NA	0	10	0	NA	NA	NA
	Iodine-129	0	36	0	0	8	0	0	10	0
	Plutonium-238	4	27	15	0	9	0	0	10	0
	Plutonium-239	0	27	0	0	9	0	0	10	0
	Strontium-90	0	40	0	2	9	11	1	10	10
	Tritium	4	42	10	0	10	0	1	10	10

NA - Not applicable
† - Total number of samples is the actual number of samples collected times the number of analytes evaluated
* Possible result of matrix interference as indicated by matrix spike/matrix spike duplicate results

equipment, technicians, and other variables, yet the interlaboratory results were comparable for the majority of the duplicate samples. Additionally, the comparison criteria used for this report for radionuclides are considered conservative because the standard deviation only accounts for the error in the counting statistics. Other sources of error, including sample preparation, sample weight, and technician variance, are not accounted for in the standard deviation of the counting statistics.

6.1.6 Laboratory Control Blanks

Laboratory blank samples were samples of deionized water which were analyzed at the time the samples were analyzed to ensure that laboratory equipment did not contribute to concentrations of chemicals or radionuclides. Laboratory blank samples were run by the laboratory concurrently with soil, water and fruit samples. The results for all laboratory blanks were below the reporting limit for all chemicals and below the detection limit for all radionuclides.

6.2 QA/QC Results Summarized by Analysis Type

In this section, the results of the QA/QC samples are organized and discussed by analysis to evaluate whether any trends were evident in the QA/QC for individual analyses.

6.2.1 Chemicals

The QA/QC data for the chemical analyses conducted by the McLaren/Hart Analytical Laboratory are summarized in this section.

6.2.1.1 Volatile Organic Compounds

Methylene chloride was detected in the trip blank sample collected on April 22, 1992, which was attributed to laboratory contamination. This trip blank was transported to the laboratory with the rinsate sample from the Radioactive Materials Disposal Facility

Watershed (BB-15-005) and the surface water sample from the Sodium Burn Pit Watershed (BB-18-003). The positive findings of methylene chloride in these two samples was, therefore, also attributed to contamination during transport or in the laboratory.

The duplicate spike recovery was 16 percent below control limits for one soil matrix spike sample analyzed for toluene.

The QA/QC samples results for the blind field duplicate, interlaboratory duplicate, and the split samples were 96 percent in agreement compared to their respective scheduled sample for soil/sediment samples and 100 percent for water samples. Fruit samples were not analyzed for VOCs.

6.2.1.2 Semi-Volatile Organic Compounds

Matrix interferences were observed for six SVOCs used to spike soil/sediment samples. The six SVOCs that showed matrix interferences had chemical structures and properties that were different from the SVOCs of concern in this study. It was concluded that the observed soil matrix interferences were not relevant since the agreement among the scheduled samples to the respective blind field duplicates, interlaboratory duplicates, and split samples was 100 percent. The QA/QC split and duplicate samples for water were also in 100 percent agreement with their respective scheduled samples.

6.2.1.3 Metals

Metals were observed in the equipment rinsate results and some matrix interference was observed in the MS/MSD results. Copper and zinc were detected in four of the seven rinsate samples for soil sampling equipment at concentrations up to 120 ug/L and 180 ug/L, respectively. One of the seven rinsate samples also had low levels of chromium and lead (11 ug/L and 8 ug/L, respectively). The copper and zinc were attributed to leaching of these metals from the brass sampling tubes due to the 1% nitric acid. The chromium and lead were assumed to be from residual soil particles. In all cases, the levels of metals were approximately 800 to 1,000 times lower than the levels detected in soils and, therefore, would not significantly affect the sample results.

Matrix interference was observed in the MS/MSD soil/sediment samples at approximately 11 percent, 89 percent of the MS/MSDs showed no matrix interference for the metals of concern in their study. Matrix interference occurred in three of the 14 MS/MSD water samples analyzed for the seven metals of interest, which is equivalent to 97 percent without matrix interference.

The QA/QC split and duplicate samples for metals were in 99 percent agreement with their respective scheduled samples. One hundred percent of the water sample splits/duplicates were in agreement.

6.2.2 Radionuclides

The QA/QC data for the radionuclide analyses conducted by the Teledyne Isotopes Laboratory (New Jersey and Illinois) are discussed in this section.

6.2.2.1 Strontium-90

QA/QC results for strontium-90 were not in agreement in two out of nine (22 percent) duplicate water samples. The field duplicate result (1.0 ±0.4 pCi/L) was different than the original scheduled sample result (<0.3pCi/L) at the Sodium Burn Pit Watershed (BB-18).

At the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16), the USEPA sample (7.8 ±0.5 pCi/L) was different than the original scheduled sample (1.8 ±0.5 pCi/L). The result of one out of ten fruit samples from the local Ralph's Supermarket [0.021 pCi/g wet)] was different from the result reported by the USEPA [< 0.004 pCi/g (wet)]. These differences were not traced to specific causes and were attributed to normal variation. Overall, QA/QC results for split/duplicate samples were in agreement 78 percent of the time for water samples and 90 percent for fruit. Results for duplicate analysis of soil/sediments were in agreement 100 percent of the time. All other QA/QC results matrix spikes, field blanks, and field rinsate blanks were consistent for soil/sediment, water, and fruit samples, as appropriate.

6.2.2.2 Tritium

Preliminary tritium results for soil/sediment samples showed QA/QC differences between the scheduled samples and duplicate samples. These were traced to two related sources: 1) the inadvertent drying of the samples at the laboratory and 2) the subsequent use of gas counting rather than liquid scintillation counting for those samples with an insufficient quantity of water needed to perform liquid scintillation.

According to the Workplan, the Teledyne Isotopes Laboratory in New Jersey would use either a liquid scintillation method or a gas-counting method to quantify the amount of tritium in the soil/sediment samples. According to the laboratory, the method selection was dependent on the amount of moisture present in the soil; samples with low soil moisture (subsequently defined as less than 9 grams of water per kilogram of soil) were usually analyzed using the gas-counting method and samples with high soil moisture (subsequently defined as greater than 9 grams of water per kilogram of soil) were usually analyzed using the liquid scintillation method. Although Teledyne has several years of data showing good, consistent results using the gas-counting method, the method had primarily been used for water samples. Dr. David Martin, Technical Vice President for Teledyne, stated that the soil/sediment sample results using the gas counting methods could not be validated. Teledyne withdrew the data for 16 samples analyzed using the gas-counting method, which included both low and high values.

Using laboratory split samples Teledyne re-extracted and reanalyzed those samples containing sufficient moisture for the liquid scintillation method. Of the 16 samples originally analyzed by the gas counting method, 10 were reanalyzed, using liquid scintillation. These results are included in this report. Additional laboratory split samples were run by the USEPA to demonstrate the reproducibility of the liquid scintillation analyses over time.

Four out of 42 (10 percent) of the QA/QC split/duplicate soil/sediment sample results were not in agreement with the respective scheduled sample. Three of the four split samples not in agreement were DHS splits at Campsite Area 2, the RMDF Watershed, and the Sodium Reactor Experiment. The fourth was a background sample (Happy Camp) where the blind field duplicate was higher than the scheduled sample.

The DHS laboratory reanalyzed the sample from Campsite Area 2 several months after the original analysis. The result of the reanalysis was 392 ±153 pCi/L compared to the original value of 2,479 ±197 pCi/L. The DHS laboratory attributed the lower value to long term storage. However, other samples from this study were reanalyzed by USEPA and Teledyne after as much as seven months in storage. The results of these reanalyses were all in agreement with the original analysis, including the sample from the Building 59 Watershed (BB-17-003) which had tritium detected at 10,800 ±300 pCi/L.

One hundred percent of the QA/QC split/duplicate samples for water were in agreement with the respective scheduled sample. In one of the background fruit split samples (tangerines from the local Ralph's Supermarket), the USEPA reported a value that was not in agreement with the scheduled sample. Overall, 90 percent of the split/duplicate fruit samples were in agreement.

The remaining QA/QC data for tritium matrix spikes, field rinsates, and field blanks were consistent and considered acceptable for soil/sediment, water, and fruit.

6.2.2.3 Iodine-129

All duplicate and split samples analyzed for iodine-129 in soil/sediment, water, and fruit were in 100 percent agreement. Matrix spike samples were within the control limits. Iodine-129 was not detected in field rinsate blanks.

Water samples were collected using sample bottles that contained 4 milliliters of 16 M nitric acid. After analyses were in process, a concern was raised that the preservative would impact the analytical results. All water samples were reanalyzed using water that was collected without a preservative. None of the samples, with or without preservatives, had detectable levels of iodine-129.

6.2.2.4 Gross Alpha and Gross Beta Analysis

All duplicate and split water samples analyzed for alpha- and beta-emitting radionuclides were in 100 percent agreement. Alpha- and beta-emitting radionuclides were not detected in the water rinsate sample indicating that sampling methods did not affect the analytical results. Matrix spike samples were within control limits.

6.2.2.5 Isotopic Plutonium

Eighty-five percent (23 out of 27) split/duplicate soil/sediment samples for plutonium-238 were in agreement. To evaluate this, these samples were reanalyzed using different aliquots of the same sample and by recounting the original material. In all four cases, the duplicate count supported the original sample result. However, the four laboratory duplicates were significantly different from the original sample and the duplicate count results. These differences were attributed to normal variation of plutonium-238 concentrations within small volumes of soil. All duplicate and split samples analyzed for plutonium-238 in water and fruit were in 100 percent agreement. Matrix spike samples were within the control limits. Plutonium-238 was not detected in field rinsate blanks.

All duplicate and split samples analyzed for plutonium-239 in soil/sediment, water, and fruit were in 100 percent agreement. Matrix spike samples were within the control limits. Plutonium-239 was not detected in field rinsate blanks.

6.2.2.6 Gamma Scan

Cesium-137 was the only analyte detected in the gamma scan analysis that was not naturally occurring and, therefore, the only radionuclide from the gamma scan analysis evaluated in this study. Naturally occurring radionuclides (i.e., potassium-40, and radium-226, and thorium-228) were detected in most of the soil samples, but are not discussed.

Three out of 50 (6 percent) QA/QC split/duplicate samples for soil/sediment were not in agreement with their respective scheduled sample. The split or duplicate soil/sediment samples not in agreement were at the Picnic Area (BB-05-077), the Main House Orchard (BB-12-020), and the Radioactive Materials Disposal Facility (BB-16-004). The water and fruit split/duplicate samples analyzed for cesium-137 were in 100 percent agreement with the respective scheduled samples.

Matrix spike, field rinsates, field blanks, for all other soil/sediment, water and fruit samples, as appropriate, were consistent.

6.3 Conclusion

A standard of 90 percent completeness is suggested in the USEPA Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (USEPA, 1983). Completeness refers to the percentage of QA/QC sample results, primarily blind field duplicates and split samples, that are consistent or in agreement. Overall completeness for this project for the primary QA/QC samples (i.e., blind field duplicates, interlaboratory split duplicates, and split samples) was 97 percent. Therefore, the data from the McLaren/Hart and Teledyne Laboratories were determined to be valid.

TABLE 6-6
SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR METALS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	ARSENIC			ANTIMONY			CADMIUM			CHROMIUM			COPPER		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD
5727-012	3/18/92	2730	90	150	30	26	17	--	--	--	--	--	--	--	--	--
5745-003	3/19/92	0	0	0	27	24	12	72	68	3	--	--	--	163	121	16
5745-063	3/19/92	292	0	200	26	22	15	--	--	--	195	171	7	--	--	--
5784-002	4/3/92	4390	7980	58	--	--	--	--	--	--	--	--	--	--	--	--
5761-003	3/25/92	--	--	--	37	32	14	--	--	--	--	--	--	--	--	--
5756	3/21/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5756-003	3/21/92	315	268	16	14	14	0	76	96	23	67	78	4	--	--	--
5758-062	3/26/92	48	61	23	24	29	20	--	--	--	--	--	--	--	--	--
5758	3/25/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5758-003	3/26/92	45	60	18	14	14	0	--	--	--	28	31	1	68	68	0
5868	5/1/92	--	--	--	--	--	--	80	74	7	--	--	--	--	--	--
5868-004	5/1/92	--	--	--	41	41	0	70	84	18	--	--	--	--	--	--
5868-079	5/1/92	--	--	--	53	50	6	92	73	23	--	--	--	--	--	--
5879	5/1/92	--	--	--	--	--	--	80	74	7	--	--	--	--	--	--
Control Limits (Acceptance Limits)		75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20

Matrix spike (MS) samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical was an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to the amount of chemical that was injected into the matrix. Only those samples showing matrix interference are presented in this table. Only samples showing matrix interference are presented in Table 6-6.

"--" - Sample was within control limits
Spike Rec% - Percent of spike (MS) recovered by analysis (control limits 75-125%)
Dup Rec% - Percent of duplicate spike (MSD) recovered by analysis (control limits 75-125%)
RPD - Relative percent difference (control limits ≤20)

TABLE 6-6
SUMMARY OF RECOVERIES BEYOND CONTROL LIMITS FOR METALS MATRIX SPIKE/MATRIX SPIKE DUPLICATES - SOIL SAMPLES

SPIKE SAMPLE ID	DATE ANALYZED	LEAD			MERCURY			SELENIUM			SILVER			THALLIUM			ZINC		
		Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD	Spike Rec%	Dup Rec%	RPD %	Spike Rec%	Dup Rec%	RPD %	Spike Rec%	Dup Rec%	RPD
5727-012	3/18/92	89	55	11	--	--	--	12	84	194	--	--	--	72	112	43	--	--	--
5745-003	3/19/92	--	--	--	--	--	--	40	44	10	--	--	--	--	--	--	148	135	4
5745-063	3/19/92	--	--	--	--	--	--	38	26	38	76	72	5	--	--	--	--	--	--
5784-002	4/3/92	--	--	--	84	104	21	--	--	--	72	68	6	--	--	--	--	--	--
5761-003	3/25/92	972	388	32	--	--	--	10	18	57	--	--	--	--	--	--	--	--	--
5756	3/21/92	--	--	--	--	--	--	--	--	--	72	80	10	--	--	--	--	--	--
5756-003	3/21/92	--	--	--	--	--	--	0	0	0	60	64	6	112	106	6	62	77	5
5758-062	3/26/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5758	3/25/92	--	--	--	72	80	10	--	--	--	--	--	--	--	--	--	--	--	--
5758-003	3/26/92	--	--	--	72	104	36	36	0	200	--	--	--	--	--	--	52	53	0
5868	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5868-004	5/1/92	--	--	--	--	--	--	52	44	16	--	--	--	--	--	--	--	--	--
5868-079	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5879	5/1/92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Control Limits (Acceptance Limits)		75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20	75-125	75-125	≤20

Matrix spike (MS) samples were collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest was added to the sample. The percent recovery of the chemical was an estimate of the accuracy of the sample measurements as affected by the environmental matrix. Accuracy refers to the proximity of a measurement to the amount of chemical that was injected into the matrix. Only those samples showing matrix interference are presented in this table. Only samples showing matrix interference are presented in Table 6-6.

"--" - Sample was within control limits
Spike Rec% - Percent of spike (MS) recovered by analysis (control limits 75-125%)
Dup Rec% - Percent of duplicate spike (MSD) recovered by analysis (control limits 75-125%)
RPD - Relative percent difference (control limits ≤20)

TABLE 6-11

SUMMARY OF DATA CONSISTENCY BETWEEN SAMPLES, BLIND FIELD DUPLICATE SAMPLES, AND SPLIT SAMPLES

ANALYSIS		SOIL			SURFACE WATER AND GROUNDWATER			FRUIT		
		# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE	# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE	# OF DIFFERENCES	TOTAL # OF COMPARISON SAMPLES	PERCENT DIFFERENCE
Chemicals	Volatile Organic Compounds	1	28	4	0	10	0	NA	NA	NA
	Semi-Volatile Compounds	0	28	0	0	8	0	NA	NA	NA
	Priority Pollutant Metals†	4*	182	2	0	63	0	NA	NA	NA
Radionuclides	Cesium -137 (gamma scan)	3	50	6	0	10	0	0	10	0
	Gross Alpha	NA	NA	NA	0	10	0	NA	NA	NA
	Gross Beta	NA	NA	NA	0	10	0	NA	NA	NA
	Iodine-129	0	36	0	0	8	0	0	10	0
	Plutonium-238	4	27	15	0	9	0	0	10	0
	Plutonium-239	0	27	0	0	9	0	0	10	0
	Strontium-90	0	40	0	2	9	11	1	10	10
	Tritium	4	42	10	0	10	0	1	10	10

NA - Not applicable

† - Total number of samples is the actual number of samples collected times the number of analytes evaluated

* Possible result of matrix interference as indicated by matrix spike/matrix spike duplicate results

SECTION 7.0

STATISTICAL ANALYSIS OF SAMPLE RESULTS

This section discusses the statistical evaluation methods used in this study. Since heavy metals and radionuclides are naturally occurring and because certain radionuclides are deposited throughout the world as a result of nuclear weapons testing, the goal of the statistical evaluation was to determine whether chemicals or radionuclides in the study areas were different from background concentrations. The statistical evaluation of the background areas and the study areas was conducted in three steps. First, the background area data were evaluated to determine the background concentration range and mean. Second, the study area data were evaluated relative to background to determine whether the study areas were different from background. If a study area had a concentration that was statistically higher than background, possible explanations for the elevated concentrations were evaluated. Section 7.1 describes the methods used to analyze the background sampling areas to develop a range for naturally occurring levels of metals and radionuclides. Section 7.2 discusses the methods used to compare analytical results for each sampling area to the results of the statistical analysis of the background samples.

Volatile and semi-volatile organic compounds were not evaluated statistically because these compounds are not naturally occurring or, in the case of polynuclear aromatic hydrocarbons, are combustion products that could be found in campfires and would not be widespread throughout the study areas. If any volatile or semi-volatile organic compounds were detected in the study area, potential reasons for this occurrence were evaluated. Additionally, mercury and cadmium were not evaluated statistically because the majority of the background samples were below the reporting limits for these compounds. Thus, there were insufficient positive numbers on which to perform meaningful statistical analyses.

Water data were not evaluated statistically because there was only one background sample. Fruit data were not evaluated statistically because the number of background and scheduled fruit samples with radionuclides above the detection limit was not large enough to make statistical comparisons.

Since the sample grids were considered to be representative of an entire area and since the sample locations were randomly selected, it was assumed that if the mean concentration of all samples from a sampling area was statistically at or below the mean concentration of the background areas, then the area had not been impacted by activities at the SSFL. If metals were below the reporting limit or radionuclides were below the detection limit, a value of one-half the reporting limit or detection limit was used to calculate the mean and standard deviation for that area. The use of one-half the detection limit is based on the conservative assumption that some level of the chemical is present throughout the area and is consistent with USEPA's Risk Assessment Guidance for Superfund (United States Environmental Protection Agency, 1989).

7.1. Statistical Evaluation of Background Soil Samples

In accordance with the Workplan, an analysis of variance (ANOVA) was used to evaluate whether all of the six background soil sampling areas were representative of general background levels of the metals and radionuclides of interest. Using the ANOVA results, any background areas where the levels of metals or radionuclides in soil were significantly different from the other background area soils could be identified. If an area was identified as different, the appropriateness of including the sample area in the group of background sample areas was further evaluated.

The purpose of collecting background samples was to determine the range and distribution of metals and radionuclides in soil that was similar to the soil in the study areas (i.e., of similar geologic origin and composition) but that was physically removed from the SSFL. Because all background were a minimum of 1.5 miles from the SSFL and none of the background locations were in the predominant wind direction (based on a windrose for the SSFL), it was assumed that soils would not have been significantly impacted by activities at the SSFL. Chemicals or radionuclides that would have moved in surface runoff or have been dissolved in rainwater flowing from the SSFL on to neighboring properties would not have impacted the background areas.

Six sample areas within a 1.5 to 12.5-mile radius of the SSFL were selected as representative of the background. A Type I (random effects) ANOVA was used to evaluate background sample areas for each analyte. A separate ANOVA was calculated for the following metals and radionuclides:

- Chromium
- Copper
- Lead
- Nickel
- Zinc
- Cesium-137
- Plutonium-238
- Strontium-90
- Tritium

Each of the background areas was treated as a separate sample set for each analyte. A computer program, *Systat* (Systat, Inc., 1989), was used to perform the ANOVA calculations. The Type I (fixed effects) ANOVA was used to determine whether all six background areas were from the same population (i.e., general background) or whether one or more of the six sample sets was statistically different from the others. The hypothesis being tested in this analysis is that the sample sets have the same mean concentration as background. A significance probability (p-value) greater than 0.05 indicates that under the hypothesis that all background sample areas are from the same population, the chance of seeing differences as great as those observed between sample areas is less than 5 percent. Therefore, when the p-value calculated in the ANOVA was less than or equal to 0.05, the hypothesis was rejected and the six background areas were considered to have different means. (Only if the sample area mean was greater than background was the sample area considered to be above background levels.) When the p-value was greater than 0.05, the hypothesis that the six background areas were from the same population was accepted.

To determine which of the background sample areas was different, the results of the Tukey "honest significant difference" (HSD) output (part of the *Systat* ANOVA output) were evaluated. In the Tukey HSD, each of the background sample areas was compared to the other background sample areas resulting in 15 comparisons. Each comparison was characterized by a p-value. As with the ANOVA for the group of background sample areas, if p-values were greater than 0.05, the hypothesis that the sample areas were from the same population was accepted. If the p-value is less than or equal to 0.05, the chance of seeing differences as great as those observed between sample groups are less than 5 percent and the hypothesis is rejected.

To further evaluate the appropriateness of deleting a background location based on the statistical results, Dr. Max Layard of Layard Associates, was consulted. According to Dr. Layard, an "appropriate benchmark (for background) would be the overall average from all the sites, and this average would be interpreted as an estimate of the average in all possible background sites. This assumes that there are no identifiable reasons for considering the measurements from any location to be nonrepresentative, such as known analytical errors" (personal communication, 1992). In other words, because the background sites were specifically identified to be representative of the general area and if there were no identifiable reasons for considering measurements at any background area to be nonrepresentative of the full spectrum of possible background measurements, all six background sites should be considered representative and used to evaluate the results at the sampling areas. Dr. Layard also indicated that the fixed effects ANOVA would not adequately represent the variability of the overall mean because it does not account for variability between sample areas. Because the sampling areas were relatively small (i.e., 10,000 square feet) when compared with the entire background area population (i.e., all soil within a 12.5 mile radius of the SSFL), the variance between ~~background~~ sample areas would be expected to be larger than the variance within background sample areas. If the variance within a sample area and the variance between sample areas differed substantially, the ANOVA would result in a p-value less than 0.05 when in actuality the sample areas are all representative of background. Therefore, all sample areas were retained as representative of the full range of background levels of metals and radionuclides, based on Dr. Layard's recommendation and with the consensus of the USEPA representative and the consultant for Brandeis-Bardin.

7.2 Statistical Evaluation of Sampling Areas

The sampling areas were divided into two groups based on whether random or deterministic (purposeful) sampling was conducted. Each randomly sampled area was statistically evaluated on an area-by-area basis because it was assumed that the sampling area represented a "population". The sample results from the randomly sampled areas were described by a mean, range, and a standard deviation. The data from deterministically sampled areas (the watersheds adjacent to the SSFL property border) were not analyzed statistically but were evaluated on a sample-by-sample basis because the distribution of chemicals in the ravines could be expected to vary at each sampling location. These ravine samples were not collected randomly, and therefore, they were not representative of the area (a "population").

7.2.1 Randomly Sampled Areas

Initial comparisons between the randomly sampled areas and background data were made using the Behrens-Fisher t-Test. This test provides a statistical comparison of the means between two data sets assuming the data are normally distributed. The t-Test is an appropriate procedure because the test is known to be only slightly affected by departures from normality. The data at a sample area were considered to be the same as background if the p-value was greater than 0.05. A p-value less than 0.05 indicates that, assuming the sample area is within the range of background, the probability of seeing a difference as great as those observed between the sample area and background is less than 5 percent.

Dr. Layard was also contacted regarding the appropriateness of using the Behrens-Fisher t-Test to identify when a sample area was different from background. Dr. Layard indicated that the use of the Behrens-Fisher t-Test may be overly conservative since the variance

within the background sample areas is not considered. At his recommendation, in cases where the sample area failed the t-Test (i.e., considered different from background), the t-Test was recalculated using the standard error of the background mean from the random effects ANOVA in the place of the standard error of the background samples. The standard error of the mean incorporates the variance between background areas as well as the variance within background areas producing a more appropriate measure for comparison with the sample areas.

7.2.2 Deterministically Sampled Areas

Soil/sediment data from the deterministically sampled areas (Watersheds) were not analyzed statistically. Comparisons were also made between the background areas and individual sampling locations within the Watersheds. This comparison provides a more conservative threshold for defining an area as different from background but was used to provide a consistent threshold for identifying data that require further evaluation. The reasons that this comparison is more conservative are:

1) When individual points rather than means or ranges are compared to background, some points that would be within the normal range appear to be different than background; and

2) The background areas were representative of the soils taken from a relatively level area. However, the sediment in the ravines most likely contains sand, silt, and clay which has eroded from the hillsides. Because chemicals and radionuclides are deposited in the top 2 to 3 inches, sediments eroded from the hillsides could have slightly higher chemical or radionuclide concentrations than the soil obtained in the background areas. Ideally, samples from the ravine study areas should have been compared to ravine background areas, but no ravine background areas were sampled.

Each chemical or radionuclide concentration at a sample location was compared to the ninety-fifth percentile of the background samples. The upper and lower ninety-fifth percentile intervals were two standard deviations above and below the mean, respectively. Any chemical or radionuclide concentration greater than the upper ninety-fifth percentile was considered to be different from background and subject to further evaluation. Chemicals or radionuclides which were below the lower 95th percent confidence interval were not evaluated further because they were less than background. This comparison was a highly conservative procedure that may have incorrectly identified purposeful sampling locations as different from background because five percent of the background concentration is expected to fall above the ninety-fifth percentile.

SECTION 8.0

SAMPLING RESULTS FROM BACKGROUND AREAS

This section presents the results of the multi-media sampling program at the Background Areas. The results are presented in two parts. Section 8.1 describes the sites and sampling locations and Section 8.2 analyzes the data statistically.

8.1 Background Area Descriptions

Six background areas were sampled.

- BG-01: Rocky Peak
- BG-02: Santa Susana Park
- BG-03: Bell Canyon
- BG-04: Western Sampling Site
- BG-05: Happy Camp
- BG-06: Santa Monica Mountains Recreation Area

This section is a brief description of the Background Areas (Figure 8-1). The analytical results for each sample area are presented in the form of tables and figures. The first table for each sample area summarizes the results for the chemical analyses. Only results above the reporting limits[1] are presented in this table. The second table summarizes the results for radionuclide analyses. The detection limit preceded by a "less than" symbol (<) is used to represent radionuclide results below detection limits[1]. For fruit analyses, one table is

---

[1] Reporting and detection limits are discussed in detail in Section 5.3.1.6.

used to present all the data as only radionuclide analyses were conducted. The sample grid and sample locations as well as relevant landmarks are noted on the figures. Only the original sample results collected by McLaren/Hart (the scheduled sample) above reporting limits for volatile organic compounds and semi-volatile organic compounds or background levels for metals and radionuclides are shown on these figures. In some cases, all the results for a particular analyte are presented on a figure, although some of those results are not considered significant, to show the trend in that particular area. Results of splits, duplicate counts, and interlaboratory samples are only reported in the tables as they were used solely for quality assurance/quality control (QA/QC) purposes.

8.1.1 Rocky Peak (BG-01)

The Rocky Peak background sample area is approximately 4.9 miles northeast of the SSFL, north of the 118 Freeway, at the Rocky Peak exit. The sample grid was located along the north side of a fire road directly above the parking area. The grid was on a steeply sloping area near the northern edge of the grid and on a more level area along the southern margin of the grid. The grid was partially covered by grasses with some shrubs. Numerous sandstone outcroppings and boulders were also exposed along the slope. The grid location was selected because the distance and height above the freeway was considered sufficient to avoid the majority of the chemical deposition from freeway traffic.

Soil samples were collected on March 10, 1992 at three sampling locations from the grid according to the approved Workplan. A blind field duplicate sample for VOCs and an Matrix spike/Matrix spike duplicate (MS/MSD) sample were collected at Block 100. In addition, three rinsate blanks were collected at this location. The radiation survey of the area by the United States Environmental Protection Agency (USEPA) showed an average radiation of 14 to 15 microroentgens per hour (uR/hr) (USEPA, 1992b).

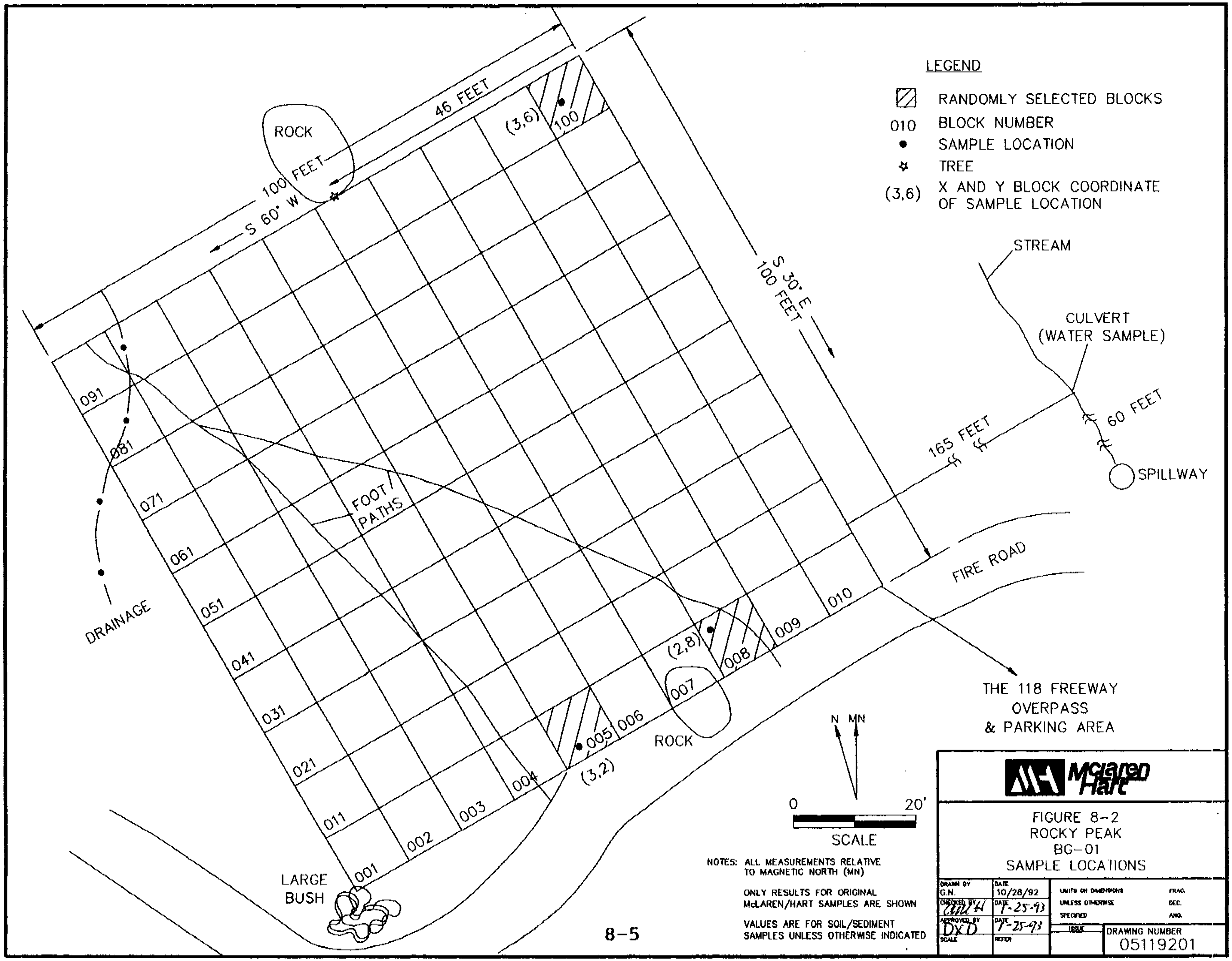
The sampling grid is shown on Figure 8-2. Summaries of the chemical and radionuclide analytical results for the soil samples are presented in Tables 8-1 and 8-2, respectively.

The soil collected at Rocky Peak was silty sand, dark brown to black fine to medium grained, poorly graded, plastic, moist, with organic material and roots. No volatile or semi-volatile organic compounds were detected at Rocky Peak.

A surface water sample was collected from a stream about 165 feet east of the grid, approximately 60 feet north of the point where the water entered a concrete spillway which drained toward the freeway. This water is shown on geologic maps as originating at the Hawaiian Spring. The surface water was sampled to provide an estimate of background levels of chemicals and radionuclides in surface water in the Simi Valley area. The surface water was sampled on March 12 according to the approved Workplan. USEPA collected split samples at this location. Zinc was detected in both the scheduled sample and the USEPA split [29 micrograms per liter of water (ug/L) and 20 ug/L, respectively]. No radionuclides were detected above the detection limit. Chemicals were not detected in the surface water that exceeded reporting limits (for volatile and semi-volatile organic compounds). Tables 8-3 and 8-4 summarize the chemical and radionuclide analytical data, respectively.

8.1.2 Santa Susana Park (BG-02)

Santa Susana Park is located approximately 2 miles south of the 118 Freeway and approximately 3 miles north of the SSFL main gate. The area that was sampled was a plateau south of the main park area. The plateau was bounded on the north by a short slope and to the south by a gradual hill leading to a steeper hill. The area was partially devoid of grass or plants except around the perimeter; several trees were present. A small



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 8-2
ROCKY PEAK
BG-01
SAMPLE LOCATIONS

DRAWN BY G.N.
DATE 10/28/92
CHECKED BY CW H
DATE 7-25-93
APPROVED BY DxD
DATE 7-25-93
SCALE
REFER
UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRAC.
DEC.
ANG.
ISSUE
DRAWING NUMBER 05119201

TABLE 8-1

Chemical Results for Soil Samples at Rocky Peak (BG-01)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-01-005									
Sample	*	*	*	21	11	18	*	16	48
BG-01-008									
Sample	*	*	*	21	11	9.5	*	16	45
BG-01-100									
Sample	*	*	*	22	12	26	*	16	51
Field Duplicate		*							

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-2

Radionuclide Results for Soil Samples at Rocky Peak (BG-01)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-01-005 Sample	0.092 +/- 0.027	< 0.07	< 0.01	0.03 +/- 0.01	< 0.2	220 +/- 80
BG-01-008 Sample	< 0.04	< 0.04	< 0.01	0.01 +/- 0.01	< 0.2	< 100
BG-01-100 Sample	0.18 +/- 0.04	< 0.02	< 0.01	0.05 +/- 0.01	< 0.1	380 +/- 100

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 8-3

Chemical Results for Surface Water Samples at Rocky Peak (BG-01)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-01-002									
Sample	*	*	*	*	*	*	*	*	29
USEPA	*	*	*	*	*	*	*	*	20

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-4

Radionuclide Results for Surface Water Samples at Rocky Peak (BG-01)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BG-01-002								
Sample	< 4	< 0.2		< 0.4	< 0.7	< 100	< 2	< 3
USEPA	< 4.70	< 0.038	< 0.025	< 0.87	< 3.3	< 200	< 5.2	< 5.3

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

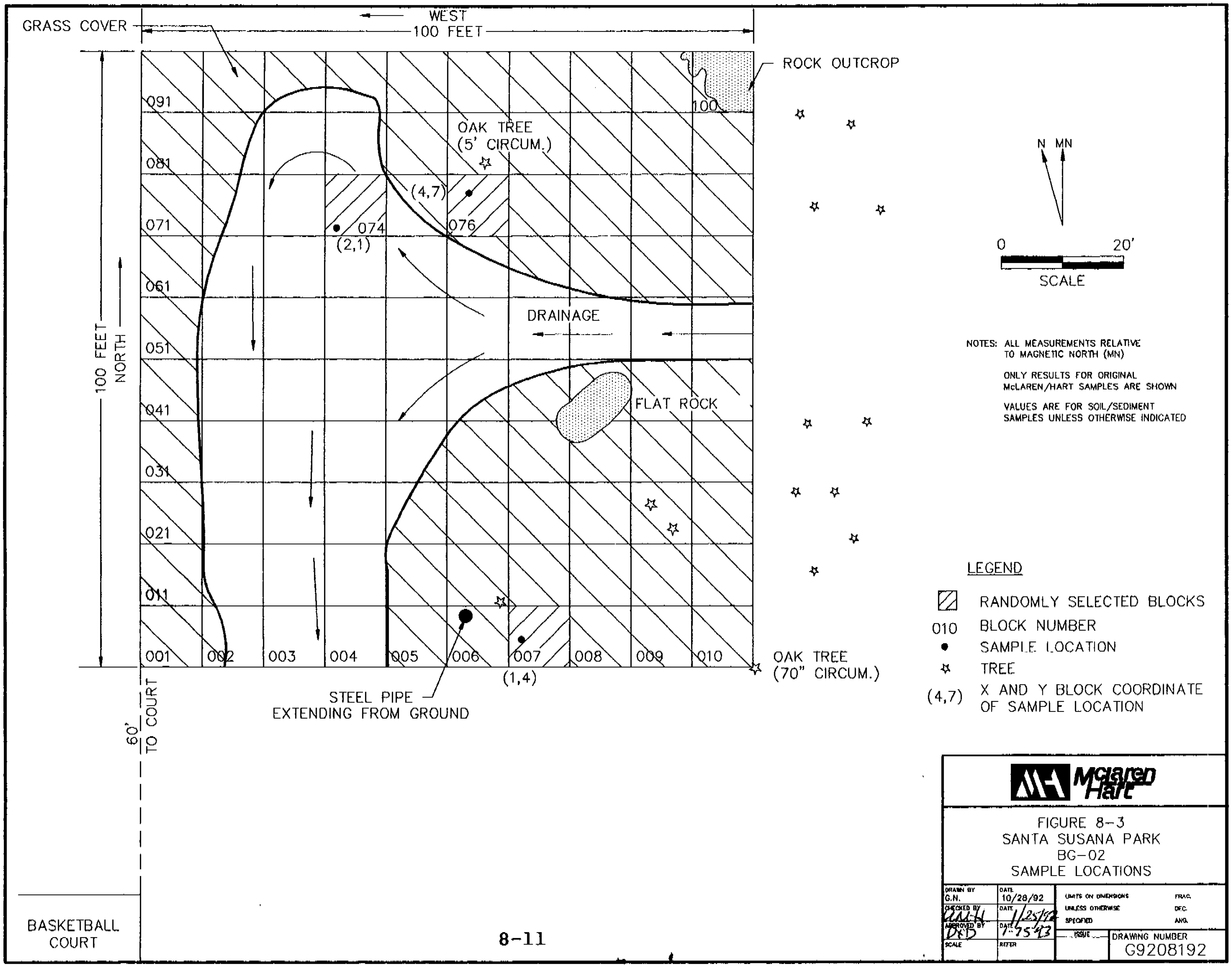
drainage area from the eastern slope appeared to run through the center of the sampling area, which was dry at the time of sampling. The location of the sample in Block 076 was moved from coordinates (4,7) to (5,4) in accordance with the Workplan protocol because of the presence of a tree.

On March 10, 1992, three sets of soil samples were collected from the grid according to the approved Workplan. In addition, a USEPA split sample was collected at Block 007. Three rinsate blanks were collected at this area. The radiation survey of the area showed an average radiation of 13 to 14 uR/hr (USEPA, 1992b). The sampling grid is shown on Figure 8-3. Summaries of the chemical and radionuclide analytical results for soil samples are presented in Tables 8-5 and 8-6, respectively.

The soil collected at Santa Susana Park was a brown sand, fine to medium grained, poorly graded, and dry. No volatile or semi-volatile organic compounds were detected in the soil at Santa Susana Park. Acetone was detected in the USEPA split sample (12 ug/kg), which was below the McLaren/Hart reporting limit of 25 ug/kg.

8.1.3 Bell Canyon (BG-03)

The Bell Canyon location is approximately 6.5 miles south of the 118 Freeway and approximately 2.5 miles southwest of the SSFL main gate. The area that was sampled was near the top of a hillside, which faced northwest. The antenna at the Santa Monica Mountains Conservancy could be seen in the distance at 10 degrees west of north. The hill overlooks Bell Canyon Boulevard; the area was accessed by a fire road that continued beyond the grid location up the hill. Approximately two-thirds of the way down the hillside, a four to six-foot ridge was formed that traversed the sampling area, possibly the result of



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,7)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 8-3
SANTA SUSANA PARK
BG-02
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY AAH	DATE 1/25/93		
APPROVED BY DKD	DATE 1-25-93	ISSUE	DRAWING NUMBER G9208192
SCALE	REFER		

TABLE 8-5

Chemical Results for Soil Samples at Santa Susana Park (BG-02)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-02-007									
Sample	*	*	*	14	10	34	*	9.1	48
USEPA	*	Acetone=12	*	9	8	22.8	*	6	37.6
BG-02-074 Sample	*	*	*	16	17	6.5	*	14	55
BG-02-076 Sample	*	*	*	14	11	12	*	10	49

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-6

Radionuclide Results for Soil Samples at Santa Susana Park (BG-02)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-02-007						
Sample	0.17 +/- 0.04	< 0.02	< 0.01	0.02 +/- 0.01	< 0.1	360 +/- 90
Interlab Duplicate						170 +/- 90
USEPA	0.19 +/- 0.01	0.05 +/- 0.05	0.06 +/- 0.06	< 0.68	< 0.37	< 200
BG-02-074						
Sample	< 0.04	< 0.01	< 0.007	< 0.01	< 0.3	W
BG-02-076						
Sample	0.099 +/- 0.032	< 0.02	< 0.01	0.03 +/- 0.01	< 0.1	420 +/- 90

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

W -- Samples results could not be verified by the laboratory and subsequently were withdrawn by the laboratory.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

a land slide. The area was covered with grasses and forbs except along the roadway; a few trees were present southeast of the sampling area.

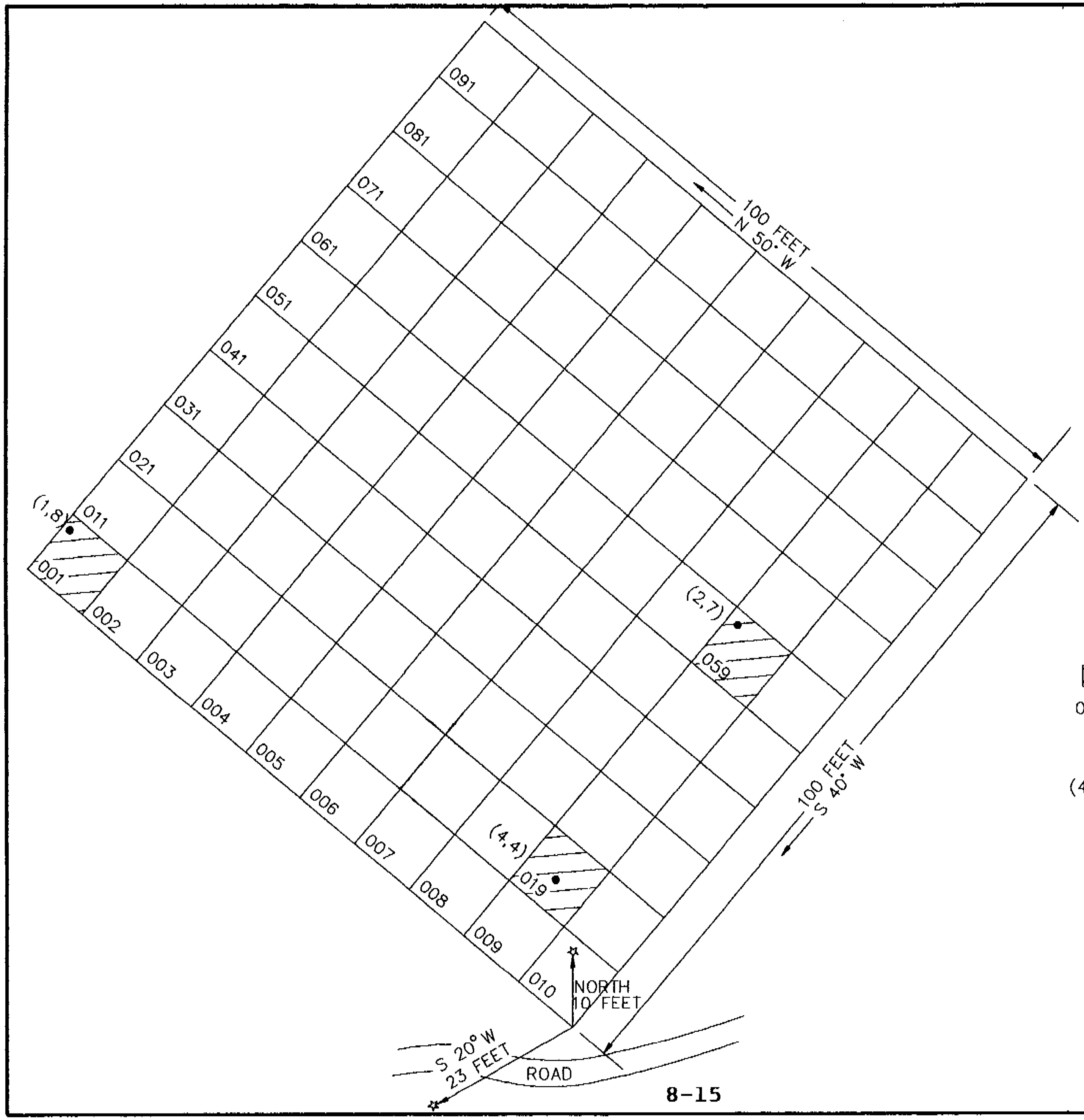
On March 12, 1992, three sets of soil samples were collected from the grid according to the approved Workplan. In addition, a USEPA split sample for all soil analyses was collected at Block 059. Bedrock was encountered during sampling at Block 059. The sampling grid and the results are shown on Figure 8-4. Summaries of the chemical and radionuclide analytical results for soil samples are presented in Tables 8-7 and 8-8, respectively.

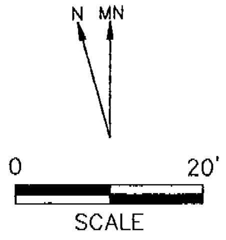
The soil collected at Bell Canyon was a brown sand, fine to medium grained, poorly graded, and dry. Volatile and semi-volatile compounds were not detected above reporting limits at Bell Canyon.

8.1.4 Western Location (BG-04)

The Western Location is approximately 4.5 miles south of the 118 Freeway and approximately 2 miles west of the Rocketdyne water tank, a visible landmark from the sampling area. The sampling area was part of a southward facing slope and adjacent to a barbed wire fence. The northwest corner of the grid was located 65 feet due east of the 17th fence post north of a gate accessing the roadway. The area was used as a cow pasture; several cows were present to the south across the dirt access road. Tire tracks were present in the southeast corner of the site near the location of Block 029. The slope was covered predominantly by grasses.

On March 13, 1992, three sets of soil samples were collected from the grid according to the approved Workplan. In addition, a blind field duplicate for metals was collected at Block 025. A USEPA split sample, for all soil analyses, was collected at Block 029. The radiation





NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,4)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 8-4
BELL CANYON
BG-03
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY GMH	DATE 1-5-93		
APPROVED BY DKB	DATE 1-5-93	ISSUE	DRAWING NUMBER 05129204
SCALE	REFER		

TABLE 8-7

Chemical Results for Soil Samples at Bell Canyon (BG-03)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-03-001 Sample Lab Duplicate	*	*	6.4	96	65	15	*	82	120
BG-03-019 Sample	*	*	4.1	87	72	9.2	*	77	120
BG-03-059 Sample USEPA	* *	* *	7.3 *	40 62	40 40	5.5 5.3	* *	64 70	72 85.5

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-8

Radionuclide Results for Soil Samples at Bell Canyon (BG-03)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-03-001 Sample	< 0.07	< 0.03	< 0.006	< 0.01	< 0.3	D
BG-03-019 Sample	< 0.07	0.066 +/- 0.055		0.02 +/- 0.01	< 0.3	< 200
BG-03-059 Sample	< 0.05	0.10 +/- 0.07	< 0.02	0.01 +/- 0.01	< 0.3	< 200
USEPA	0.017 +/- 0.018	0.019 +/- 0.03	< 0.018	< 0.018	0.019 +/- 0.03	< 210

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

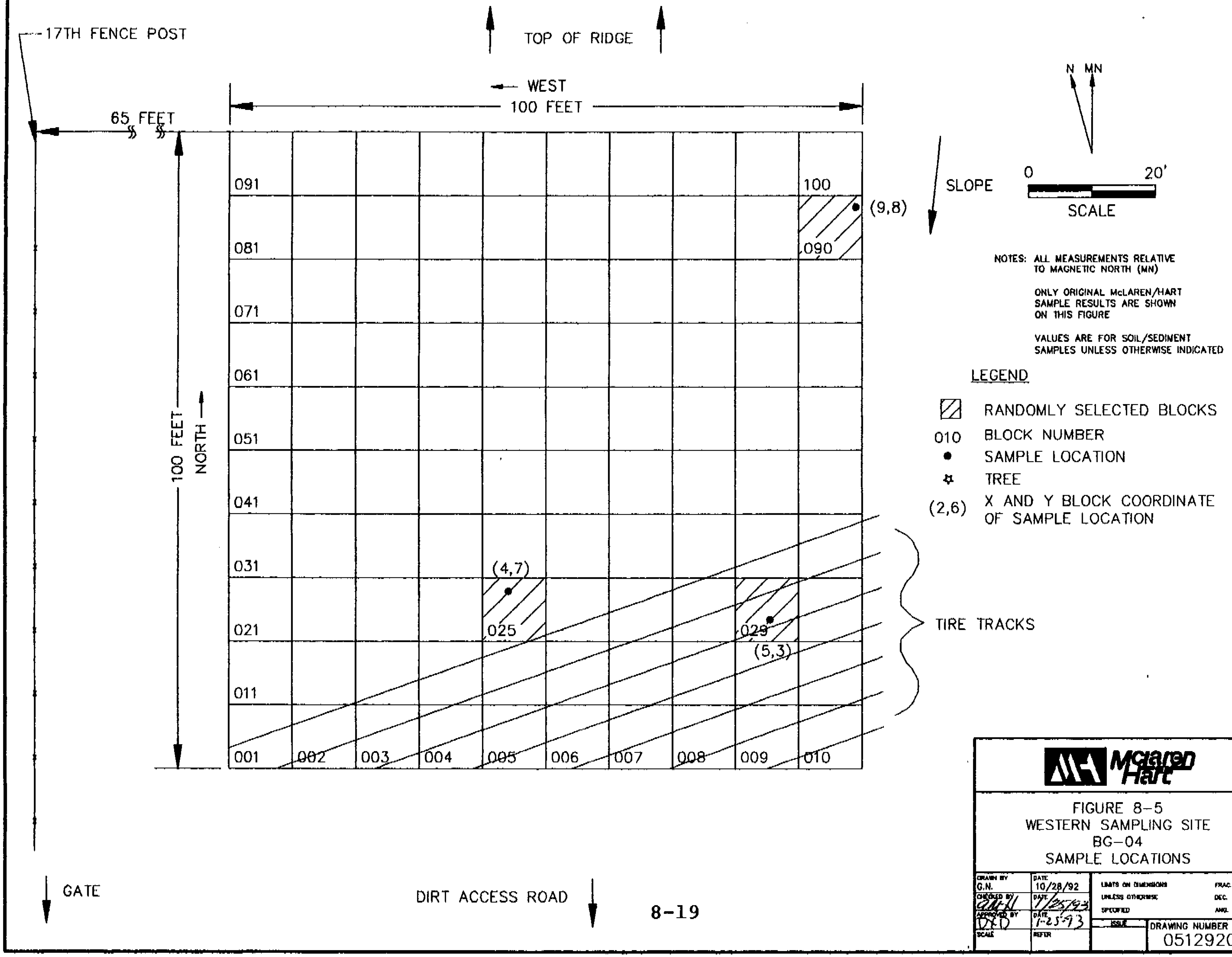
survey of the area by USEPA showed an average radiation of 13 uR/hr (USEPA, 1992b). The sampling grid is shown on Figure 8-5. Summaries of the chemical and radionuclide analytical results for soil samples are presented in Tables 8-9 and 8-10, respectively.

The soil collected at the Western Sampling Site was clayey sand, dark brown, medium to fine grained, moist, with organic material. Volatile and semi-volatile compounds were not detected above the reporting limits at this site.

8.1.5 Happy Camp (BG-05)

The Happy Camp background area is located in Moorpark approximately 12.5 miles feet northwest of the SSFL. The sampling area was a flat area located between two plateaus seemingly created by erosion off the Middle Ridge Fire Road approximately one mile from the main gate. A stream bed ran through the center of the Happy Camp Area and ran west of the sampling area (the stream bed was dry during the sampling). The northeast corner of the sampling grid was located 60 feet west of a large double-trunked oak tree. Tire tracks were present across the southwest corner of the site near the road. The area was sparsely covered by grasses and small shrubs.

On March 13, 1992, three sets of soil samples were collected from the grid according to the approved Workplan. In addition, a matrix spike duplicate was collected at Grid 026. The radiation survey of the area by the USEPA showed an average level of radiation of 10 uR/hr (UPEPA, 1992). The sampling grid is shown on Figure 8-6. Summaries of the chemical and radionuclide analytical results for soil samples are presented in Tables 8-11 and 8-12, respectively.



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
✡	TREE
(2,6)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 8-5
WESTERN SAMPLING SITE
BG-04
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS	FRAC.
CHECKED BY amH	DATE 1/25/93	UNLESS OTHERWISE	DEC.
APPROVED BY DJD	DATE 1-25-93	SPECIFIED	ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER 05129207

TABLE 8-9

Chemical Results for Soil Samples at the Western Sampling Site (BG-04)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-04-025									
Sample	*	*	*	23	20	18	*	16	69
Field Duplicate			*	23	17	18	*	16	68
BG-04-029									
Sample	*	*	*	23	14	15	*	15	67
USEPA	*	*	*	30	14	10.5	*	17	75
BG-04-090									
Sample	*	*	*	24	14	20	*	14	70

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-10

Radionuclide Results for Soil Samples at the Western Sampling Site (BG-04)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-04-025						
Sample	0.15 +/- 0.05	< 0.009	< 0.006	0.02 +/- 0.01	< 0.3	220 +/- 80
Interlab Duplicate						160 +/- 70
USEPA	0.11 +/- 0.01					
BG-04-029						
Sample	0.14 +/- 0.05	< 0.008	< 0.005	0.02 +/- 0.01	< 0.2	750 +/- 200
Interlab Duplicate						240 +/- 70
USEPA	0.15 +/- 0.01	< 0.04	< 0.023	< 0.67	< 0.27	< 209
BG-04-090						
Sample	0.19 +/- 0.03	< 0.01	< 0.007	0.05 +/- 0.01	< 0.3	120 +/- 70

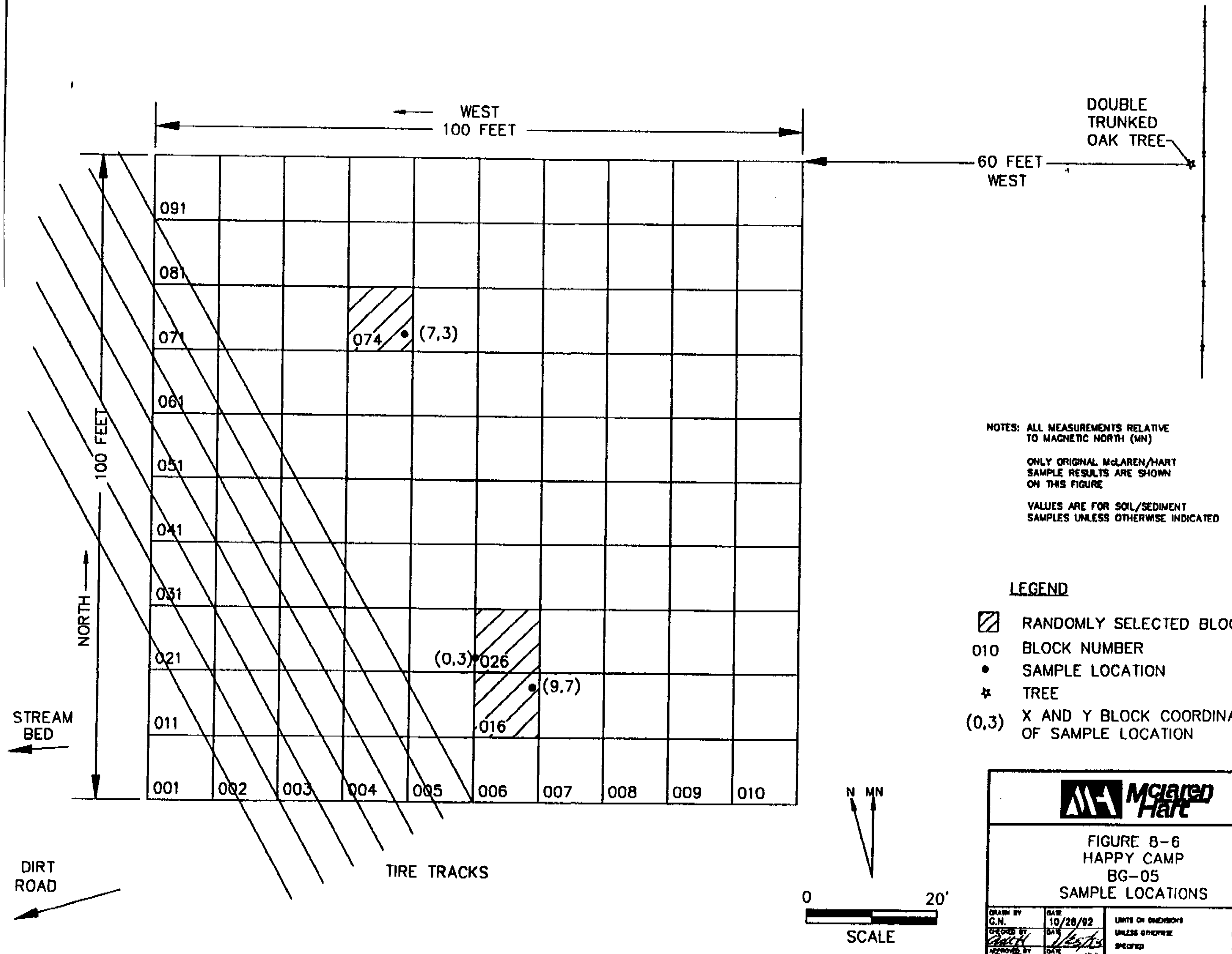
pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
✡	TREE
(0,3)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 8-6
HAPPY CAMP
BG-05
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	UNITS OF DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC DEC ANG
CHECKED BY	DATE		
APPROVED BY D&D	DATE 7-23-93		
SCALE	REFER		DRAWING NUMBER 05139209

TABLE 8-11

Chemical Results for Soil Samples at Happy Camp (BG-05)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-05-016 Sample	*	*	1.2	16	17	8.7	*	17	42
BG-05-026 Sample	*	*	1.5	15	16	7.5	*	17	40
BG-05-074 Sample	*	*	2.2	22	19	6.6	*	23	51

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-12

Radionuclide Results for Soil Samples at Happy Camp (BG-05)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-05-016 Sample	0.074 +/- 0.029	< 0.02	< 0.005	0.05 +/- 0.01	< 0.2	260 +/- 160
BG-05-026 Sample Interlab Duplicate	0.067 +/- 0.025	< 0.03	< 0.006	0.08 +/- 0.02	< 0.2	380 +/- 160 200 +/- 70
BG-05-074 Sample Field Duplicate	0.10 +/- 0.03 0.073 +/- 0.026	< 0.02	< 0.005	0.05 +/- 0.01	< 0.3	490 +/- 180 140 +/- 80

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

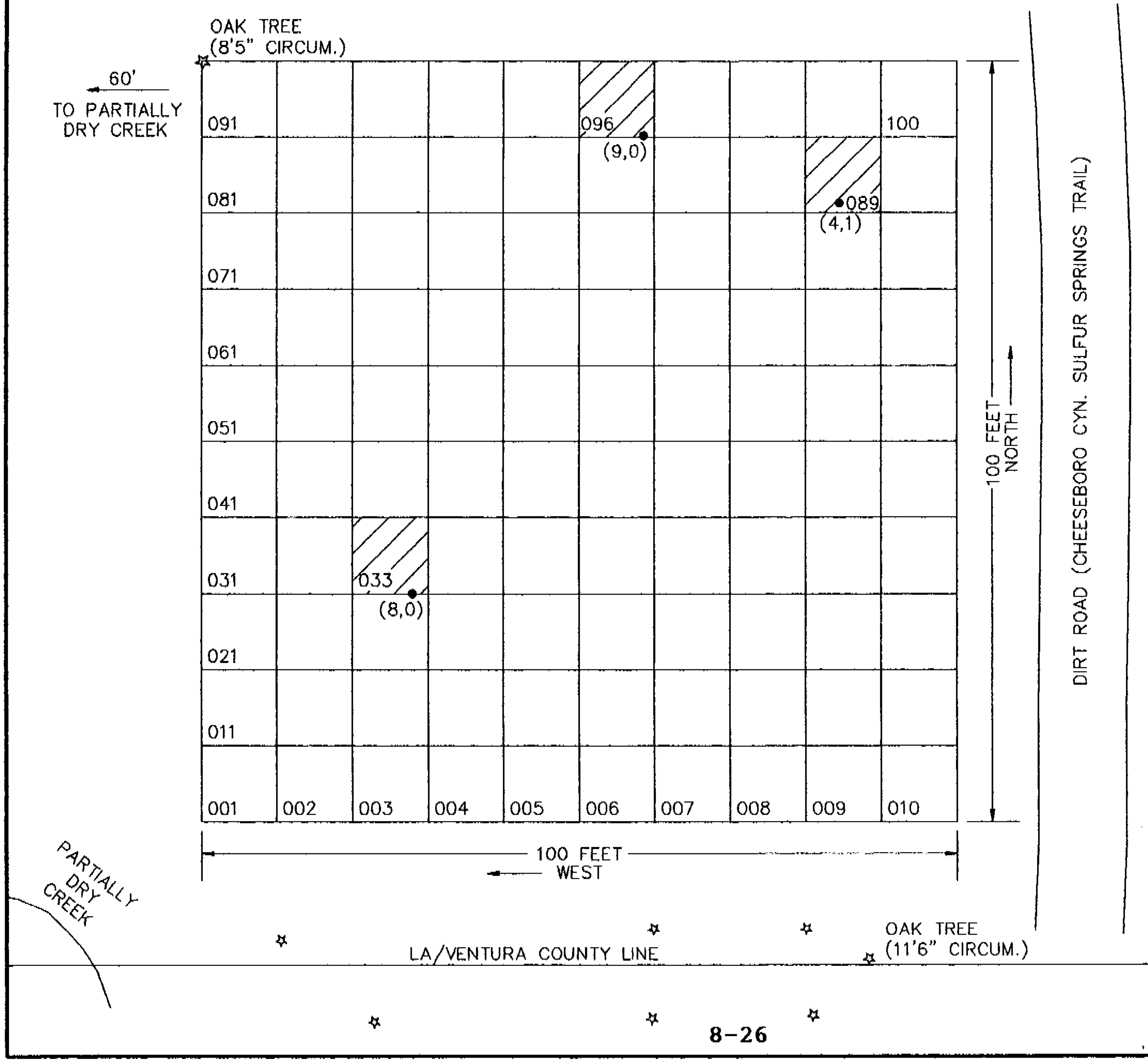
The soil collected at Happy Camp was clayey sand, dark brown, medium to fine grained, moist, with organic material. Volatile and semi-volatile compounds were not detected above the reporting limits at Happy Camp.

8.1.6 Santa Monica Mountains National Recreation Area (BG-06)

The Santa Monica Mountains National Recreation Area (SMMNRA) background area is located in Agoura approximately 2 miles north of Highway 101 and approximately 4.5 miles southwest of the SSFL facility. The sampling area was 20 feet north of the Los Angeles/Ventura County Line and approximately 1.5 miles north of a Los Angeles County Class III Landfill. The sampling area was adjacent to and west of the dirt access road and east of a dry creek bed. The sampling grid was located on a flat area covered by grasses and fords. A few trees were located outside of the sampling area.

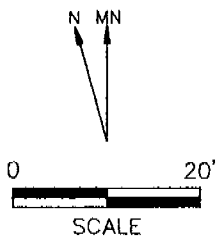
On March 12, 1992, three sets of soil samples were collected from the grid according to the approved Workplan. Blind field duplicates were collected at Block 089 for SVOCs, and at Grid 096 for strontium-90, iodine-129, and isotopic plutonium. An MS/MSD sample was collected at Block 033. Two rinsate blanks were collected at this site. The radiation survey of the area by USEPA showed an average radiation of 14 uR/hr (USEPA, 1992b). The sampling grid is shown on Figure 8-7. Summaries of the chemical and radionuclide analytical results for soil samples are presented in Tables 8-13 and 8-14, respectively.

The soil collected at the Santa Monica Mountains Recreation Area was silty sand, dark brown to black, fine to medium grained, poorly graded, plastic, moist, with organic material and roots. Volatile and semi-volatile compounds were not detected above reporting limits at the Santa Monica Mountains National Recreation Area.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
✡	TREE
(4,1)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)
ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN
VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 8–7
SANTA MONICA MOUNTAINS
NATIONAL RECREATION AREA
BG–06
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY CMK	DATE 1/25/93		
APPROVED BY DYD	DATE 1-25-93	ISSUE	DRAWING NUMBER G9208191
SCALE	REFER		

TABLE 8-13

Chemical Results for Soil Samples at Santa Monica Mountains National Recreation Area (BG-06)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BG-06-033 Sample	*	*	2.7	24	24	8.3	*	35	58
BG-06-089 Sample Field Duplicate	* *	*	3.6	33	34	8.3	*	45	66
BG-06-096 Sample	*	*	3.9	35	30	12	*	46	68

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 8-14

Radionuclide Results for Soil Samples at Santa Monica Mountains National Recreation Area (BG-06)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BG-06-033						
Sample	0.097 +/- 0.034	< 0.08	< 0.03	0.03 +/- 0.01	< 0.4	330 +/- 80
BG-06-089						
Sample	< 0.06	< 0.07	< 0.02	0.03 +/- 0.01	< 0.3	440 +/- 90
BG-06-096						
Sample	0.14 +/- 0.03	0.13 +/- 0.03	0.01 +/- 0	0.02 +/- 0.01	< 0.3	D
Field Duplicate		0.012 +/- 0.002	< 0.0002	0.04 +/- 0.01	< 0.3	
Lab Duplicate		< 0.01				
Duplicate Count		0.11 +/- 0.04				

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Duplicate Count -- A recount of the original aliquot of the sample.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

8.1.7 Orchards Near Happy Camp (BG-07)

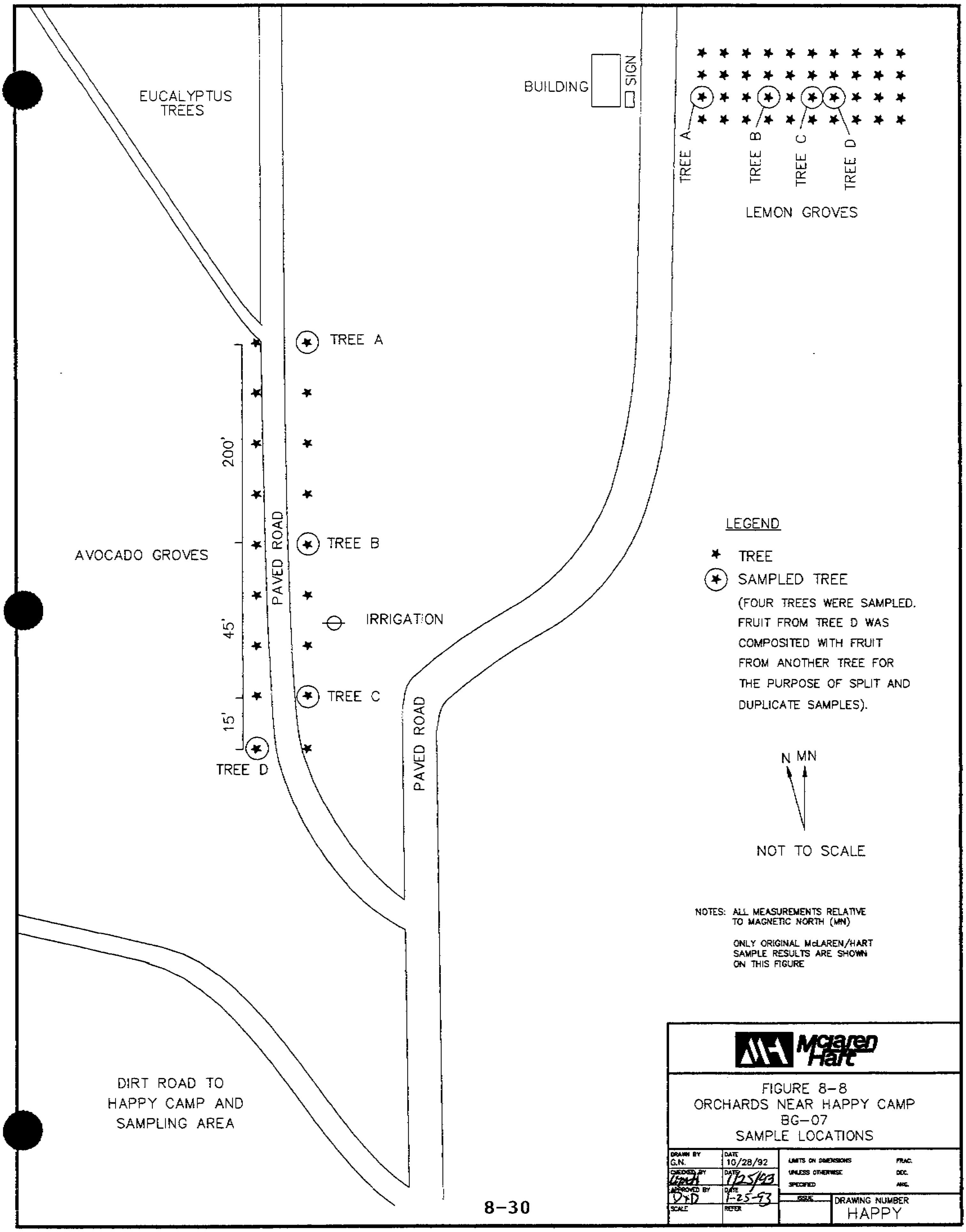
Lemon and avocado samples were collected from groves and orchards located east/southeast of and adjacent to Happy Camp. The orchards were located on the eastern plateau across from the Happy Camp parking lot. The groves and orchards were approximately 11 miles from the SSFL facility.Three sets of samples for both avocados and lemons were collected in this area. The USEPA collected splits of both avocados (001) and lemons (004). The approximate sample locations are shown in Figure 8-8. Summaries of the analytical results for avocado and lemon samples are presented in Tables 8-15 and 8-16, respectively.

8.1.8 Ralph's Supermarket (BG-08)

Orange, tangerine, and avocado samples were purchased for use as background samples from the Ralph's Supermarket located at the intersection of Topanga Canyon Road and Roscoe Boulevard in Chatsworth, California. Three sets of samples for each fruit (oranges, tangerines, and avocados) were purchased at this location. The USEPA collected splits of tangerines (004). An MS/MSD sample for oranges and a blind field duplicate of the oranges (001) and avocados (009) were also collected. Summaries of the radionuclide analytical results for orange, tangerine, and avocado samples are presented in Tables 8-17, 8-18, and 8-19, respectively.

8.2 Background Summary by Analysis

Soil, surface water, and fruit samples were collected to provide data on the naturally occurring levels of heavy metals and radionuclides in the soil within a fifteen-mile radius of the SSFL. These data were compared to the data from the Brandeis-Bardin Institute and



LEGEND

✱ TREE

⊛ SAMPLED TREE

(FOUR TREES WERE SAMPLED. FRUIT FROM TREE D WAS COMPOSITED WITH FRUIT FROM ANOTHER TREE FOR THE PURPOSE OF SPLIT AND DUPLICATE SAMPLES).

NOT TO SCALE

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

McLaren Hart

FIGURE 8-8
ORCHARDS NEAR HAPPY CAMP
BG-07
SAMPLE LOCATIONS

DRAWN BY G.N.
DATE 10/28/92
CHECKED BY
DATE 1/25/93
APPROVED BY D+D
DATE 1-25-93
SCALE
REFER
LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRAC.
DEC.
ANG.
ISSUE
DRAWING NUMBER HAPPY

TABLE 8-15

Radionuclide Results for Avocado Samples at the Orchards Near Happy Camp (BG-07)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BG-07-001						
Sample	< 0.006	< 0.002		< 0.003	< 0.033	< 200
USEPA	< 0.021	< 0.00061	< 0.00058	< 0.023	< 0.17	< 206
BG-07-002						
Sample	< 0.007	< 0.002	< 0.002	< 0.003	< 0.02	< 200
BG-07-003						
Sample	< 0.006	< 0.0007	< 0.00	0.0053 +/- 0.003	< 0.01	< 200

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 8-16

Radionuclide Results for Lemon Samples at the Orchards Near Happy Camp (BG-07)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BG-07-004						
Sample	< 0.006	< 0.0001	< 0.00	0.0021 +/- 0.001	< 0.02	< 200
USEPA	< 0.013	< 0.00009	< 0.00008	< 0.003	< 0.040	400 +/- 200
BG-07-005						
Sample	< 0.007	< 0.00009	< 0.00	0.0041 +/- 0.001	< 0.03	< 200
BG-07-006						
Sample	< 0.005	< 0.0002	< 0.00	0.0016 +/- 0.001	< 0.02	< 200

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 8-17

Radionuclide Results for Orange Samples at the Local Ralph's Supermarket (BG-08)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BG-08-001						
Sample	< 0.005	< 0.0002	< 0.0002	0.0076 +/- 0.002	< 0.02	< 200
Field Duplicate	< 0.003	< 0.002	< 0.0005	0.0034 +/- 0.001	< 0.03	< 100
BG-08-002						
Sample	< 0.005	< 0.0003	< 0.0001	< 0.002	< 0.03	< 200
BG-08-003						
Sample	< 0.005	< 0.0002	< 0.0001	0.0032 +/- 0.001	< 0.03	< 200

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
Field Duplicate - A duplicate sample is collected and mixed in the field and submitted under an anonymous sample identifier.

TABLE 8-18

Radionuclide Results for Tangerine Samples at the Local Ralph's Supermarket (BG-08)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BG-08-004						
Sample	< 0.005	< 0.0007	< 0.0003	0.021 +/- 0.005	< 0.03	< 100
USEPA	< 0.010	< 0.0001	< 0.00009	< 0.004	< 0.078	400 +/- 200
BG-08-005						
Sample	< 0.007	< 0.0005	< 0.0002	< 0.004	< 0.04	< 100
BG-08-006						
Sample	< 0.007	< 0.0007	< 0.0004	0.014 +/- 0.005	< 0.03	< 100

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 8-19

Radionuclide Results for Avocado Samples at the Local Ralph's Supermarket (BG-08)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BG-08-007						
Sample	< 0.007	< 0.0007	< 0.0002	0.016 +/- 0.005	< 0.03	< 100
BG-08-008						
Sample	< 0.008	< 0.0007	< 0.0002	0.0068 +/- 0.003	< 0.03	160 +/- 100
BG-08-009						
Sample	< 0.007	< 0.0005	< 0.0001	0.0072 +/- 0.002	< 0.03	< 100
Field Duplicate	< 0.007	< 0.001	< 0.0004	< 0.1	< 0.02	< 100

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
Field Duplicate - A duplicate sample is collected and mixed in the field and submitted under an anonymous sample identifier.

the Santa Monica Mountains Conservancy to determine whether these sites had significantly higher chemical and/or radionuclide concentrations, which may have been due to activities at the SSFL. The measured data were tabulated for all of the background areas. A complete summary of all the data by analysis is included in Appendix C.

8.2.1 Volatile Organic Compounds

Of the 18 analyses for volatile organic compounds (USEPA Method 8240) from the six Background Areas, none of the samples contained volatile organic compounds (VOCs)above the laboratory reporting limits. (Refer to Table 2-1 for a list of VOCs analyzed for a discussion on reporting limits refer to Section 5.3.1.6). The surface water sample likewise did not have any reportable VOCs. This indicated that there was not a background level of VOCs in soil or surface water; any VOCs detected in the study areas were attributable to a specific source.

8.2.2 Semi-Volatile Organic Compounds

Of the 18 soil analyses for semi-volatile organic compounds (SVOCs) using USEPA Method 8270 from the six Background Areas, none of the samples had SVOCs above the laboratory reporting limits. (Refer to Table 2-2 for a list of SVOCs analyzed. For a discussion on reporting limits, refer to Section 5.3.1.6). The surface water sample likewise did not have any reportable SVOCs. This indicated that there was not a background level of SVOCs in soil or surface water; any SVOCs detected in the study areas were attributable to a specific source.

8.2.3 Heavy Metals

Heavy metals are naturally occurring throughout the Background Areas. As stated in Section 2.0, all 13 priority pollutant metals on the California Assessment Manual list of metals were analyzed in this study, but only those five metals known to be associated with activities at the SSFL (chromium, copper, lead, nickel, and zinc) were subjected to statistical analysis. (Cadmium and mercury, reportedly used at Rocketdyne, were not present in background samples above reporting limits in a sufficient number of samples for statistical analysis).

8.2.4 Radionuclides

Low levels of radionuclides are ubiquitous as a result of two sources: naturally occurring radionuclides such as radon and uranium and fallout from atmospheric testing of nuclear weapons since 1945.

The radionuclides that were evaluated and discussed are limited to the following man-made radionuclides detected in the samples:

- Cesium-137 (Cs-137)
- Plutonium-238 (Pu-238)
- Strontium-90 (Sr-90)
- Tritium (H-3) (also naturally produced in the upper atmosphere)

Iodine-129 and plutonium-239 were not detected in any of the samples and, therefore, are not discussed.

8.3 Summary of Background Information

The measured background data sets for metals and radionuclides were evaluated using analysis of variance (ANOVA) and Tukey's "honest significant difference" (HSD) statistical methods to determine if all of the background data sets had the same mean and therefore considered to be from the same population. The ANOVA was used to indicate whether or not any of the data sets were different and Tukey's HSD was used, if necessary, to indicate which sample area(s) was significantly different.

As discussed previously, the significance probability (p-value) was used to determine if one or more sample areas were different from the other background sample areas. As shown in Table 8-20, the p-values for copper, chromium, nickel, zinc, and strontium-90 were less than 0.05. However, based on discussions with Dr. Max Layard (Section 7.1) and with the consensus of the USEPA and the consultant to Brandeis-Bardin, all Background Areas were included as representative of the range and distribution of background levels of each analyte in soil. Therefore, the statistical comparison of the sampling areas to background was based on all eighteen background samples. The following sections describe the background results for analytes of interest for soil and selected analytes for fruit and surface water. Tables 8-21, 8-22, and 8-23 summarize the statistical parameters (mean, standard deviation, and range) defining measured background for each analysis as well as background values found in the literature for soil, fruit, and water, respectively.

8.3.1 Chromium

Chromium concentrations in the measured background soil samples ranged from 14 milligrams per kilogram (mg/kg) at Santa Susana Park (BG-02) to 96 mg/kg at Bell Canyon (BG-03) with an arithmetic mean concentration of 30 ±23 mg/kg. The ninety-fifth

TABLE 8-20

SUMMARY OF THE RESULTS OF THE ANALYSIS OF VARIANCE (ANOVA) AND THE TUKEY HONEST SIGNIFICANT DIFFERENCE (HSD) TEST FOR THE BACKGROUND SAMPLE AREAS

METALS (SOIL)	SIGNIFICANCE PROBABILITY (P VALUE)[1]	BACKGROUND AREAS[2] DIFFERING FROM MORE THAN TWO OTHER BACKGROUND LOCATIONS
Chromium	0.001	BG-03
Copper	0.000	BG-03
Lead	0.319	
Nickel	0.000	BG-03; BG-06
Zinc	0.011	BG-03
RADIONUCLIDES		
Cesium-137	0.296	
Plutonium-238	0.061	
Strontium-90	0.023	BG-05
Tritium	0.582	

[1] P values less than 0.05 indicate at least one background sample area differs from the others.

[2] BG-01 - Rocky Peak
BG-02 - Santa Susana Park
BG-03 - Bell Canyon
BG-04 - Western Location
BG-05 - Happy Camp
BG-06 - Santa Monica Mountains National Recreation Area

This table indicates that for some of the metals and one radionuclide a difference occurred at the Background Areas as shown. However, based on discussions with an independent statistician, Dr. Max Layard, and by consensus with the USEPA and the consultant to Brandeis-Bardin, all Background Areas were included in the analysis as valid representations of background.

TABLE 8-21

BACKGROUND LEVELS OF METALS AND RADIONUCLIDES IN SOIL

	MEASURED BACKGROUND AREAS				LITERATURE VALUES			REFERENCE
	RANGE	ARITHMETIC MEAN	SD	5TH TO 95TH PERCENTILE[3]	RANGE	ARITHMETIC MEAN	GEOMETRIC MEAN±SD	
METALS[1] (mg/kg)								
Chromium	14-96	30	23	0-76	3-2,000	41	37 ± 2.37	Shacklette & Boerngen, 1984
Copper	10-72	24	18	0-60	2-300	27	17 ± 2.4	Shacklette & Boerngen, 1984
Lead	5.5-26	13	8	0-29	<10-700	17	16 ± 1.9	Shacklette & Boerngen, 1984
Nickel	9.1-82	29	23	0-75	<5-700	15	13 ± 2.13	Shacklette & Boerngen, 1984
Zinc	18-120	60	26	8-112	10-2,100	65	48 ± 1.95	Shacklette & Boerngen, 1984
RADIONUCLIDES (pCi/g(dry))								
Cesium-137	<0.04-0.19	0.092	0.058	0-0.21 0.21	0.1-0.8[1]	0.5		Gustafson, 1969 and 1970 Eisenbud, 1987
					0.01-0.39	0.09		Layton, 1990
					0.024-0.253	0.10		Dinnel, 1985
					0.05-0.24	0.8	0.5	USEPA, 1992a
					0.3-1.3			Ritchie and McHenry 1977 and 1982
Plutonium-238[2]	<0.01-0.13	0.029	0.036	0-0.10		0.00045[4]		Eisenbud, 1987
					0.00004-0.0018[5]			Beck, 1992
Strontium-90	<0.01-0.08	0.029	0.020	0-0.07	0.16-0.32[1]	0.24		Eisenbud, 1987
						0.27		UNSCEAR, 1969 and 1972
								Ritchie and McHenry 1977
Tritium (pCi/L)	<100-750	274	139	0-552				

[1] Adjusted for decay over-time.

[2] Amount in environment due to fallout considered insignificant compared to other plutonium isotopes (Eisenbud, 1987).

[3] The fifth percentile equals the mean minus two times the standard deviation (mean-2 SD).
The ninety-fifth percentile equals the mean plus two times the standard deviation (mean + 2 SD).

[4] Extrapolated from Pu-238 and Pu-240 concentrations based on fallout from nuclear weapons testing.

[5] Samples collected were between 1958 and 1960, and therefore do not reflect most plutonium-238 deposition from atmospheric nuclear testing.

mg/kg - Milligrams per kilogram
pCi/g(dry) - Picocuries per gram of dried sample of water
pCi/L - Picocuries per liter
SD - Standard deviation
< - Less than
± Plus or minus

TABLE 8-22

BACKGROUND LEVELS OF RADIONUCLIDES IN FRUIT

RADIONUCLIDE	MEASURED BACKGROUND AREAS			LITERATURE VALUES		
	RANGE	MEAN	SD	RANGE	AVERAGE (DATE OF SAMPLES)	REFERENCES
Strontium-90[1] (pCi/g(wet))	<0.004-0.021	0.006	0.006	0.0014-0.0039	0.0013[2] (1982) 0.0022[2] (1982)	Eisenbud, 1987 Stroube and Jelinek, 1985
Tritium[1](pCi/L)	<100-160	87	31	21-350	0.0022[2] (pCi/g; 1972) 150 (1989)	United States Atomic Energy Commission, 1973 Layton, 1990

pCi/g(wet) - Picocuries per gram of undried sample.
pCi/L - Picocuries per liter.

[1] Several values were below detection limits. One-half the detection limit was used to develop a mean and standard deviation for the background areas.

[2] Adjusted for decay over-time using the half-life of the radionuclide.

TABLE 8-23

BACKGROUND LITERATURE VALUES OF TRITIUM IN WATER

RANGE (pCi/L)	TYPE	REFERENCES
100 - 200	Drinking Water	USEPA, 1992a
100 - 300	Precipitation	Layton, 1991
100 - 2600	Surface Water	USEPA, 1992a
37 - 1230	Surface Water	Layton, 1991

pCi/L - picocuries per liter of water

percentile was 76 mg/kg. The geometric mean[1] chromium concentration in the contiguous United States is 37 ± 2.37 mg/kg (Shacklette and Boerngen, 1984) and the arithmetic mean[2] concentration in the Western United States is 41 mg/kg with a range from 3 to 2,000 mg/kg (Shacklette and Boerngen, 1984). The chromium arithmetic mean concentration in the Background Areas was slightly lower than the published arithmeticmean background concentrations for soils in the Western United States and within the published range for the Western United States.

8.3.2 Copper

Copper concentrations in the measured background soil samples ranged from 10 mg/kg at Santa Susana Park (BG-02) to 72 mg/kg at Bell Canyon (BG-03), with an arithmetic mean concentration of 24 ±18 mg/kg. The ninety-fifth percentile was 60 mg/kg. The geometric mean copper concentration in the contiguous United States is reported as 17 ±2.4 mg/kg (Shacklette and Boerngen, 1984) and the arithmetic mean concentration in the Western United States is 27 mg/kg with a range of 2 to 300 mg/kg (Shacklette and Boerngen, 1984). The copper arithmetic mean concentration in the Background Areas was slightly lower than the published arithmetic mean background concentration for soils in the Western United States and within the published range for soils in the Western United States.

[1] Geometric mean - Average concentration in soils for lognormally distributed data sets calculated by summing the logarithm of the sample results and dividing by the total number of samples.

[2] Arithmetic mean - Average concentration in soils for normally distributed data sets calculated by summing all sample results and dividing by the total number of samples.

8.3.3 Lead

Lead concentrations in the measured background soil samples ranged from 5.5 mg/kg at Bell Canyon (BG-03) to 26 mg/kg at Rocky Peak (BG-01) with an arithmetic mean concentration of 13 ±8 mg/kg. The ninety-fifth percentile was 29 mg/kg. The geometric mean lead concentration in the contiguous United States is reported as 16 ±1.9 mg/kg (Shacklette and Boerngen, 1984) and the arithmetic mean concentration in the Western United States is 17 mg/kg with a range from less than 10 to 700 mg/kg (Shacklette and Boerngen, 1984). The arithmetic mean concentration for the Background Areas was slightly lower than the published arithmetic mean background concentration for soils in the Western United States and the Background Area values were within the published background range.

8.3.4 Nickel

Nickel concentrations in the measured background soil samples ranged from 9.1 mg/kg at Santa Susana Park (BG-02) to 82 mg/kg at Bell Canyon (BG-03) with an arithmetic mean concentration of 29 ±23 mg/kg. The ninety-fifth percentile was 75 mg/kg. The geometric mean nickel concentration in the contiguous United States is reported as 13 ±2.31 mg/kg (Shacklette and Boerngen, 1984) and the arithmetic mean concentration in the Western United States is 15 mg/kg with a range from less than 5 to 700 mg/kg (Shacklette and Boerngen, 1984). The arithmetic mean concentration for the Background Areas was higher than the published arithmetic mean background concentration for soils in the Western United States, but the range of Background Area values was within the published range.

8.3.5 Zinc

Zinc concentrations in the measured background soil samples ranged from 18 mg/kg at Happy Camp (BG-05) to 120 mg/kg at Bell Canyon (BG-03) with an arithmetic mean concentration of 60 ±26 mg/kg. The ninety-fifth percentile was 112 mg/kg. The geometric mean zinc concentration in the contiguous United States is reported as 48 ±1.95 mg/kg (Shacklette and Boerngen, 1984) and the arithmetic mean concentration in the Western United States is 65 mg/kg with a range from 10 to 2,100 mg/kg (Shacklette and Boerngen, 1984). The arithmetic mean concentration for the Background Areas was slightly lower than the published arithmetic mean background concentration for soils in the Western United States and the range of Background Area values was within the published range.

8.3.6 Cesium-137

Cesium-137 in the measured background soil samples ranged from less than 0.04 picocuries per gram of soil dried [pCi/g(dry)] at Santa Susana Park (BG-02) to 0.19 ±0.03 pCi/g(dry) at the Western Location, with an arithmetic mean concentration of approximately 0.09±0.06 pCi/g(dry). The ninety-fifth percentile was approximately 0.21 pCi/g(dry). Cesium-137 in the Background Areas was well within the background cesium-137 range from published reports, which range from 0.001 pCi/g(dry) (Layton, 1990) to 1.3 pCi/g(dry) (Ritchie and McHenry, 1977 and 1982).

8.3.7 Plutonium-238

Plutonium-238 in the measured background soil samples ranged from less than 0.008 pCi/g(dry) at the Western Location (BG-04) to 0.13 ±0.03 pCi/g(dry) at the Santa Monica Mountains National Recreation Area (BG-06), with an arithmetic mean concentration of approximately 0.029 ±0.036 pCi/g(dry). The ninety-fifth percentile was approximately 0.10 pCi/g(dry). Background concentrations for plutonium-238 were reported in the literature prior to atmospheric nuclear weapons testing the 1960's and prior to the reentry of the TRANSIT SA satellite in 1964 as 0.00004 to 0.0018 pCi/g(dry) (Beck, 1992). The plutonium-238 measured background value therefore could not be compared to published literature. Since the literature does not have documentation of plutonium-238 concentrations that are representative of expected plutonium-238 concentration due to fallout.

8.3.8 Strontium-90

Strontium-90 in the measured background soil samples ranged from less than 0.01 pCi/g(dry) at several background locations to 0.08 ±0.02 pCi/g(dry) at Happy Camp (BG-05) with an arithmetic mean concentration of approximately 0.029 ±0.020 pCi/g(dry). The ninety-fifth percentile was approximately 0.07 pCi/g(dry). The strontium-90 in the Background Areas was less than the published background levels of strontium-90 in soil [0.16-0.32 pCi/g(dry)], which were calculated based on inventories from above-ground nuclear weapons testing through 1965 (Eisenbud, 1987). The average concentration reported by UNSCEAR (1969 and 1970) was 0.027 pCi/g(dry).

Strontium-90 was detected in eleven background fruit samples ranging approximately from 0.002 to 0.02 picocuries per gram of wet sample [pCi/g(wet)]. The arithmetic mean was 0.006 ±0.006 pCi/g(wet) and the ninety-fifth percentile was approximately 0.02 pCi/g(wet). Background levels of strontium-90 in fruit from published reports were 0.0013 pCi/g(wet) (Eisenbud, 1987) and 0.0022 pCi/g(wet) (Stroube and Jelinek, 1985).

8.3.9 Tritium

Tritium in the measured background soil samples ranged from less than 100 picocuries per liter of water (pCi/L) at several background locations to 750 ±200 pCi/L at the Western site (BG-04), with an arithmetic mean concentration of approximately 274 ±139 pCi/L. The ninety-fifth percentile was 600 pCi/L. Background levels of tritium in soil were not available in the literature.

Tritium was below detection limits in the background surface water sample (less than 100 pCi/L). Background levels of tritium in surface water are reported as 37 to 1,230 pCi/L (Layton, 1991) and as 100 to 2,600 pCi/L (USEPA, 1992a). Levels of tritium in drinking water are reported between 100 and 200 pCi/L (USEPA, 1992a).

Tritium levels in the background fruit samples were less than 200 pCi/L with one sample having a detected level of 160 ±100 pCi/L. [The USEPA had two detectable levels of tritium in the fruit samples both at concentrations of 400 ±200pCi/L]. Background levels of tritium in fruit from published reports were 0.0022 pCi/g (Eisenbud, 1987) and 150 pCi/L (Layton, 1990). The measured tritium level detected in the background fruit samples was approximately the same as that cited in the published literature.

SECTION 9.0

SAMPLING RESULTS FROM THE BRANDEIS-BARDIN INSTITUTE

Nineteen sites were sampled at Brandeis-Bardin, 14 human activity areas and five Watershed (ravine) areas. The sampling locations were shown on Figure 3-2. The results from each section are discussed below. A summary of all data from the Brandeis-Bardin Institute is presented in Appendix C.

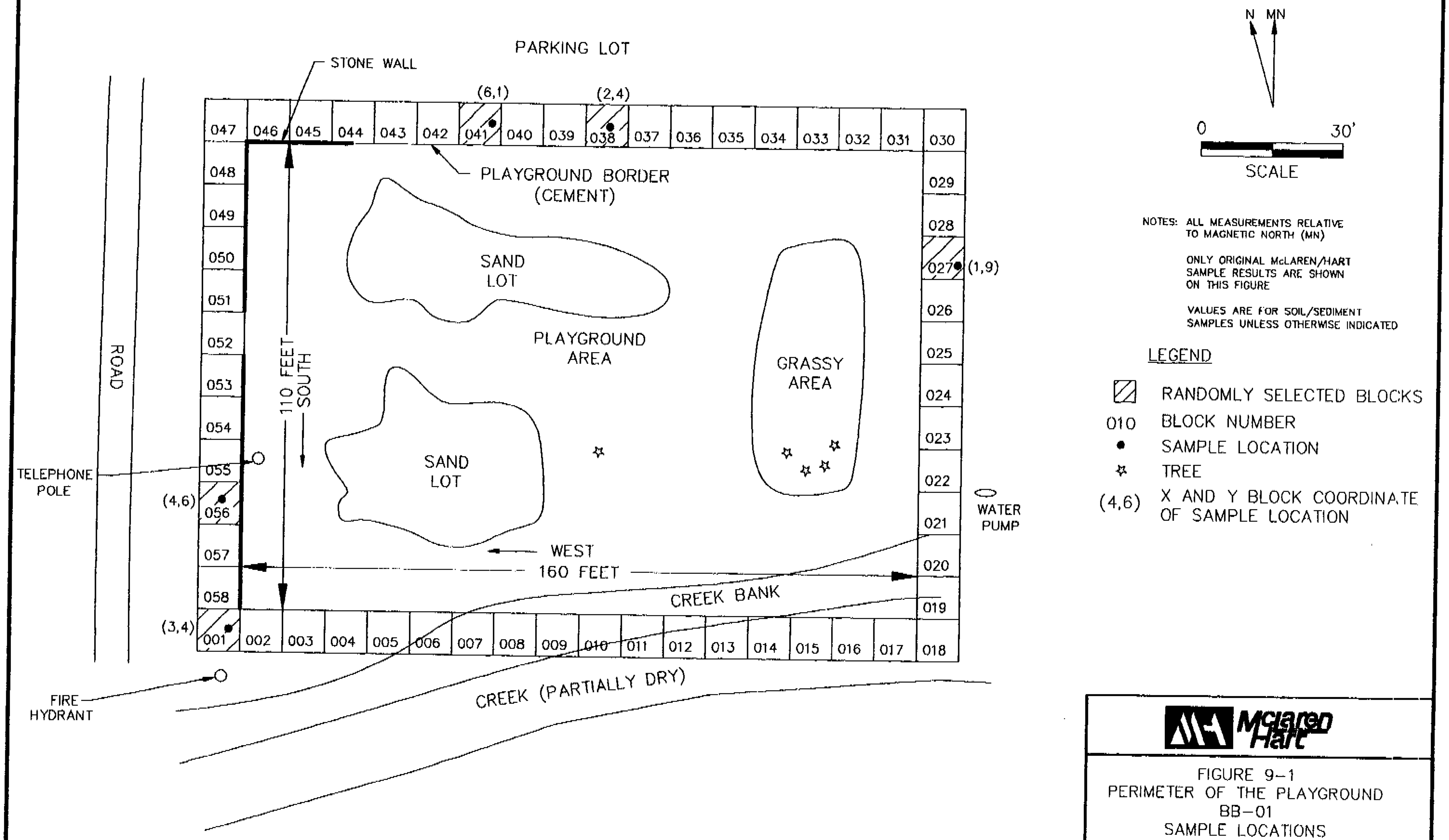
Results for the 14 human activity areas were evaluated using the statistical criteria described in Section 7.0. For the five ravine areas, individual sample points were compared to background levels because the ravines were sampled deterministically (purposefully) rather than randomly, and a comparison using the mean value for a ravine sampling location was not appropriate (see Section 7.0).

The analytical results for each sample area are presented in the form of tables and figures. The first table for each sample area summarizes the results for the chemical analyses. Only results above the reporting limits are presented in this table (for a discussion on reporting limits refer to Section 5.3.1.6). The second table summarizes the results for radionuclide analyses. The detection limit preceded by a "less than" (<) symbol is used to represent radionuclide results at or below detection limits. For fruit analyses, one table is used to present all the data as only radionuclide analyses were conducted. The sample grid and sample locations are noted on the figures as well as relevant landmarks. Buildings and areas on the Rocketdyne property are referenced as landmarks only and are not intended to suggest a source of any chemicals detected. Only sample results considered for further evaluation (results above the reporting limits for volatile and semi-volatile organic compounds or the measured background levels for metals and radionuclides) are shown on each figure. In some cases, to show the trend in that particular area, all of the results for a particular analyte are presented on a figure, although some of those results are not considered significant. Only the original sample results are presented on each figure because the duplicate split and confirmatory samples were used for QA/QC purposes.

9.1 Perimeter of the Playground (BB-01)

The playground is approximately 6,500 feet north of the Rocketdyne property line. The playground itself was comprised of cultivated grass, planters, and sand-filled areas. The area that was sampled was the natural soil surrounding the cement-curbed boundary of the playground. The sampling blocks were numbered starting in the southwest corner and moving east and then north in a rectangle around the playground area. Because the playground was not a perfect rectangle, extension of the grid along the southern side resulted in grid blocks in the creek bed (which was partially dry at the time of sampling). Samples were not collected from blocks in the creek bed because sediment from the creek bed was not representative of soil at the perimeter. The perimeter of the playground was devoid of vegetation except near the creek bed and on the eastern side; gravel was present at some sample blocks to the south and west of the playground.

On March 18, 1992, five soil samples were collected from the grid according to the approved Workplan. Because the ground was too hard at Block 052 and because Blocks 020 and 015 fell in the creek, Blocks 001, 027, and 038 respectively, were substituted in accordance with the random sampling tables in the Workplan. The USEPA collected a split sample for all analyses at Block 056. Field duplicate samples were collected at Blocks 001 (gamma scan and tritium) and 038 (strontium-90 and iodine-129). The USEPA radiation survey of the area ranged from 12 to 15 microroentgen per hour (uR/hr) (USEPA, 1992). The sampling grid and the results are shown on Figure 9-1. A summary of the chemical and radionuclide analytical results for soil is presented in Tables 9-1 and 9-2, respectively.



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,6)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 9-1
PERIMETER OF THE PLAYGROUND
BB-01
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY anHI	DATE 1/25/93		
APPROVED BY	DATE 1-25-93	ISSUE	DRAWING NUMBER 05129203
SCALE	REFER		

TABLE 9-1

Chemical Results for Soil Samples at the Perimeter of the Playground (BB-01)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-01-001 Sample	*	*	*	19	18	16	*	17	64
BB-01-027 Sample	*	*	*	10	9.6	26	*	5.9	52
BB-01-038 Sample	*	*	*	11	14	12	*	7.9	42
BB-01-041 Sample	*	*	*	12	19	14	*	9.5	52
BB-01-056 Sample USEPA	* *	* *	* *	24 22	28 20	18 15.8	* *	18 17	74 71.1

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-2

Radionuclide Results for Soil Samples at the Perimeter of the Playground (BB-01)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-01-001 Sample Field Duplicate Lab Duplicate	0.060 +/- 0.027 < 0.04 < 0.03	< 0.1	< 0.07	< 0.01	< 0.3	< 100 < 100 < 100
BB-01-027 Sample BBI	< 0.03 < 0.3	< 0.03	< 0.008	< 0.01 < 0.7	< 0.3	< 200
BB-01-038 Sample Field Duplicate	0.085 +/- 0.033	< 0.02	< 0.007	0.02 +/- 0.01 0.01 +/- 0.01	< 0.2 < 0.3	< 100
BB-01-041 Sample	0.10 +/- 0.02	< 0.06	< 0.02	0.02 +/- 0.01	< 0.3	< 200
BB-01-056 Sample USEPA	< 0.04 0.035 +/- 0.012	< 0.1 < 0.02	< 0.04 < 0.015	0.04 +/- 0.01 < 0.69	< 0.3 < 0.23	190 +/- 70 < 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

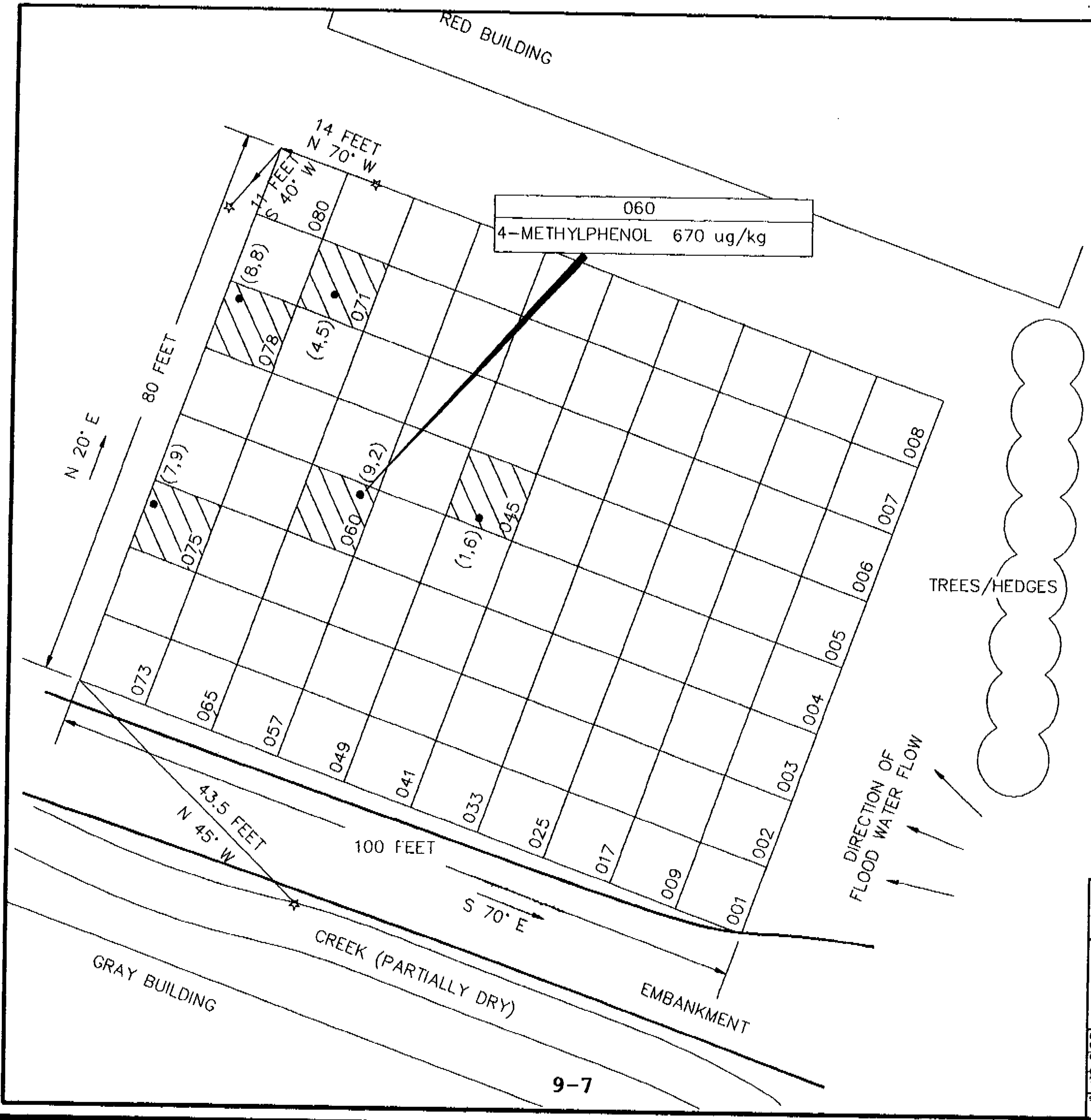
Soil at the Perimeter of the Playground was a dark grayish brown sand, fine to medium grained, poorly sorted, non-plastic, and moist. No chemicals were detected in the soil at the Perimeter of the Playground that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds).

9.2 Dormitory Area (BB-02)

The Dormitory area is approximately 7,000 feet north of the Rocketdyne property line. The area to be sampled was located between dormitory buildings to the north and the creek (partially dry) to the south. The sampling area was nearly perfectly level and the top layer of soil was a silty sand. Many boulders and rocks were present leading to the assumption that the area had been washed out by the creek during heavy storms in February. The area was surrounded by trees, but was devoid of other vegetation.

On March 19, 1992, five soil samples were collected from the grid according to the approved Workplan. A field duplicate sample was collected at Block 060 (gamma scan and tritium). The sampling grid and the results are shown on Figure 9-2.

Soil at the Dormitory Area was a brown sand, fine to medium grained, poorly graded, non-plastic, and dry. The compound 4-methylphenol was detected in the soil at Block 060. (See Section 11.0 for further discussion.) No other chemicals were detected in the soil at the Dormitory Area that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds). Tables 9-3 and 9-4 summarize the chemical and radionuclide results for soil, respectively.



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
ug/kg	microgram per kilogram

McLaren Hart

FIGURE 9-2
DORMITORY AREA
BB-02
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY QMT	DATE 1/25/93		
APPROVED BY DXD	DATE 1-25-93	ISSUE	DRAWING NUMBER 08079206
SCALE	REFER		

TABLE 9-3

Chemical Results for Soil Samples at the Dormitory Area (BB-02)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-02-045 Sample	*	*	*	6.7	7.2	5.1	*	4.2	27
BB-02-060 Sample	4-Methylphenol=670	*	*	8.2	9.1	8.1	*	4.9	34
BB-02-071 Sample	*	*	*	6.7	11	6.4	*	5	30
BB-02-075 Sample	*	*	*	10	8.5	11	*	6.6	39
BB-02-078 Sample	*	*	*	10	13	11	*	6.8	48

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

4-Methylphenol is a component of herbicides and disinfectants.

TABLE 9-4

Radionuclide Results for Soil Samples at the Dormitory Area (BB-02)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-02-045						
Sample	< 0.05	< 0.01	< 0.004	< 0.01	< 0.2	W
BB-02-060						
Sample	< 0.05	< 0.02	< 0.006	0.01 +/- 0.01	< 0.2	< 200
Field Duplicate	< 0.05					< 200
BB-02-071						
Sample	0.058 +/- 0.032	< 0.01	< 0.003	0.01 +/- 0.01	< 0.3	W
BBI	< 0.3			< 1.2		
BB-02-075						
Sample	0.048 +/- 0.025	< 0.03	< 0.007	0.01 +/- 0.01	< 0.3	< 200
BB-02-078						
Sample	0.10 +/- 0.04	< 0.05	< 0.02	0.02 +/- 0.01	< 0.3	< 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

W -- Samples results could not be verified by the laboratory and subsequently were withdrawn by the laboratory.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

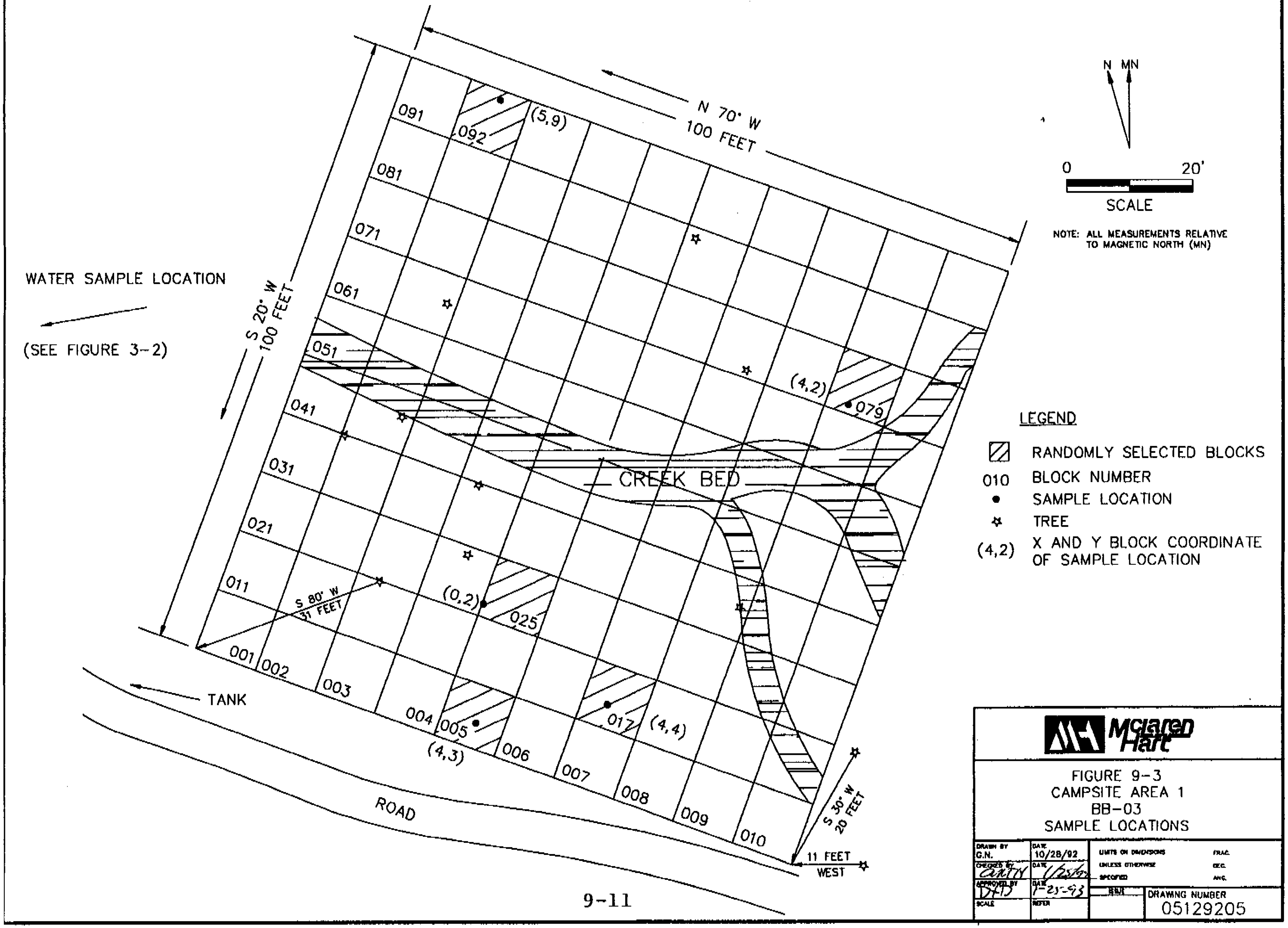
Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

9.3 Campsite Area 1 (BB-03)

Campsite Area 1 is approximately 3,500 feet northwest of the Rocketdyne property line and is connected by stream beds to the runoff from the Building 59, RMDF, and the Sodium Burn Pit watersheds. Samples were taken from a flat area approximately 250 feet north/northeast of a large red water tank. A creek ran through the center of the sampling area and a water sample was collected downstream. The access road ran along the southwest side of the sampling area. The area was covered with grasses and forbs, including abundant growth of poison oak. Several trees were located on both sides of the creek; three trees were used as landmarks to anchor the grid.

On March 17, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 005. A field duplicate sample was collected at Block 017 (gamma scan and tritium). A matrix spike sample was collected at Block 092. The USEPA radiation survey of the area ranged from 13 to 15 uR/hr. The sampling grid and the results are shown on Figure 9-3. The relationship of Campsite 1 to the watersheds is shown in Figure 3-2.

Soil at Campsite Area 1 was brown to black silty sand, fine grained, poorly graded, plastic, moist, with organic material and roots. Acetone was detected in a USEPA split sample slightly above the McLaren/Hart detection limit. Although, Campsite 1 is downgradient from the ravines that showed tritium, cesium-137, strontium-90, and plutonium-238, no other chemicals were detected at Campsite Area 1 that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the soil. Tables 9-5 and 9-6 summarize the chemical and radionuclide data for soil samples, respectively.



McLaren Hart

FIGURE 9-3
CAMPSITE AREA 1
BB-03
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY	DATE 1/25/93		
APPROVED BY	DATE 1-25-93		
SCALE	REFER		DRAWING NUMBER 05129205

TABLE 9-5

Chemical Results for Soil Samples at Campsite Area 1 (BB-03)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-03-005 Sample USEPA	 * *	* Acetone=27	 * *	 13 11	 11 8	 14 13.8	 * *	 11 11	 46 39.7
BB-03-017 Sample	*	*	*	10	10	8.8	*	8.5	37
BB-03-025 Sample	*	*	*	12	10	12	*	10	44
BB-03-079 Sample	*	*	*	13	10	9.8	*	9.1	47
BB-03-092 Sample	*	*	*	17	9.6	12	*	14	46

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-6

Radionuclide Results for Soil Samples at Campsite Area 1 (BB-03)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-03-005 Sample USEPA	0.20 +/- 0.04 0.26 +/- 0.02	< 0.08 0.04 +/- 0.05	< 0.02 < 0.023	0.06 +/- 0.01 < 0.66	< 0.2 < 0.28	< 200 < 209
BB-03-017 Sample Field Duplicate	0.085 +/- 0.038 0.057 +/- 0.028	< 0.007	< 0.007	0.05 +/- 0.01	< 0.3	< 300 < 400
BB-03-025 Sample Interlab Duplicate	0.20 +/- 0.05	< 0.2	< 0.05	0.09 +/- 0.01	< 0.2	340 +/- 120 240 +/- 120
BB-03-079 Sample	< 0.04	< 0.01	< 0.01	0.03 +/- 0.01	< 0.2	< 200
BB-03-092 Sample	0.38 +/- 0.06	< 0.1	< 0.04	0.04 +/- 0.01	< 0.2	< 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

A surface water sample was collected from the creek approximately 300 feet downstream from the sampling grid. The water was murky due to disturbances by a bulldozer upstream. Water collected for the gamma scan, tritium, isotopic plutonium, strontium-90, iodine-129, and metals analyses was filtered twice due to the large quantities of solids present on the filter after the first filtration. The USEPA collected a split of the surface water at this location. Zinc was detected in the surface water sample at 21 micrograms per liter of water (ug/L) by McLaren/Hart and at 16 ug/L by the USEPA, which was less than background sample result (29 ug/L). Gross beta activity was 7.8 ±3.3 picocuries per liter of water (pCi/L) and 5.2 ±1.5 pCi/L for the scheduled sample and the USEPA split, respectively. (See Section 11.0 for further discussion.) No other chemicals or radionuclides were detected in the surface water sample at Campsite Area 1. Tables 9-7 and 9-8 summarize the chemical and radionuclide data for water samples, respectively.

9.4 Campsite Area 2 (BB-04)

Campsite Area 2 was an amphitheater with concrete bleachers in the center of the hillside soil. Samples were collected from the level area in front of the bleachers in an area with picnic benches and fire pits. One area in the center of the amphitheater was used for camp fires. A small creek ran along the north side of the sampling area and a larger stream ran down from the RD-51 Watershed on the south side. The area was sparsely vegetated and trees were present to the north and northwest.

Campsite Area 2 is approximately 2,400 feet north of the Rocketdyne property line, near the vicinity of the RD-51 Watershed (BB-15). Campsite Area 2 is hydrologically connected to the RD-51 Watershed by the stream that passes through the southwest portion of the area approximately 150 feet from the grid which potentially carries runoff from the SSFL.

TABLE 9-7

Chemical Results for Surface Water Samples at Campsite Area 1 (BB-03)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-03-001									
Sample	*	*	*	*	*	*	*	*	21
USEPA	*	*	*	*	*	*	*	*	16

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-8

Radionuclide Results for Surface Water Samples at Campsite Area 1 (BB-03)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-03-001								
Sample	< 4	< 0.2	< 0.07	< 0.5	< 0.7		< 3	7.8 +/- 3.3
USEPA	< 4.3	< 0.023	< 0.038	< 0.78	< 3.3	< 200	< 2.4	5.2 +/- 1.5

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

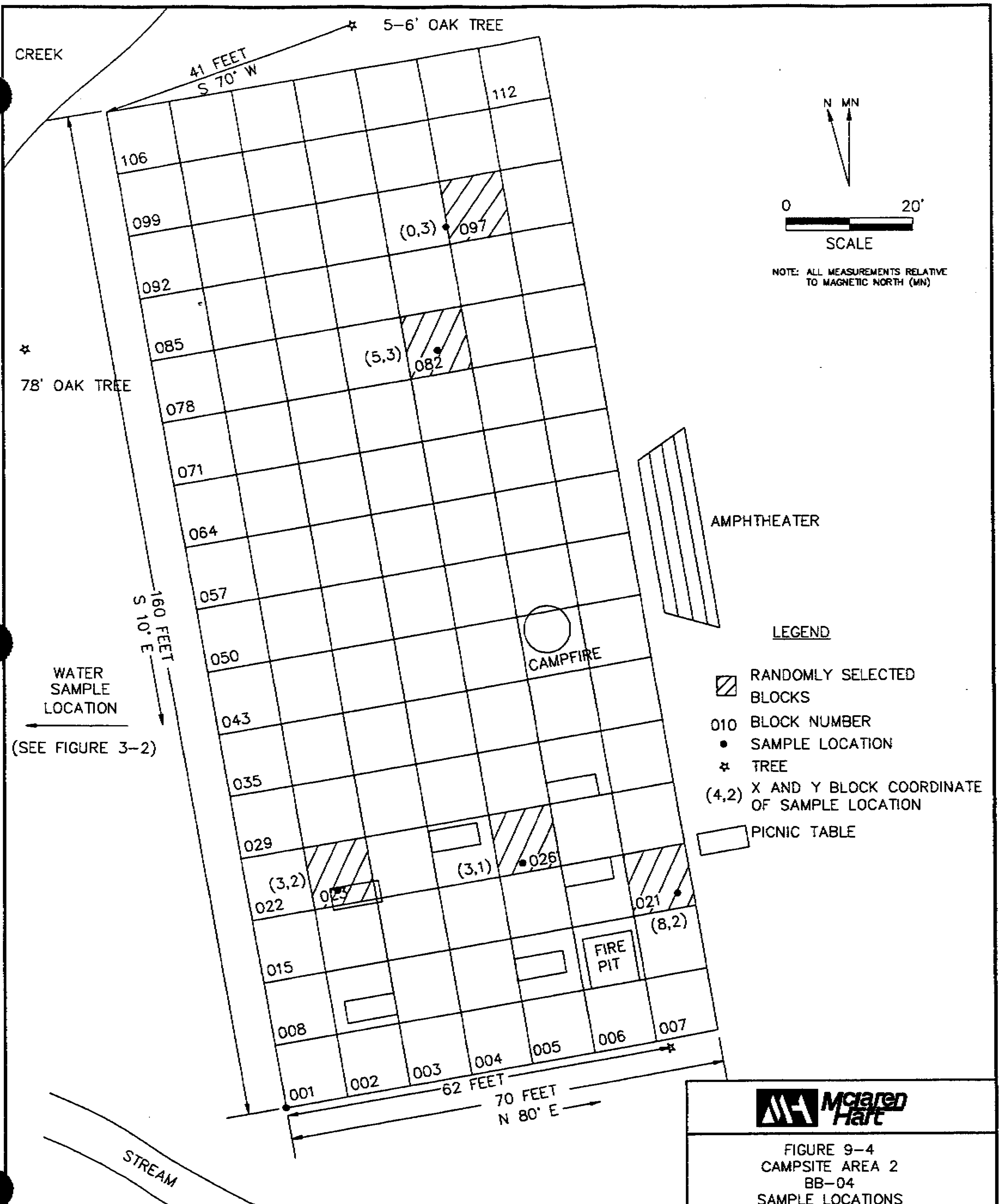
BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

On March 16, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 021. The DHS collected a split sample at Block 097. Two rinsate blanks were collected at this sampling area. The sampling grid and the results are shown on Figure 9-4.

Soil at Campsite Area 2 was silty sand, dark brown to black, fine to medium grained, poorly graded, plastic, and moist. No chemicals were detected at Campsite Area 2 that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the scheduled soil samples. A DHS split soil sample detected tritium at 2,470 ±197 pCi/L, which was substantially higher than the scheduled sample or the USEPA interlaboratory duplicate. The DHS later reanalyzed this sample which resulted in a value of 392 ±153, which was more in line with the other results. However, the DHS laboratory attributed this reduction to losses during storage. (Section 6.1.5 discusses this in greater detail.) Chemical and radionuclide analytical results for soil samples are presented in Tables 9-9 and 9-10.

A surface water sample was collected from a running stream located approximately 450 feet downstream from the amphitheater. The water flowed along a concrete stream bed at the point where the samples were collected. A complete set of water samples was collected and split with the USEPA. No chemicals or radionuclides above detection or reporting limits, respectively, were detected in the surface water samples at Campsite Area 2. Chemical and radionuclide analytical data for the surface water samples are summarized in Tables 9-11 and 9-12.



McLaren Hart

FIGURE 9–4
CAMPSITE AREA 2
BB–04
SAMPLE LOCATIONS

DRAWN BY C.N.	DATE 10/28/92	LIMITS ON DIMENSIONS	FRAC.		
CHECKED BY	DATE 1/25/93	UNLESS OTHERWISE	DEC.		
APPROVED BY OSD	DATE 1-25-93	SPECIFIED	ANG.		
SCALE	REFER	ISSUE	DRAWING NUMBER 08079205		

TABLE 9-9

Chemical Results for Soil Samples at Campsite Area 2 (BB-04)

	Semi-Volatile Organic Compounds (ug/kg)	**Volatile Organic Compounds (ug/kg)**	**Metals (mg/kg)**						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-04-021 Sample	*	*	*	9	9.1	6.6	*	5.1	45
USEPA	*	*	*	7	6	5.3	*	5	36.6
BB-04-023 Sample	*	*	*	9.7	10	7.4	*	6	41
BB-04-026 Sample	*	*	*	9.7	8.2	7.6	*	5.4	45
BB-04-082 Sample	*	*	*	8.6	7	5	*	4.8	39
BB-04-097 Sample	*	*	*	7.8	5.9	8.8	*	4.4	40

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-10

Radionuclide Results for Soil Samples at Campsite Area 2 (BB-04)

	Cesium-137 [pCi/g(dry)]	**Plutonium-238** [pCi/g(dry)]	**Plutonium-239** [pCi/g(dry)]	**Strontium-90** [pCi/g(dry)]	**Iodine-129** [pCi/g(dry)]	**Tritium** (pCi/L)
BB-04-021						
Sample	< 0.05	< 0.02	< 0.007	0.03 +/- 0.01	< 0.2	390 +/- 200
USEPA	0.034 +/- 0.018	0.025 +/- 0.020	< 0.016	< 0.71	< 0.29	< 200
BB-04-023						
Sample	0.099 +/- 0.040	< 0.01	< 0.006	0.02 +/- 0.01	< 0.3	310 +/- 160
Interlab Duplicate						230 +/- 90
BB-04-026						
Sample	0.15 +/- 0.03	< 0.009	< 0.006	0.03 +/- 0.01	< 0.2	660 +/- 210
BB-04-082						
Sample	< 0.03	< 0.02	< 0.007	0.01 +/- 0.01	< 0.3	510 +/- 180
Field Duplicate				0.04 +/- 0.01	< 0.3	
BB-04-097						
Sample	< 0.03	< 0.02	< 0.005	0.01 +/- 0.01	< 0.3	< 200
DHS	0.03 +/- 0.01					2470 +/- 197
USEPA						< 192

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
* A second analysis was conducted three months later by DHS with the result of the 392 +/-153 pCi/L, which was lower than the initial analysis. The DHS attributed this to loss during long-term storage.

TABLE 9-11

Chemical Results for Surface Water Samples at Campsite Area 2 (BB-04)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-04-001									
Sample	*	*	*	*	*	*	*	*	*
USEPA	*	*	*	*	*	*	*	*	10

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-12

Radionuclide Results for Surface Water Samples at Campsite Area 2 (BB-04)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-04-001								
Sample	< 4	< 0.2	< 0.2	< 0.4	< 0.8	< 100	< 3	< 4
USEPA	< 8.1	< 0.027	< 0.016	< 0.99	< 3.3	< 200	< 1.6	4.2 +/- 1.5

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

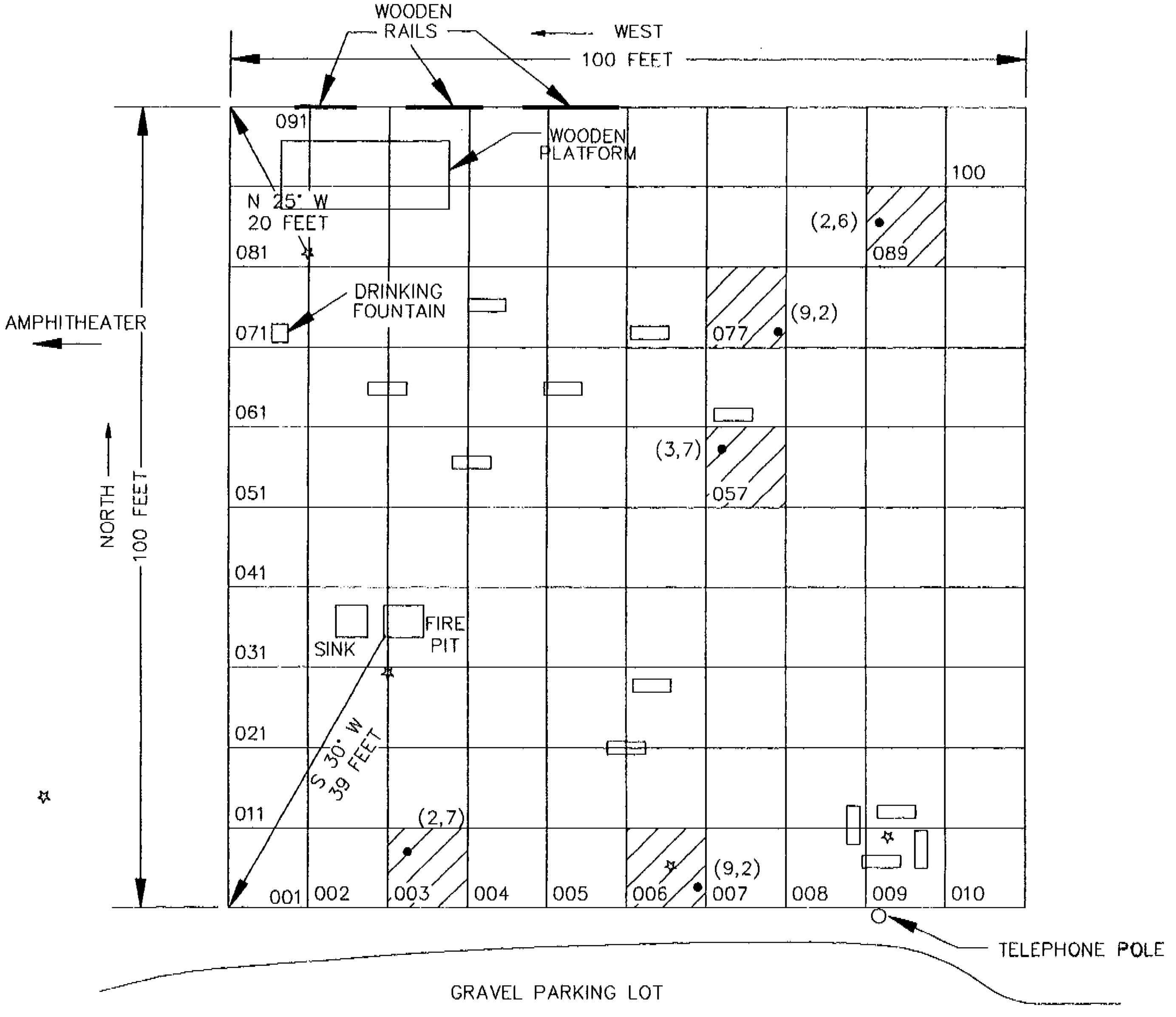
9.5 Picnic Area (BB-05)

The Picnic Area is approximately 7,000 feet north of the Rocketdyne property line. The sampling area was located on a sloped area under several trees. Picnic tables, a fire pit, a sink, and a drinking fountain were located in the area. An amphitheater was located to the west. The sampling area was generally devoid of vegetation at the southern end of the slope and was sparsely vegetated at the top.

On March 18, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 077. Five rinsate blanks were collected at this area. A field duplicate sample was collected at Block 003 (isotopic plutonium). The USEPA radiation survey of the area ranged from 12 to 15 uR/hr. The sampling grid and the results are shown on Figure 9-5. Soil at the Picnic Area was a dark brown silty sand, fine to medium grained, moderately well graded, plastic, and moist. No chemicals were detected at the Picnic Area that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide analytical data for soil samples are summarized in Tables 9-13 and 9-14.

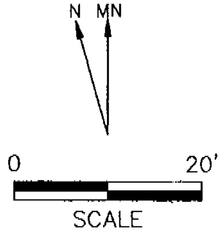
9.6 House of the Book (BB-06)

The House of the Book is approximately 6,500 feet north of the Rocketdyne property line. The area sampled was a flat grassy area located across the parking lot north of the House of the Book. The sampling area was bordered by an access road to the south. One tree was present in a depression west of the sampling grid. The area was uniformly covered with annual grasses and forbs.



LEGEND

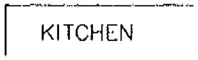
▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(3,7)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED



McLaren Hart

FIGURE 9–5
PICNIC AREA
BB–05
SAMPLE LOCATIONS

DRAWN BY G.N.
DATE 10/28/92
CHECKED BY
DATE 1/25/93
APPROVED BY DXD
DATE 1-25-93
SCALE
REFER
UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRAC.
DEC.
ANG.
ISSUE
DRAWING NUMBER 05139208

TABLE 9-13

Chemical Results for Soil Samples at the Picnic Area (BB-05)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-05-003 Sample	*	*	*	13	16	18	*	10	52
BB-05-006 Sample	*	*	*	11	13	10	*	8.4	36
BB-05-057 Sample	*	*	*	12	17	10	*	10	46
BB-05-077 Sample	*	*	*	12	15	12	*	10	44
USEPA	*	*	*	11	13	14	*	10	44.1
BB-05-089 Sample	*	*	*	11	14	12	*	9.2	36

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-14

Radionuclide Results for Soil Samples at the Picnic Area (BB-05)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-05-003 Sample Field Duplicate	0.22 +/- 0.03	< 0.01 < 0.02	< 0.005 < 0.02	0.02 +/- 0.01	< 0.2	280 +/- 130
BB-05-006 Sample	0.11 +/- 0.02	< 0.03	< 0.008	0.02 +/- 0.01	< 0.2	200 +/- 110
BB-05-057 Sample	0.052 +/- 0.030	< 0.006	< 0.006	0.03 +/- 0.01	< 0.2	< 200
BB-05-077 Sample USEPA	0.16 +/- 0.04 0.086 +/- 0.014	< 0.008 0.03 +/- 0.03	< 0.01 0.015 +/- 0.02	0.06 +/- 0.01 < 0.71	< 0.2 < 0.23	< 200 < 200
BB-05-089 Sample	0.14 +/- 0.04	< 0.03	< 0.02	0.02 +/- 0.01	< 0.2	< 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

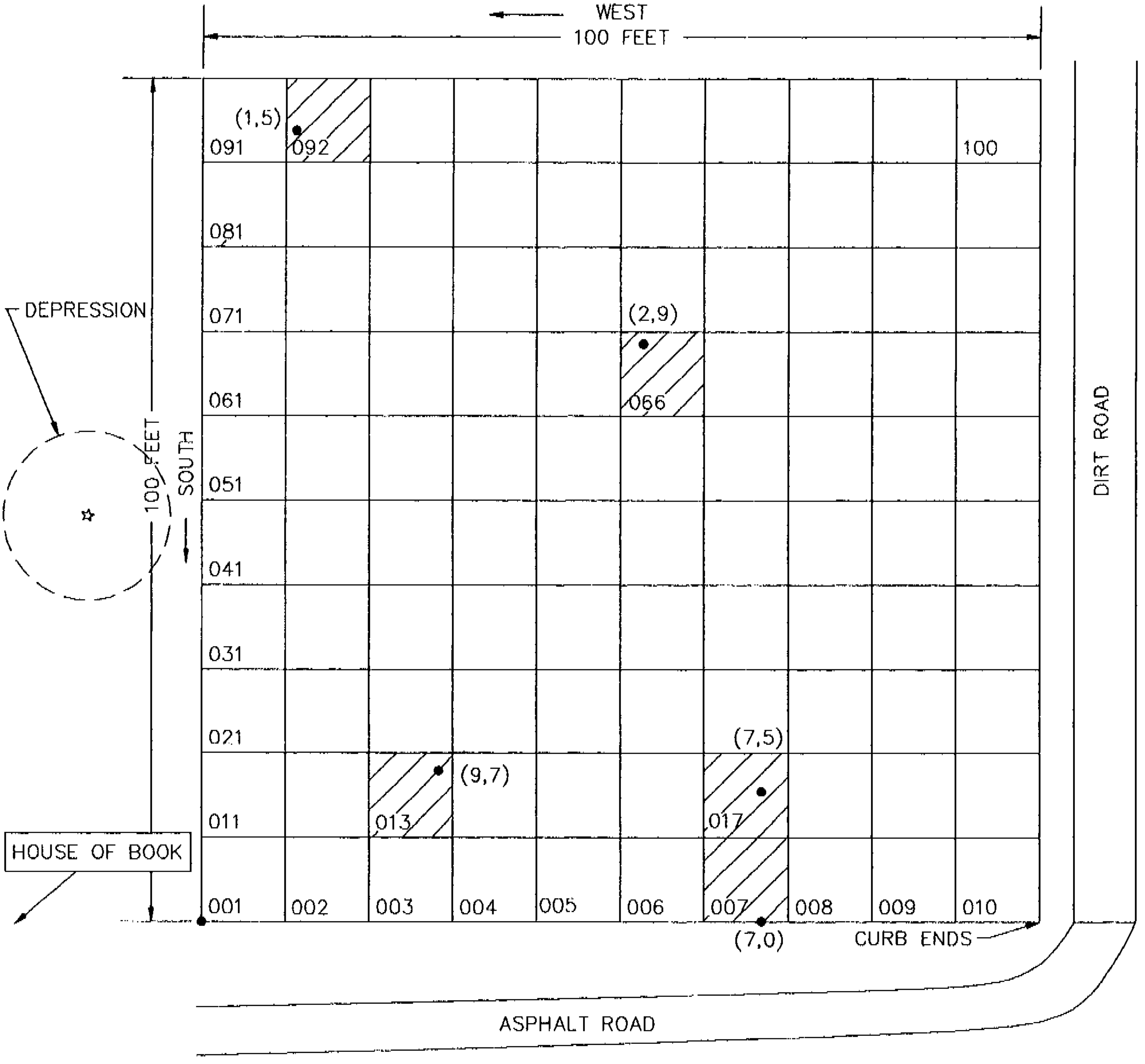
On March 17, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 092. The USEPA radiation survey of the area ranged from 13 to 15 uR/hr. The sampling grid and the results are shown on Figure 9-6.

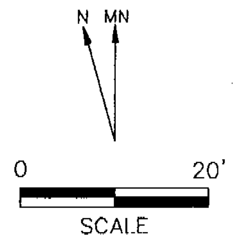
Soil at the House of the Book was a brown silt, fine grained, poorly graded, plastic, and moist. Chemicals were not detected at the House of the Book that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide analytical results are summarized in Tables 9-15 and 9-16.

9.7 Counselor-in-Training Area (BB-07)

The Counselor-in-Training Area is approximately 5,600 feet north of the Rocketdyne property line. The area sampled was a vegetable garden bordered on all sides by fences; the sampling grid corresponded to the area within the fence. The main dirt road ran along the northern perimeter of the garden and another dirt road ran along the northwest perimeter between the garden, the horse stable and storage sheds. The area had been tilled and prepared for planting prior to the time samples were collected. In general, vegetation was not present although some grasses and trees grew around the perimeter of the sampling area.

On March 19, 1992, five soil samples were collected from the grid according to the approved Workplan. The Brandeis-Bardin consultant collected a split soil sample of Block 035 for gamma scan and strontium-90. Three rinsate blanks were collected at this area. A matrix spike sample was collected at Block 036. The USEPA radiation survey of the area ranged from 12 to 13 uR/hr. The sampling grid and the results are shown on Figure 9-7.





NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 9-6
HOUSE OF THE BOOK
BB-06
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY CL/KH	DATE 1/25/93		
APPROVED BY DXD	DATE 1-25-93	ISSUE	DRAWING NUMBER 08069203
SCALE	REFER		

TABLE 9-15

Chemical Results for Soil Samples at the House of the Book (BB-06)

	Semi-Volatile Organic Compounds (ug/kg)	**Volatile Organic Compounds (ug/kg)**	**Metals (mg/kg)**						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-06-007 Sample	*	*	*	20	20	17	*	15	80
BB-06-013 Sample	*	*	*	23	22	13	*	23	72
BB-06-017 Sample	*	*	*	19	20	16	*	16	73
BB-06-066 Sample	*	*	*	15	18	15	*	10	53
BB-06-092 Sample	*	*	*	14	19	15	*	9.6	54
USEPA	*	*	*	12	18	12.6	*	10	52.4

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-16

Radionuclide Results for Soil Samples at the House of the Book (BB-06)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-06-007						
Sample	< 0.05	< 0.02	< 0.004	< 0.01	< 0.3	480 +/- 90
Interlab Duplicate						
BB-06-013						
Sample	< 0.05	< 0.02	< 0.01	0.01 +/- 0.01	< 0.2	< 300
BB-06-017						
Sample	< 0.03	< 0.01	< 0.004	0.01 +/- 0.01	< 0.2	D
Lab Duplicate	< 0.04					
BB-06-066						
Sample	< 0.04	< 0.01	< 0.009	< 0.01	< 0.2	< 300
BB-06-092						
Sample	< 0.04	< 0.006	< 0.006	< 0.01	< 0.2	190 +/- 100
USEPA	< 0.033	0.031 +/- 0.05	< 0.022	< 0.70	< 0.28	< 210

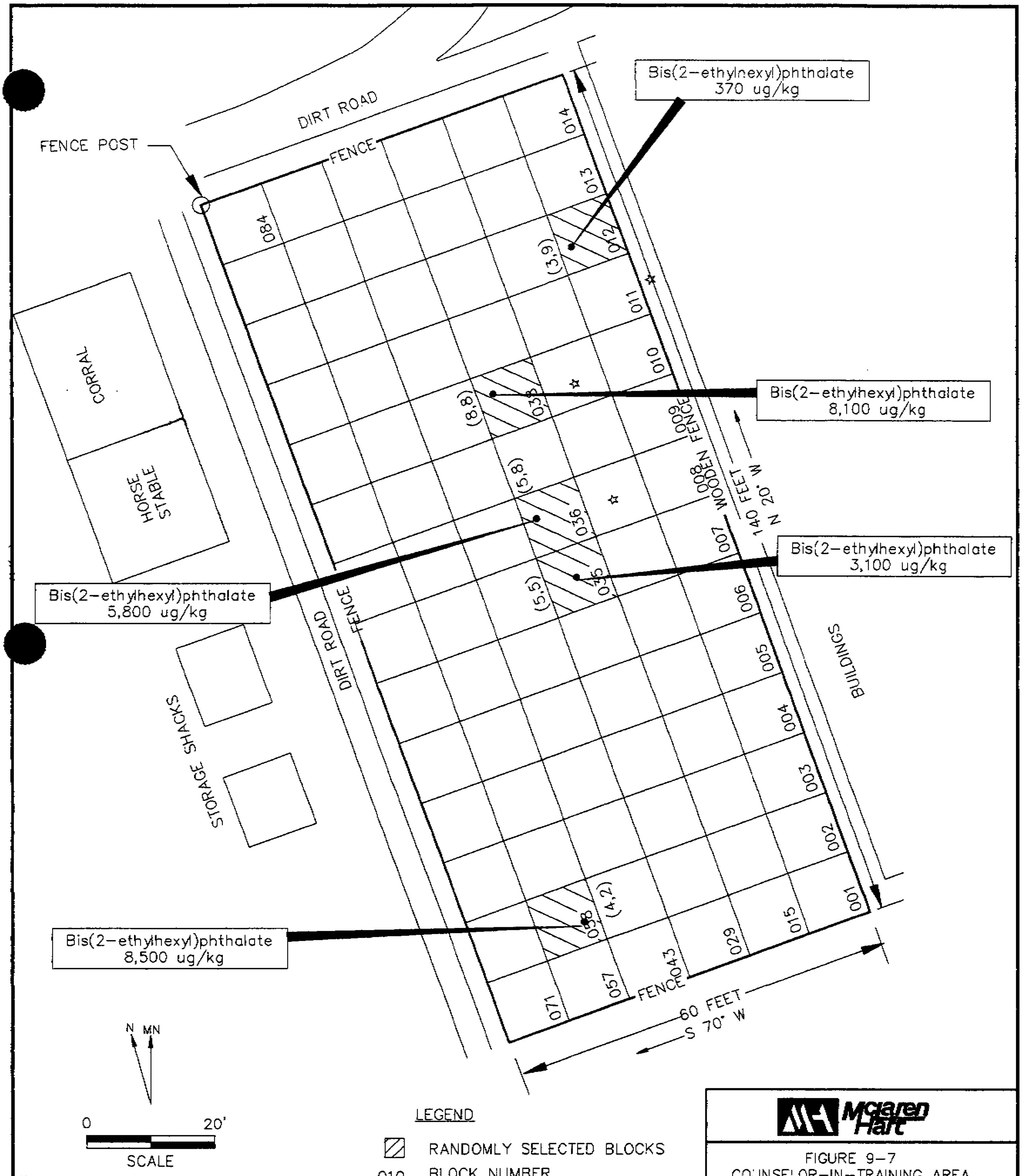
pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(5,5)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
ug/kg	microgram per kilogram

TES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY ORIGINAL McLAREN/HART SAMPLE RESULTS ARE SHOWN ON THIS FIGURE

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 9-7
COUNSELOR-IN-TRAINING AREA
BB-07
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED FRAC. DEC. ANG.
CHECKED BY Aunty	DATE 1/25/93	
APPROVED BY DXD	DATE 1-25-93	ISSUE
SCALE	REFER	DRAWING NUMBER 05139210

Soil at the Counselor-in-Training Area was a dark grayish brown silty sand, fine to mediumgrained, moderately graded, slightly plastic, and moist. Bis(2-ethylhexyl)phthalate was detected in all five soil samples at concentrations ranging from 370 to 8,500 ug/kg. (See Section 11.0 for further discussion.) No other chemicals were detected at the Counselor-in-Training Area that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide results are summarized in Tables 9-17 and 9-18.

9.8 Potential Development Site 1 (BB-08)

The Potential Development Site 1 is approximately 5,400 feet north/northwest of the Rocketdyne property line. The sample grid was approximately 40 feet northwest of a small corral and approximately 200 feet west of the main dirt road. Drainage to the west appeared to run across the southeast corner of the sampling area. The area had been planted with hay which had grown 6 to 12 inches.

On March 19, 1992, five soil samples were collected from the grid according to the approved Workplan. The Brandeis-Bardin consultant collected a split sample of Block 022. Five rinsate blanks were collected at this location. A field duplicate was collected at Block 034 (VOCs). A matrix spike sample was collected at Block 035. The USEPA radiation survey of the area ranged from 12 to 13 uR/hr. The sampling grid and the results are shown on Figure 9-8.

Soil at the Potential Development Site 1 was a grayish brown silt, poorly graded, semi-plastic, and moist to dry. No chemicals or radionuclides were detected at the Potential Development Site 1 that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds) in the soil. A

TABLE 9-17

Chemical Results for Soil Samples at the Counselor-in-Training Area (BB-07)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-07-012 Sample	Bis(2-ethylhexyl)phthalate=370	*	*	9.4	10	11	*	6.6	46
BB-07-035 Sample	Bis(2-ethylhexyl)phthalate=3100	*	*	13	13	12	*	8.7	48
BB-07-036 Sample	Bis(2-ethylhexyl)phthalate=5800	*	*	9.8	11	9.7	*	7.1	42
BB-07-038 Sample	Bis(2-ethylhexyl)phthalate=8100	*	*	10	9.3	12	*	7.4	45
BB-07-058 Sample	Bis(2-ethylhexyl)phthalate=8500	*	*	8.1	11	15	*	6.7	41

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Bis(2-ethylhexyl)phthalate is used as a plasticizer.

TABLE 9-18

Radionuclide Results for Soil Samples at the Counselor-in-Training Area (BB-07)

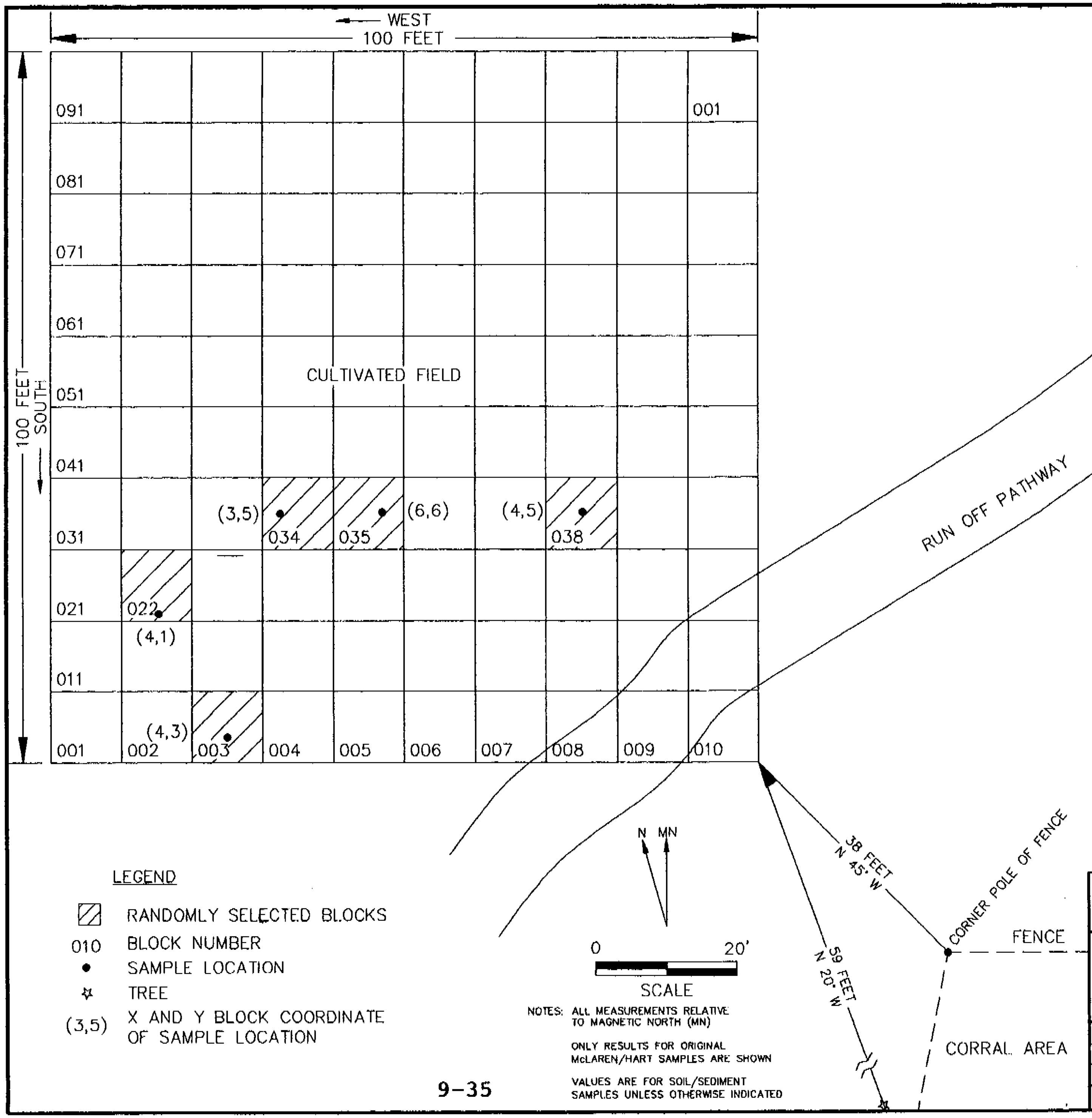
	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-07-012 Sample	0.044 +/- 0.021	< 0.06	< 0.02	0.01 +/- 0.01	< 0.3	210 +/- 70
BB-07-035 Sample BBI	0.095 +/- 0.027 < 0.3	< 0.06	< 0.02	0.02 +/- 0.01 < 1.2	< 0.3	< 200
BB-07-036 Sample	0.095 +/- 0.026	< 0.08	< 0.04	0.02 +/- 0.01	< 0.4	< 200
BB-07-038 Sample	0.13 +/- 0.03	< 0.2	< 0.04	0.02 +/- 0.01	< 0.2	< 100
BB-07-058 Sample	0.099 +/- 0.036	< 0.06	< 0.01	0.01 +/- 0.01	< 0.2	190 +/- 80

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(3,5)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 9–8
POTENTIAL DEVELOPMENT SITE 1
BB–08
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY	DATE 1/25/93		
APPROVED BY DXD	DATE 1-25-93	ISSUE	DRAWING NUMBER 05149212
SCALE	REFER		

summary of the chemical and radionuclide analytical results for soil samples is presented in Tables 9-19 and 9-20.

9.9 Potential Development Site 2 (BB-09)

Potential Development Site 2 is approximately 5,700 feet north of the Rocketdyne property line. The area is located on a plateau overlooking Potential Development Site 1 with a small dry creek to the south and east. The nearest landmark is a tree located 470 feet from the southeast corner on the opposite side of the creek. The sampling area was flat but surrounded by hills in the distance. The area was covered with freshly planted grasses.

On March 19, 1992, five soil samples were collected from the grid according to the approved Workplan. A matrix spike sample was collected at Block 051. Field duplicate samples were collected at Block 031 (metals), Block 070 (isotopic plutonium), and Block 100 (strontium-90 and iodine-129). The Brandeis-Bardin consultant collected a sample at Block 092. The sampling grid and the results are shown on Figure 9-9.

Soil at Potential Development Site 2 was a grayish brown silt, poorly graded, semi-plastic, and moist to dry. No chemicals were detected at Potential Development Site 2 that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide analytical results for soil samples are summarized in Tables 9-21 and 9-22.

9.10 Potential Development Site 3 (BB-10)

Potential Development Site 3 is approximately 7,900 feet north of the Rocketdyne property line. The area sampled was in the center of a 180 degree curve in the dirt road. Two trees on opposite sides of the grid were used as landmarks. The area was generally flat,

TABLE 9-19

Chemical Results for Soil Samples at Potential Development Site 1 (BB-08)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-08-003 Sample	*	*	*	21	24	16	*	15	58
BB-08-022 Sample	*	*	*	21	25	16	*	16	59
BB-08-034 Sample Field Duplicate	*	* *	*	22	25	16	*	16	61
BB-08-035 Sample	*	*	*	20	25	17	*	16	60
BB-08-038 Sample	*	*	*	20	26	16	*	16	60

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-20

Radionuclide Results for Soil Samples at Potential Development Site 1 (BB-08)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-08-003 Sample	0.16 +/- 0.04	< 0.1	< 0.03	0.02 +/- 0.01	< 0.3	280 +/- 100
BB-08-022 Sample BBI	0.14 +/- 0.04 < 0.3	< 0.1	< 0.08	0.01 +/- 0.01 < 1.3	< 0.3	210 +/- 90
BB-08-034 Sample Lab Duplicate	0.15 +/- 0.04	< 0.06 < 0.2	< 0.02 < 0.1	< 0.01	< 0.3	< 100
BB-08-035 Sample	0.17 +/- 0.04	< 0.1	< 0.03	< 0.01	< 0.3	200 +/- 90
BB-08-038 Sample	0.094 +/- 0.035	< 0.05	< 0.02	0.02 +/- 0.01	< 0.3	420 +/- 100

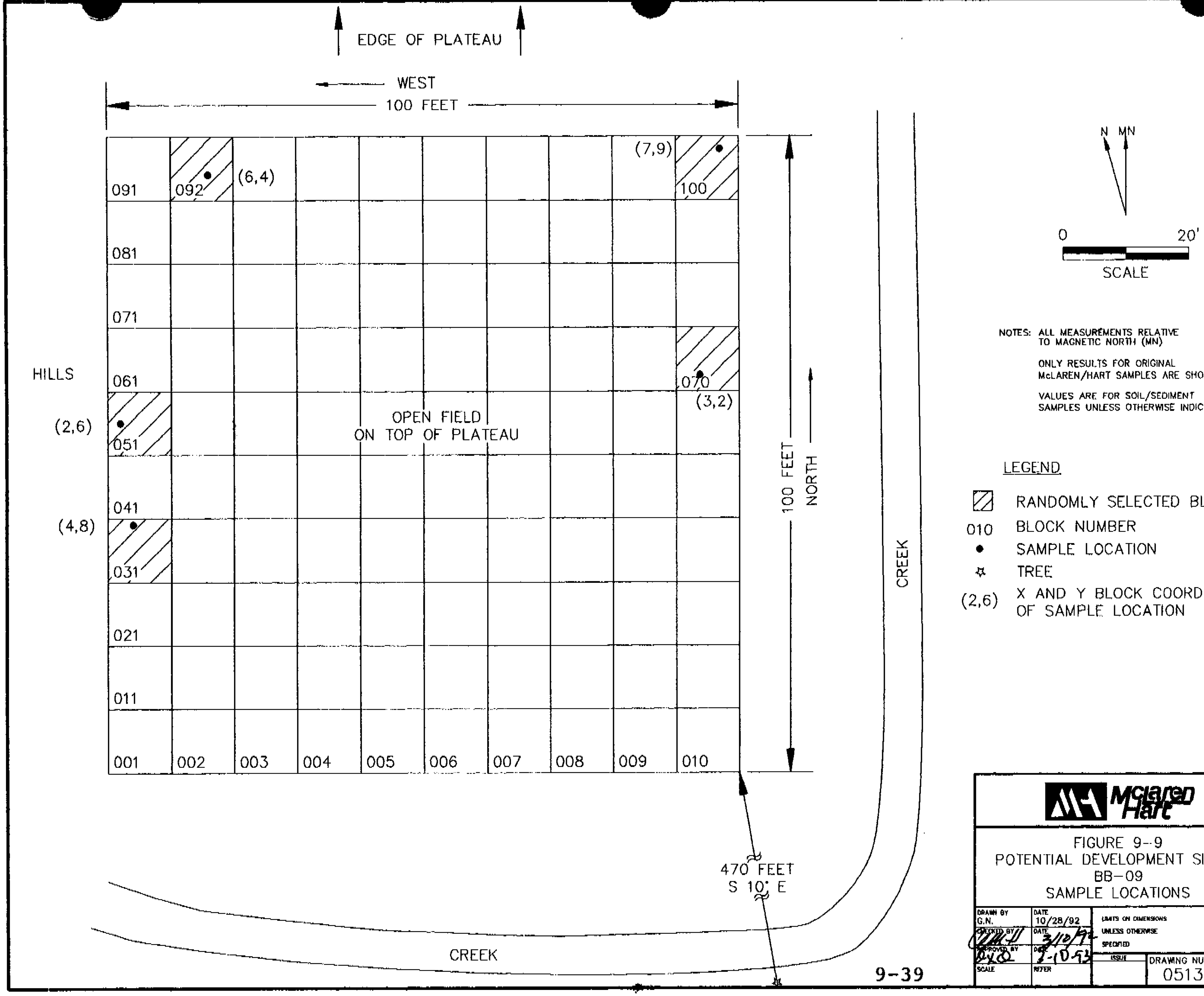
pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Lab Duplicate -- A reanalysis of the sample including extraction and counting.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(2,6)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 9-9
POTENTIAL DEVELOPMENT SITE 2
BB-09
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS	FRAC.
CHECKED BY	DATE 3/10/93	UNLESS OTHERWISE	DEC.
APPROVED BY	DATE 3-10-93	SPECIFIED	ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER 05139211

TABLE 9-21

Chemical Results for Soil Samples at Potential Development Site 2 (BB-09)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-09-031 Sample Field Duplicate	*	*	* *	22 25	28 27	18 19	* *	19 18	63 61
BB-09-051 Sample	*	*	*	21	29	17	*	18	60
BB-09-070 Sample	*	*	*	27	28	19	*	20	65
BB-09-092 Sample	*	*	*	24	27	19	*	19	62
BB-09-100 Sample	*	*	*	24	27	16	*	18	60

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-22

Radionuclide Results for Soil Samples at Potential Development Site 2 (BB-09)

	Cesium-137 [pCi/g(dry)]	**Plutonium-238** [pCi/g(dry)]	**Plutonium-239** [pCi/g(dry)]	**Strontium-90** [pCi/g(dry)]	**Iodine-129** [pCi/g(dry)]	**Tritium** (pCi/L)
BB-09-031 Sample	0.062 +/- 0.034	< 0.07	< 0.02	0.02 +/- 0.01	< 0.3	180 +/- 100
BB-09-051 Sample	0.11 +/- 0.05	< 0.5	< 0.02	0.02 +/- 0.01	< 0.3	< 200
BB-09-070 Sample Field Duplicate Lab Duplicate	0.092 +/- 0.020	< 0.09 < 0.02 < 0.2	< 0.02 < 0.02 < 0.04	0.01 +/- 0.01	< 0.2	< 200
BB-09-092 Sample BBI	0.069 +/- 0.026 < 0.3	< 0.1	< 0.04	0.02 +/- 0.01 < 1.4	< 0.3	220 +/- 110
BB-09-100 Sample Field Duplicate	0.066 +/- 0.020	< 0.1	< 0.05	0.02 +/- 0.01 0.02 +/- 0.01	< 0.3 < 0.3	< 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

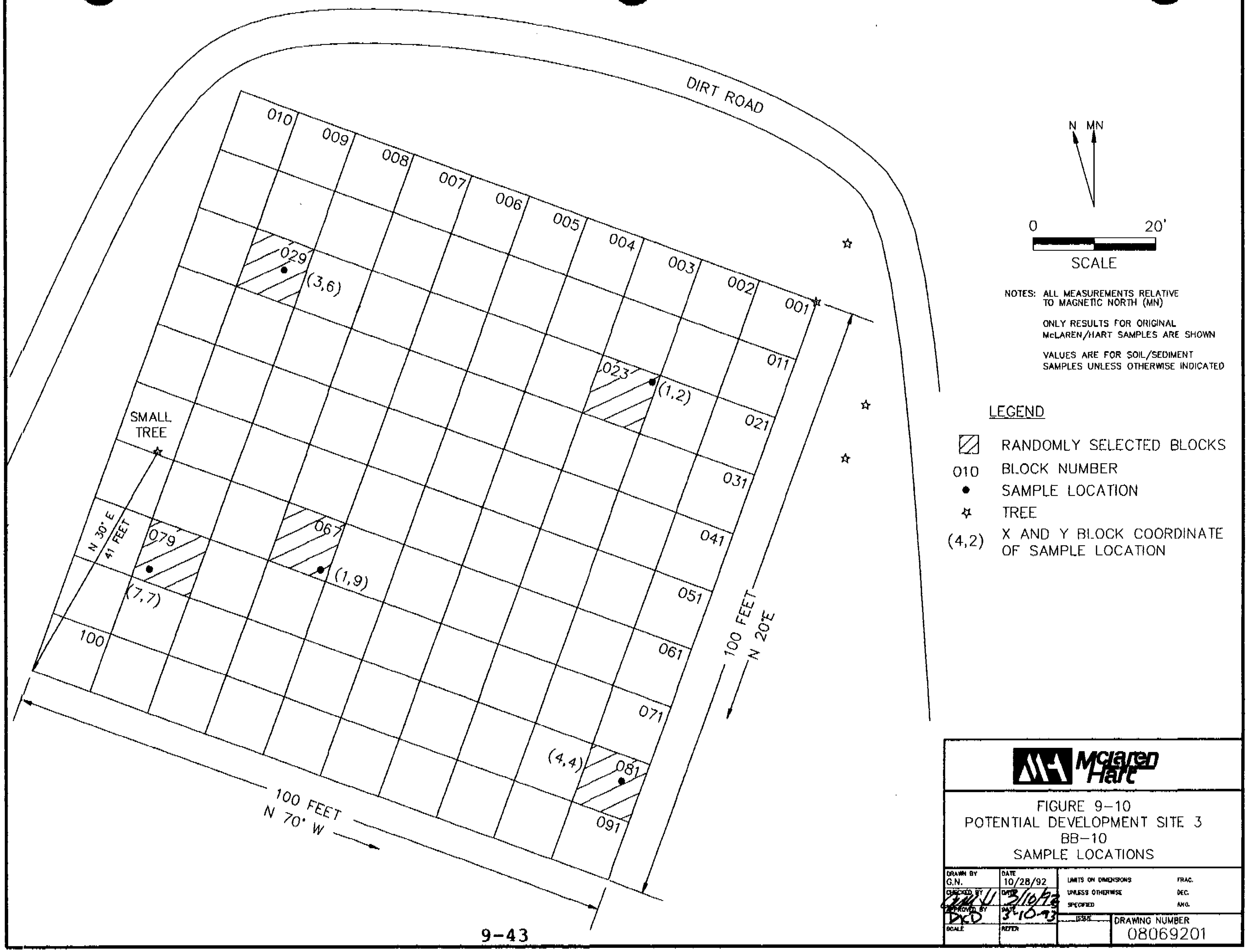
but sloped up to the road on the northern border. The area was densely covered with grasses and forbs; several trees were located along the southern and western borders. On March 19, 1992, five soil samples were collected from the grid according to the approved Workplan. The Brandeis-Bardin consultant collected a split sample at Block 081. Field duplicates were collected at Block 067 (SVOCs and metals) and Block 079 (gamma scan and tritium). Five rinsate samples were collected. The USEPA radiation survey of the area showed 12 uR/hr for all five readings. The sampling grid and the results are shown on Figure 9-10.

Soil at the Potential Development Site 3 was a grayish brown silt, poorly graded, semi-plastic, and moist to dry. No chemicals were detected at Potential Development Site 3 that exceeded background levels (for heavy metals and radionuclides) or reporting limits (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide analytical results are summarized on Tables 9-23 and 9-24.

9.11 Vegetable Garden (BB-11)

The Vegetable Garden is approximately 9,400 feet north of the Rocketdyne property line. The area that was sampled extended past the borders of the cultivated garden and into the flower beds along the northern border. The main road ran along the northern border of the flower beds. A partially dry creek ran along the southwestern edge of the garden, about 30 feet south. A shack was located near the southwestern corner of the sampling area. The vegetable garden had been cultivated and prepared for planting, but vegetation had not been planted. Petunias were growing in the flower bed.

On March 18, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 061. A field duplicate was collected at Block 057 (SVOCs). The Brandeis-Bardin consultant collected a sample at



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION

McLaren Hart

FIGURE 9-10
POTENTIAL DEVELOPMENT SITE 3
BB-10
SAMPLE LOCATIONS

DRAWN BY G.N.
DATE 10/28/92
CHECKED BY
DATE 3/10/93
APPROVED BY DCD
DATE 3-10-93
SCALE
REFER
LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRAC.
DEC.
ANG.
ISSUE
DRAWING NUMBER 08069201

TABLE 9-23

Chemical Results for Soil Samples at Potential Development Site 3 (BB-10)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg) Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-10-023 Sample	*	*	*	19	17	17	*	15	61
BB-10-029 Sample	*	*	*	24	24	18	*	20	80
BB-10-067 Sample Field Duplicate	* *	*	* *	25 24	22 21	17 16	* *	19 19	80 75
BB-10-079 Sample	*	*	*	17	16	13	*	13	60
BB-10-081 Sample	*	*	*	18	15	13	*	13	54

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-24

Radionuclide Results for Soil Samples at Potential Development Site 3 (BB-10)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-10-023 Sample	0.16 +/- 0.04	< 0.04	< 0.02	0.02 +/- 0.01	< 0.3	< 100
BB-10-029 Sample	0.068 +/- 0.028	< 0.04	< 0.01	0.02 +/- 0.01	< 0.3	< 100
BB-10-067 Sample	0.098 +/- 0.029	< 0.03	< 0.008	0.06 +/- 0.01	< 0.3	< 100
BB-10-079 Sample Field Duplicate Lab Duplicate	0.15 +/- 0.04 0.13 +/- 0.04 0.10 +/- 0.04	< 0.02	< 0.005	0.05 +/- 0.01	< 0.3	< 100 170 +/- 80 170 +/- 80
BB-10-081 Sample BBI	0.093 +/- 0.038 < 0.3	< 0.03	< 0.01	0.02 +/- 0.01 < 0.6	< 0.3	< 100

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

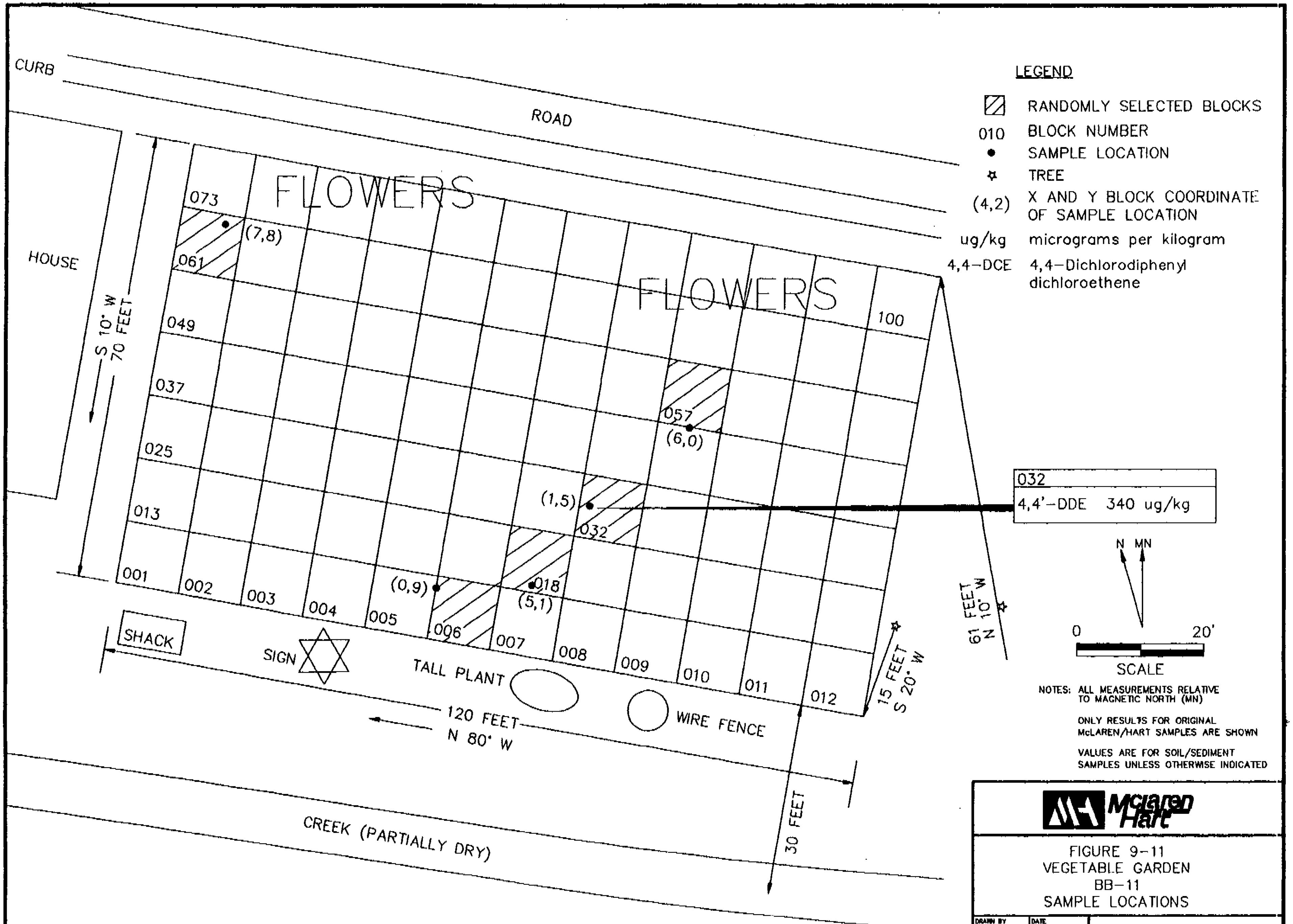
Block 018. Three rinsate blanks were collected at this location. The sampling grid and the results are shown on Figure 9-11. A summary of the chemical and radionuclide analytical results are presented in Tables 9-25 and 9-26.

Soil at the Vegetable Garden was a dark brown silty sand, fine grained, poorly graded, slightly plastic, and moist. Pesticide residues, dichlorodiphenyldichloroethene (4,4'-DDE), was detected in one of the five soil samples at a concentration of 340 ug/kg and in the field duplicate of another sample at 360 ug/kg. (See Section 11.0 for further discussion.) No other chemicals were detected at the Vegetable Garden that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the soil.

9.12 Main House Orchard (BB-12)

The Main House Orchard is approximately 9,800 feet north of the Rocketdyne property line. The sampling area encompassed the entire orchard and extended slightly beyond on the northwestern side. Several trees had fruit (lemons, tangerines and grapefruit) while others were barren. There were large gaps between adjacent trees. A house was located to the south of the sampling area. The main road ran alongside the northern edge of the sampling area. The soil was devoid of vegetation.

On March 18, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample for all analyses at Block 020. The Brandeis-Bardin consultant collected a split soil samples at Block 019 and 023. Field duplicate soil samples were collected at Block 006 (VOCs) and Block 020 (metals). The sampling grid and the results are shown on Figure 9-12.



032
4,4'-DDE 340 ug/kg

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
ug/kg	micrograms per kilogram
4,4-DCE	4,4-Dichlorodiphenyl dichloroethene

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 9-11
VEGETABLE GARDEN
BB-11
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	UNITS ON DIMENSIONS	FRAC.
CHECKED BY	DATE 1/25/93	UNLESS OTHERWISE	DEC.
APPROVED BY DYD	DATE 1-25-93	SPECIFIED	ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER 08079204

TABLE 9-25

Chemical Results for Soil Samples at the Vegetable Garden (BB-11)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-11-006 Sample	*	*	*	14	16	19	*	11	69
BB-11-018 Sample	*	*	*	14	15	19	*	10	65
BB-11-032 Sample	4,4'-DDE=340	*	*	16	15	22	*	11	69
BB-11-057 Sample Field Duplicate	* 4,4'-DDE=360	*	*	13	15	22	*	8.9	64
BB-11-061 Sample USEPA	* *	* *	* *	15 15	23 23	18 11.4	* *	11 12	70 67

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-26

Radionuclide Results for Soil Samples at the Vegetable Garden (BB-11)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-11-006 Sample Interlab Duplicate	0.11 +/- 0.03	< 0.03	< 0.01	0.02 +/- 0.01	< 0.3	< 100 160 +/- 80
BB-11-018 Sample BBI	0.16 +/- 0.03 < 0.3	< 0.07	< 0.05	0.02 +/- 0.01 < 1.0	< 0.3	< 100
BB-11-032 Sample	0.20 +/- 0.04	< 0.07	< 0.02	0.02 +/- 0.01	< 0.3	< 100
BB-11-057 Sample	0.11 +/- 0.03	< 0.06	< 0.02	0.02 +/- 0.01	< 0.2	< 100
BB-11-061 Sample USEPA	< 0.05 0.056 +/- 0.018	< 0.05 0.02 +/- 0.03	< 0.01 < 0.008	< 0.01 < 0.68	< 0.3 < 0.16	< 100 < 200

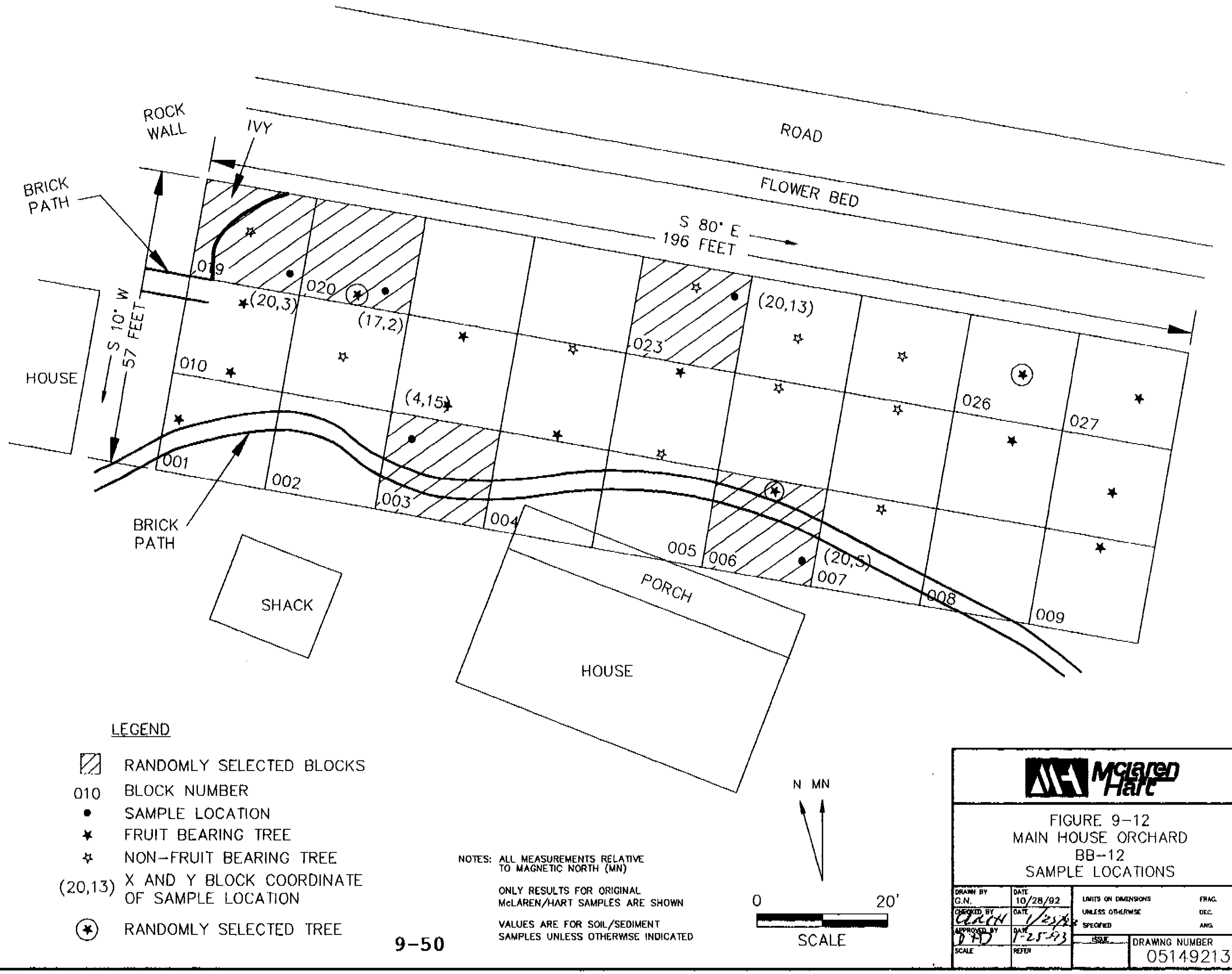
pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.



LEGEND

- ▨ RANDOMLY SELECTED BLOCKS
- 010 BLOCK NUMBER
- ● SAMPLE LOCATION
- ★ FRUIT BEARING TREE
- ☆ NON-FRUIT BEARING TREE
- (20,13) X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
- ⊛ RANDOMLY SELECTED TREE

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 9-12
MAIN HOUSE ORCHARD
BB-12
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC.
CHECKED BY CACH	DATE 1/25/93		DEC.
APPROVED BY DHD	DATE 1-25-93		ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER 05149213

Soil at the Main House Orchard was a dark brown, silty sand, fine grained, poorly to moderately graded, semi-plastic, moist and contained organic fibrous material. No chemicals were detected at the Main House Orchard that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the soil. Chemical and radionuclide analytical results for soil samples are included in Tables 9-27 and 9-28.

Fruit samples were collected from two trees located in the blocks where soil was sampled (Block 020 and Block 006). Blocks 019, 023, and 003 did not have any fruit bearing trees; therefore, per the Workplan, Block 026 was selected for a fruit sample. Two lemon samples (Blocks 026 and 006) and one tangerine sample (Block 020) were collected for radionuclide analyses. A field duplicate sample was collected from Block 026 (lemons). The USEPA collected a split sample at Block 006 (lemons). No radionuclides were detected above background levels in the fruit. Table 9-29A summarizes the radionuclide analytical results for the lemon samples and Table 9-29B summarizes the tangerine sample.

9.13 Avocado Grove (BB-13)

The Avocado Grove is approximately 7,100 feet north of the Rocketdyne property line. The sampling area encompassed the southeastern portion of the avocado grove, that was ten trees long and three trees wide. A wire hutch was located near Block 034. Samples were collected from the soil underneath the trees. A production bee hive was located adjacent to the road leading up to the southeastern part of the grove. The area between the trees was vegetated with grasses and forbs.

On March 17, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 024. Field duplicates were collected from Block 024 (isotopic plutonium), Block 037 (SVOCs), and Block 039 (SVOCs).

TABLE 9-27

Chemical Results for Soil Samples at the Main House Orchard (BB-12)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-12-003									
Sample	*	*	*	12	16	17	*	8.5	72
BB-12-006									
Sample	*	*	*	12	16	53	*	8.6	78
Field Duplicate		*							
BB-12-019									
Sample	*	*	*	15	21	20	*	9.9	74
BB-12-020									
Sample	*	*	*	13	21	18	*	9.7	70
Field Duplicate			*	16	22	18	*	11	76
USEPA	*	*	*	15	18	19	*	11	72.4
BB-12-023									
Sample	*	*	*	13	21	25	*	10	76

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-28

Radionuclide Results for Soil Samples at the Main House Orchard (BB-12)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-12-003						
Sample	< 0.04	< 0.08	< 0.03	0.01 +/- 0.01	< 0.2	< 200
BB-12-006						
Sample	0.091 +/- 0.027	< 0.07	< 0.02	0.03 +/- 0.01	< 0.2	< 100
BB-12-019						
Sample	0.15 +/- 0.03	< 0.1	< 0.09	0.04 +/- 0.01	< 0.2	< 200
BBI				< 1.1		
BB-12-020						
Sample		< 0.1	< 0.04	0.03 +/- 0.01	< 0.2	< 200
Field Duplicate	0.091 +/- 0.030					W
USEPA	0.084 +/- 0.017	0.03 +/- 0.04	< 0.019	< 0.74	< 0.23	< 200
BB-12-023						
Sample	0.12 +/- 0.03	< 0.07	< 0.02	0.02 +/- 0.01	< 0.3	< 200
BBI	< 0.3					
USEPA	0.130 +/- 0.016					

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

W -- Samples results could not be verified by the laboratory and subsequently were withdrawn by the laboratory.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 9-29A

Radionuclide Results for Lemon Samples at the Main House Orchard (BB-12)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BB-12-006						
Sample	< 0.003	< 0.0005	< 0.0002	< 0.003	< 0.03	< 100
USEPA	< 0.013	< 0.00009	< 0.0007	< 0.006	< 0.079	< 190
BB-12-026						
Sample	< 0.003	< 0.0005	< 0.0002	< 0.002	< 0.03	< 100
Field Duplicate	< 0.004	< 0.0003	< 0.0001	0.0032 +/- 0.002	< 0.04	< 100
Lab Duplicate	< 0.007			< 0.003	< 0.04	130 +/- 70

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
Field Duplicate - A duplicate sample is collected and mixed in the field and submitted under an anonymous sample identifier.

TABLE 9-29B

Radionuclide Results for Tangerine Samples at the Main House Orchard (BB-12)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BB-12-020						
Sample	< 0.005	< 0.0003	< 0.00009	< 0.004	< 0.02	< 100

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

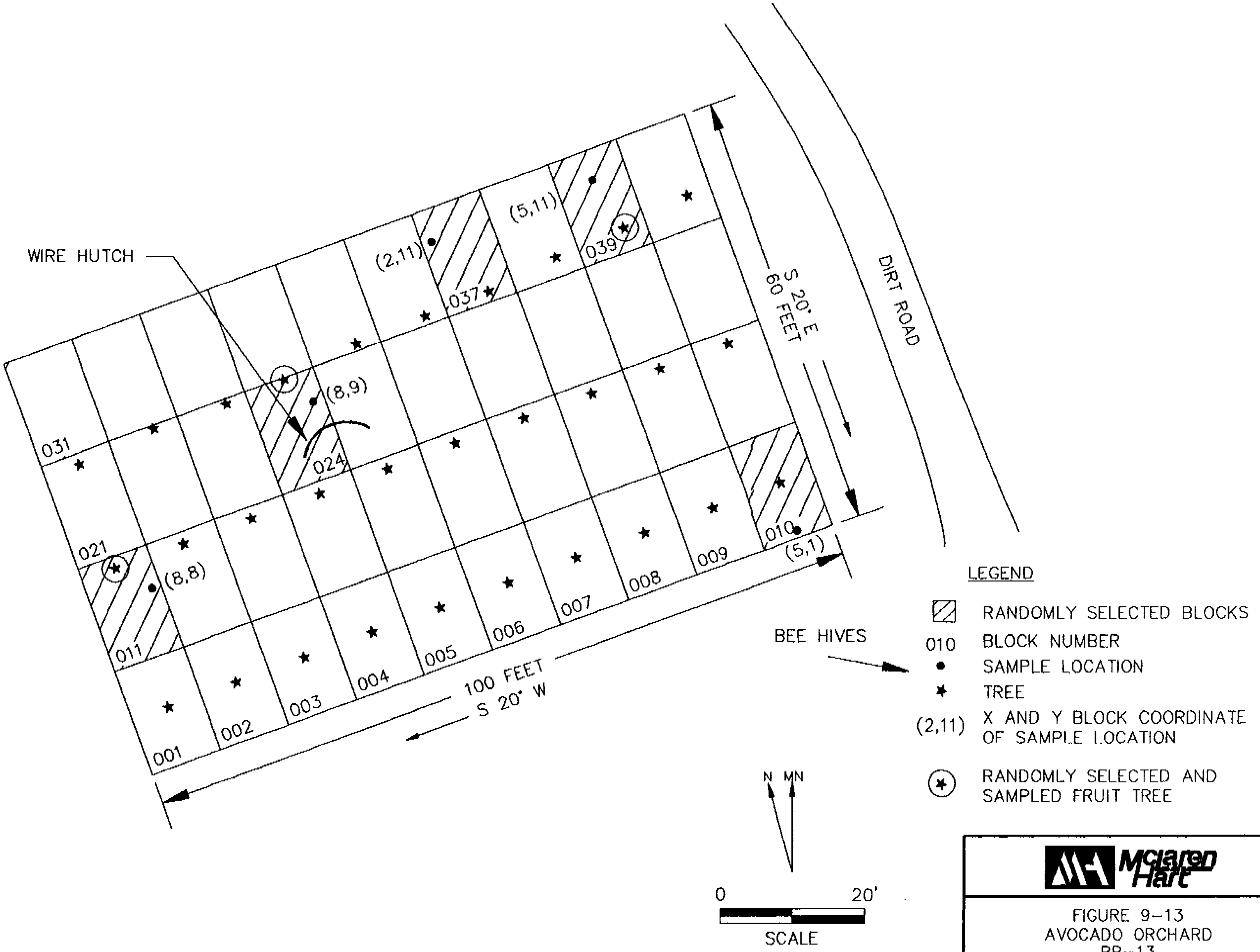
Three rinsate blanks were collected. The USEPA radiation survey of the area ranged from 12 to 13 uR/hr. The sampling grid and the results are shown on Figure 9-13. A summary of the chemical and radionuclide analytical results is presented in Tables 9-30 and 9-31, respectively.

Soil at the Avocado Grove (BB-13) was a brown to dark brown, silty clay, poorly graded, plastic, moist, with some organic fibrous material. No chemicals were detected in soil at the Avocado Grove that exceeded background levels (for heavy metals and radionuclides) or the reporting limit (for volatile and semi-volatile organic compounds).

Three avocado samples were collected from trees located in Blocks 011, 024, and 039 where soil samples were collected in accordance with the Workplan. No radionuclides were detected in the avocado samples. Table 9-32 summarizes the radionuclide analytical results for the fruit samples.

9.14 Old Well Campsite (BB-14)

The Old Well Campsite is approximately 4,200 feet north of the Rocketdyne property line. The sampling area was located adjacent to, but at least 10 feet above, the run-off creek bed. An old pump house was located in the center of the sampling area which was excluded as a groundwater sampling location because it was non-functional and was not going to be used in the near future. Stagnant, standing water surrounded the pump house on the southern, western, and eastern sides, caused sampling Block 044 to be changed to Block 004 in accordance with the Workplan. The southern side of the sampling area was located on a steeply sloping hill. Oak trees and other trees and shrubs surrounded the sampling area; two trees were selected for use as landmarks in addition to the fixed piping. Grasses of various heights were present in areas where the stagnant water was not present.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
★	TREE
(2,11)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
⊛	RANDOMLY SELECTED AND SAMPLED FRUIT TREE

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 9–13
AVOCADO ORCHARD
BB–13
SAMPLE LOCATIONS

DRAWN BY G.N.
DATE 10/28/92
CHECKED BY
DATE 3/1/93
APPROVED BY
DATE 3-09
SCALE
REFER
LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRAC.
DEC.
ANG.
ISSUE
DRAWING NUMBER 05149214

TABLE 9-30

Chemical Results for Soil Samples at the Avocado Grove (BB-13)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-13-010 Sample	*	*	*	22	21	17	*	19	74
BB-13-011 Sample	*	*	*	20	17	15	*	16	63
BB-13-024 Sample USEPA	* *	* *	* *	25 19	20 15	16 10.3	* *	18 15	68 62.8
BB-13-037 Sample Field Duplicate	* *	*	*	20	19	16	*	16	67
BB-13-039 Sample Field Duplicate	* *	*	*	21	19	17	*	16	67

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-31

Radionuclide Results for Soil Samples at the Avocado Grove (BB-13)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-13-010						
Sample	< 0.05	< 0.05	< 0.01	< 0.01	< 0.2	< 200
BB-13-011						
Sample	0.098 +/- 0.039	< 0.05	< 0.02	0.01 +/- 0.01	< 0.2	520 +/- 110
BB-13-024						
Sample	< 0.05	< 0.09	< 0.02	0.01 +/- 0.01	< 0.2	760 +/- 200
Field Duplicate		< 0.05	< 0.01			
Interlab Duplicate						120 +/- 70
USEPA	0.030 +/- 0.011	< 0.03	< 0.021	< 0.65	< 0.29	< 206
BB-13-037						
Sample	0.10 +/- 0.04	< 0.03	< 0.01	0.01 +/- 0.01	< 0.2	400 +/- 130
BB-13-039						
Sample	0.077 +/- 0.018	< 0.1	< 0.04	0.01 +/- 0.01	< 0.2	< 200
Lab Duplicate	0.059 +/- 0.033					< 200
Interlab Duplicate						170 +/- 80

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 9-32

Radionuclide Results for Avocado Samples at the Avocado Grove (BB-13)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
BB-13-011						
Sample	< 0.005	< 0.001	< 0.0005	< 0.002	< 0.03	< 200
BB-13-024						
Sample	< 0.004	< 0.0004	< 0.0002	< 0.002	< 0.03	< 200
BB-13-039						
Sample	< 0.005	< 0.0005	< 0.0002	< 0.002	< 0.03	< 200

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

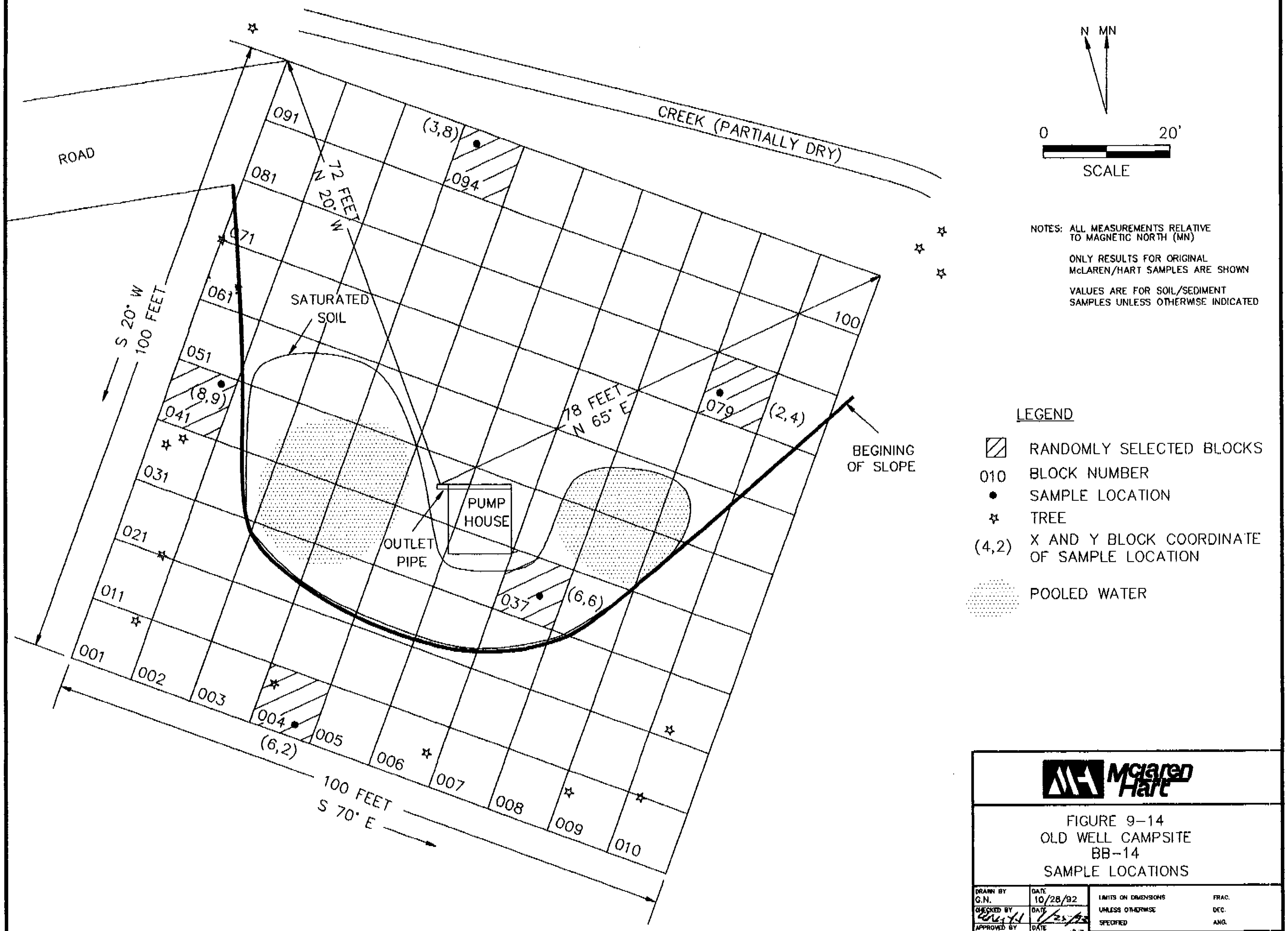
On March 16, 1992, five soil samples were collected from the grid according to the approved Workplan. The USEPA collected a split sample at Block 079. Field duplicate samples were collected at Block 004 (strontium-90 and iodine-129), Block 041 (metals), and Block 079 (VOCs). Five rinsate blanks were collected. The USEPA radiation survey of the area ranged from 14 to 15 uR/hr. The sampling grid and the results are shown on Figure 9-14.

Soil at the Old Well Campsite was characterized in two places. In the area of the stagnant water, the soil was a brown to dark brown, silty sand, fine grained, poorly graded, moist to wet. Upon the hillside the soil was a dark, yellowish brown sand, fine to medium grained, poorly graded, non-plastic and moist. Chemicals were not detected in the soil at the Old Well Campsite that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). Chemical and radionuclide data for soil samples is summarized in Table 9-33 and 9-34, respectively.

9.15 RD-51 Watershed (BB-15)

The RD-51 Watershed is approximately 4,800 to 5,600 feet northeast of Building 59. This area represents the watershed just west of Well 13 (WS-13). The sampled area was a narrow creek bed that connected to the main ravine which appeared to be connected to the stream bed near Campsite 2.

The drainage area was vegetated with tall grasses and some woody scrub. The drainage channel was followed from the top of the hill (near the east end of the parking lot where the cluster wells RD-51 A, B, and C are located) to the edge of the cliff where the water falls off into the main ravine that originates to the west of Well 13. An attempt was made to locate the property line from tanks on the Rocketdyne facility and the fence these were not always visible and the location of the sample points relative to the fence line is only an approximation. line, but



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	TREE
(4,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
░	POOLED WATER

McLaren Hart

FIGURE 9–14
OLD WELL CAMPSITE
BB–14
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY [illegible]	DATE 1/25/93		
APPROVED BY DxD	DATE 1-25-93	ISSUE	DRAWING NUMBER 08069202
SCALE	REFER		

TABLE 9-33

Chemical Results for Soil Samples at the Old Well Campsite (BB-14)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-14-004									
Sample	*	*	*	11	8.9	11	*	6.2	41
BB-14-037									
Sample	*	*	*	15	11	9	*	7.9	42
BB-14-041									
Sample	*	*	*	8.7	6	10	*	5.2	37
Field Duplicate			*	15	14	9	*	8.3	44
BB-14-079									
Sample	*	*	*	14	9.2	7.4	*	8.5	40
Field Duplicate		*							
USEPA	*	*	*	13	22	5.5	*	9	45
BB-14-094									
Sample	*	*	*	12	9.4	9.4	*	6.8	43

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-34

Radionuclide Results for Soil Samples at the Old Well Campsite (BB-14)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-14-004						
Sample	0.20 +/- 0.04	< 0.07	< 0.02	0.05 +/- 0.01	< 0.3	< 200
Field Duplicate				0.06 +/- 0.01	< 0.2	
BB-14-037						
Sample	0.17 +/- 0.04	< 0.01	< 0.009	0.02 +/- 0.01	< 0.2	D
BB-14-041						
Sample	0.27 +/- 0.05	< 0.06	< 0.008	0.06 +/- 0.01	< 0.2	D
BB-14-079						
Sample	< 0.04	0.12 +/- 0.03	< 0.006	0.03 +/- 0.01	< 0.3	140 +/- 80
Lab Duplicate		< 0.08				
Duplicate Count		0.10 +/- 0.03				
USEPA	0.015 +/- 0.008	< 0.02	< 0.011	< 0.71	< 0.28	< 200
BB-14-094						
Sample	< 0.04	< 0.05	< 0.01	0.02 +/- 0.01	< 0.2	W

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.
W -- Samples results could not be verified by the laboratory and subsequently were withdrawn by the laboratory.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Duplicate Count -- A recount of the original aliquot of the sample.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

On April 22, 1992, five sediment samples were collected from the creek bed according to the approved Workplan. The USEPA collected a split sediment sample at Block 005. The DHS took a split sediment sample at Block 001 and the Brandeis-Bardin consultant took a split sediment sample at Block 004. Field duplicate samples were collected at Block 002 (gamma scan, tritium, and SVOCs) and 001 (strontium-90 and iodine-129). Three rinsate samples were also collected. The sample locations and the results are shown on Figure 9-15.

Soil from the RD-51 Watershed was a yellowish brown to dark brown, sand, fine, poorly graded, moist to wet. Plutonium-238 was detected at 0.22 ±0.07 pCi/g(dry) in Block 001. (See Section 11.0 for further discussion.) No other chemicals or radionuclides were detected that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the sediment. Chemical and radionuclide analytical results for the sediment samples are summarized in Tables 9-35 and 9-36, respectively.

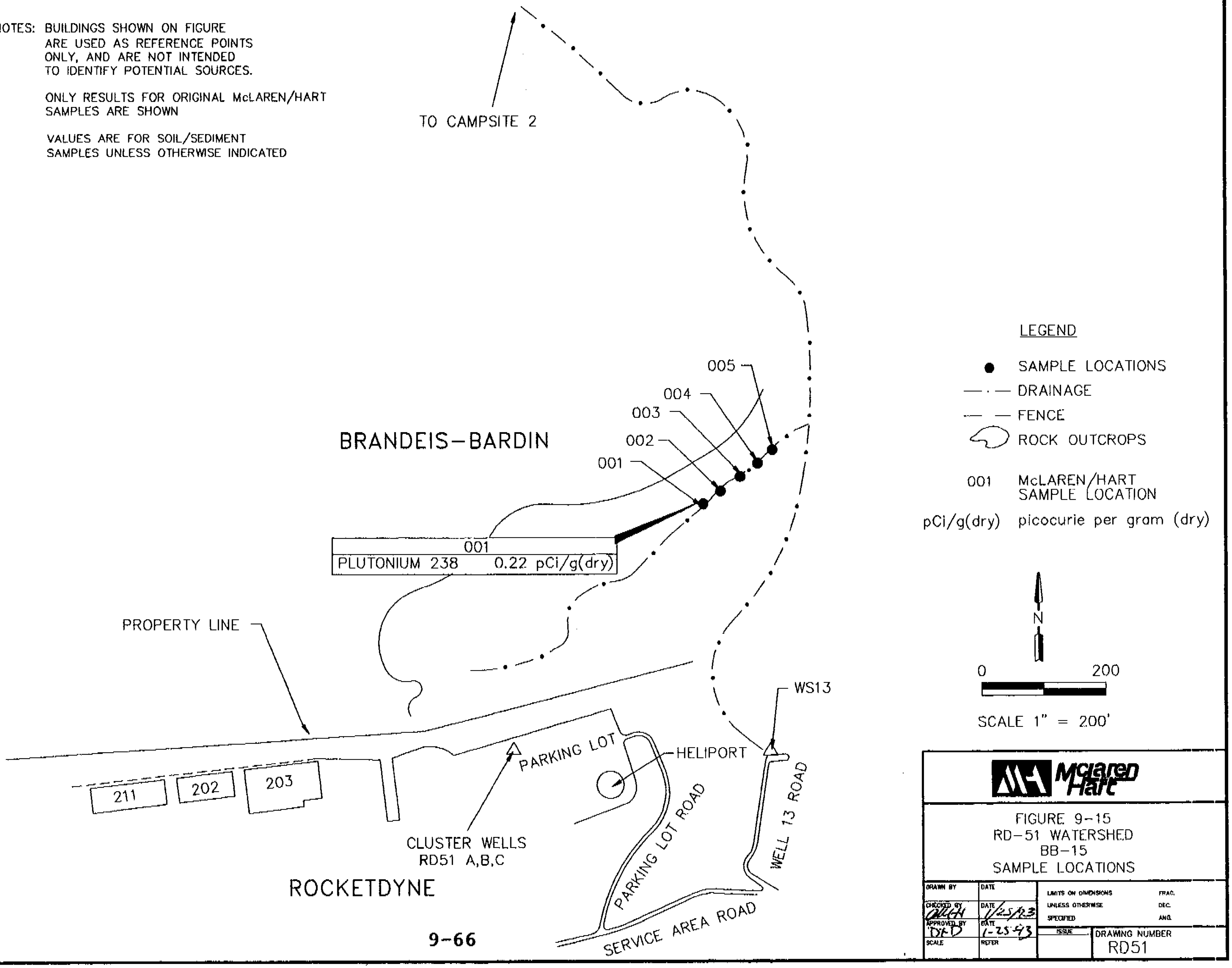
9.16 Radioactive Materials Disposal Facility Watershed (BB-16)

The Radioactive Materials Disposal Facility (RMDF), consists of Buildings 078, 621, 021, 022, 044, and 034. The watershed was sampled approximately 200 feet north of the north-west corner of the RMDF, immediately below the Rocketdyne property line. The sediment samples were collected in the creek bed directly downstream from the RD-30 well, located on Rocketdyne property, and the cluster wells RD-34, A, B, and C (hereafter RD-34 located on Brandeis-Bardin). The RMDF is on the top of a hill overlooking the ravine.

NOTES: BUILDINGS SHOWN ON FIGURE ARE USED AS REFERENCE POINTS ONLY, AND ARE NOT INTENDED TO IDENTIFY POTENTIAL SOURCES.

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED



McLaren Hart

FIGURE 9-15
RD-51 WATERSHED
BB-15
SAMPLE LOCATIONS

DRAWN BY | DATE
CHECKED BY | DATE 1/25/93
APPROVED BY DAD | DATE 1-25-93
SCALE | REFER

LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED FRAC. DEC. ANG.

ISSUE

DRAWING NUMBER RD51

TABLE 9-35

Chemical Results for Sediment Samples at the RD-51 Watershed (BB-15)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-15-001 Sample	*	*	*	7.6	5.2	7.6	*	4.2	45
BB-15-002 Sample Field Duplicate	* *	*	*	8.8	5.3	8.6	*	5	49
BB-15-003 Sample	*	*	*	7.4	5.3	9.8	*	4.5	51
BB-15-004 Sample	*	*	*	12	6.2	21	*	5.5	54
BB-15-005 Sample USEPA	* *	* Acetone=19 Methylene Chloride=17	* *	9.8 17	5.9 5	12 9.3	* *	6 6	51 68.9

ug/kg -- micrograms per kilogram of sediment
mg/kg -- milligrams per kilogram of sediment
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-36

Radionuclide Results for Sediment Samples at the RD-51 Watershed (BB-15)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-15-001						
Sample	0.045 +/- 0.026	0.22 +/- 0.07	< 0.01	0.01 +/- 0.01	< 0.3	W
Field Duplicate				0.02 +/- 0.02	< 0.3	
DHS	0.04 +/- 0.01					316 +/- 152
BB-15-002						
Sample	0.044 +/- 0.022	0.067 +/- 0.025	< 0.005	< 0.01	< 0.3	< 200
Field Duplicate	< 0.04					< 100
BB-15-003						
Sample	0.039 +/- 0.020	< 0.05	< 0.01	0.01 +/- 0.01	< 0.3	< 200
Interlab Duplicate						
BB-15-004						
Sample	0.043 +/- 0.025	< 0.05	< 0.01	< 0.01	< 0.2	W
BBI	< 0.3			< 0.6		
BB-15-005						
Sample	0.052 +/- 0.025	0.055 +/- 0.042	< 0.01	< 0.01	< 0.2	D
USEPA	0.041 +/- 0.013	< 0.02	< 0.011	< 0.73	< 0.17	< 171

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.
W -- Samples results could not be verified by the laboratory and subsequently were withdrawn by the laboratory.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

The drainage area between RD-30 and RD-34 was not vegetated and appeared to have been disturbed, possibly as a result of bringing heavy equipment to construct RD-34. Downstream from RD-34 was heavily vegetated with woody scrub, trees, and intermittent areas of poison ivy and poison oak. A path was made along the more level southern side of the creek bed with sample points at turns in the stream where sediments had accumulated. The property line at this location was clearly marked with surveyor stakes.

On April 22, 1992, six sediment samples were collected from the creek bed downstream of RD-34 according to the approved Workplan. Sediment and surface water samples were collected at Block 001A in a small channel that entered the main stream channel about 70 feet west of RD-34. The USEPA collected a split sediment and surface water sample at Block 001B. The DHS collected a split sediment sample at Block 004 and the Brandeis-Bardin consultant collected a sample from Block 005. Field duplicate samples were collected at Block 003 (VOCs) and at Block 002 (strontium-90 and iodine-129). One rinsate sample was collected (metals). The USEPA radiation survey of the area ranged from 15 to 16 uR/hr. The sample locations and the results are shown on Figure 9-16.

Sediment from the RMDF Watershed was a yellowish brown sand, fine to very coarse grained with some gravel, well graded, loose, and wet. Tritium was detected in the six sediment samples at concentrations ranging from <200 to 1,500 ±200 picocuries per liter of water (pCi/L). The DHS split sediment samples at Block 004 detected tritium at 1,902 ±200 pCi/L; a concentration of 1,300 ±200 pCi/L was detected in the McLaren/Hart sample at the same sampling location. Strontium-90 was detected in the RMDF Watershed in three of the six sediment samples at 0.08 ±0.019, 0.09 ±0.01 and 0.15 ±0.02 pCi/g(dry) at Blocks 001A, 002, and 004, respectively. The USEPA and the consultant for Brandeis-Bardin were not able to detect strontium-90 at these levels. Cesium-137 was detected at Block 004 in the sediment at 0.34 ±0.04 pCi/g(dry); the DHS split sediment sample detected cesium-137 at 0.60 ±0.04 pCi/g(dry). Zinc was detected at Block 004 in the

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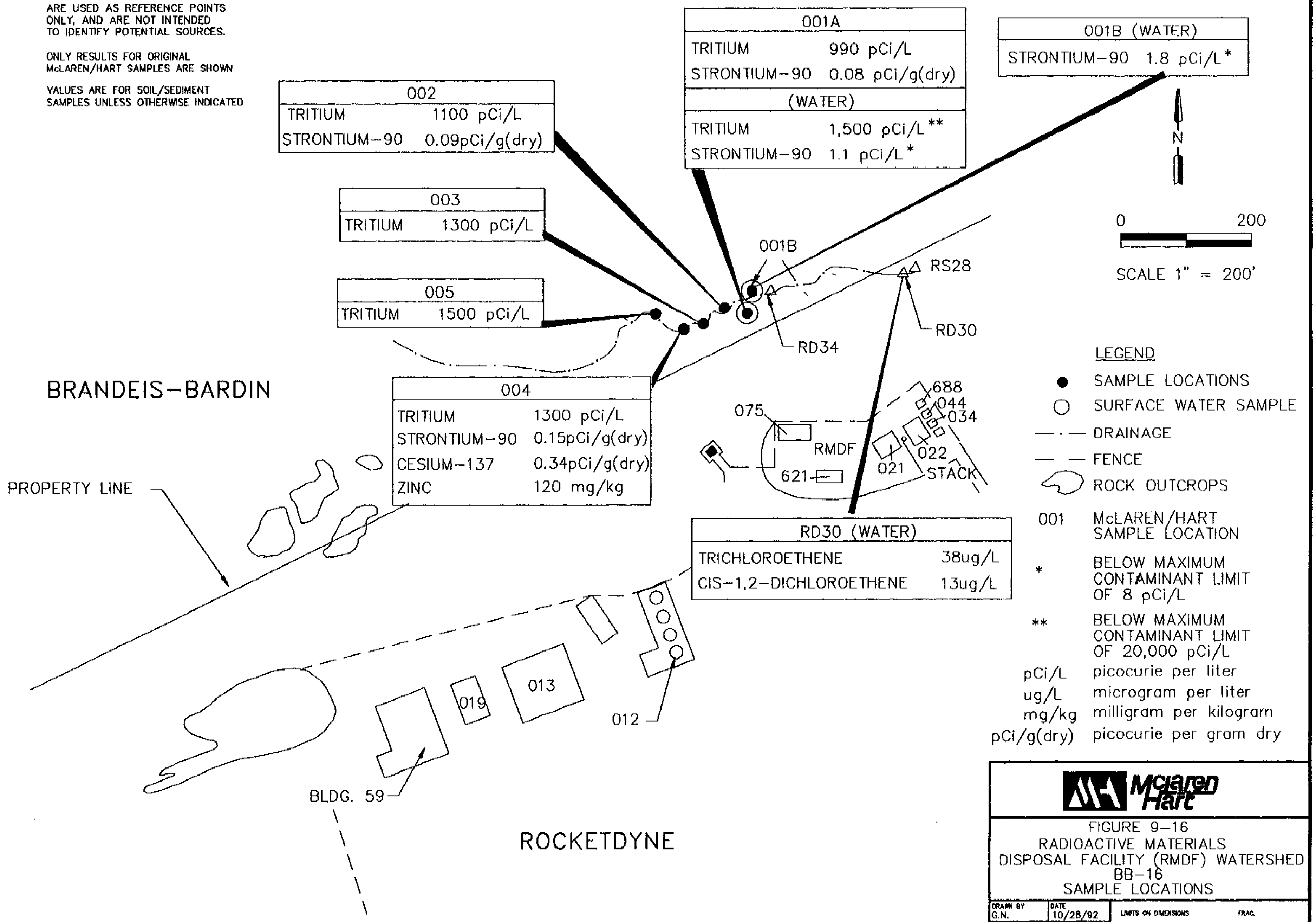

McLaren Hart

FIGURE 9-16
RADIOACTIVE MATERIALS
DISPOSAL FACILITY (RMDF) WATERSHED
BB-16
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS		FRAC.
CHECKED BY	DATE 3/10/93	UNLESS OTHERWISE		DEC.
APPROVED BY	DATE 3-10-93	SPECIFIED		ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER WTRSHED	

sediment at 120 mg/kg. Methylene chloride (7 ug/kg) was detected in one USEPA sediment sample. (See Section 11.0 for further discussion.) No other chemicals or radionuclides were detected in the RMDF Watershed sediment samples that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). Chemical and radionuclide sediment sample results are presented in Tables 9-37 and 9-38, respectively.

Surface water samples were collected from a pool of running water adjacent to Blocks 001A and 001B. The USEPA detected fluoroanthene (0.33 ug/L) in the surface water at Block 001B. Strontium-90 was detected at 1.8 ± 0.5 pCi/L at Block 001A and at 1.1 ± 0.3 pCi/L at Block 001B. Tritium was detected at 1,500 ±100 pCi/L at sample location 001A, which is well below the California drinking water standard of 20,000 pCi/L. Gross beta activity was detected in the surface water at 001A (20 ± 4 pCi/L) and at in 001B (25 ±4 pCi/L) and in the groundwater at RD-30 (10.9 ±1.6 pCi/L). These levels are below the California drinking water standard of 50 pCi/L for gross beta. A water sample was collected from water flowing out of the top of the RD-30 well on the SSFL property which had become artesian due to the heavy rainfall and analyzed for volatile organic compounds and radionuclides. Trichloroethene and cis-1,2-dichloroethene were detected in the well water at 38 and 13 ug/L, respectively. (See Section 11.0 for further discussion.) No other chemicals were detected above the detection limits (radionuclides) or the reporting limits (volatile and semi-volatile organic compounds and metals) in the water samples taken at the RMDF Watershed. Chemical and radionuclide results for the water samples are presented in Tables 9-39 and 9-40.

TABLE 9-37

Chemical Results for Sediment Samples at Radioactive Materials Disposal Facility Watershed (BB-16)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-16-001A Sample	*	*	*	14	7.5	8	*	8.1	44
BB-16-001B Sample USEPA	* *	* Methylene Chloride=7	* *	5.8 5.0	3 6.0	3.3 2.0	* *	2.8 3.0	19 21.1
BB-16-002 Sample	*	*	*	10	6.3	5	*	6.5	36
BB-16-003 Sample Field Duplicate	*	* *	*	4.9	2.7	*	*	2.9	18
BB-16-004 Sample	*	*	*	9.9	6.5	14	*	5.7	120
BB-16-005 Sample	*	*	*	5	2.5	2.6	*	2.8	18

ug/kg -- micrograms per kilogram of sediment
mg/kg -- milligrams per kilogram of sediment
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-38

Radionuclide Results for Sediment Samples at Radioactive Materials Disposal Facility Watershed (BB-16)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-16-001A						
Sample	0.070 +/- 0.028	< 0.04	< 0.008	0.08 +/- 0.01	< 0.3	990 +/- 150
Interlab Duplicate						955 +/- 100
BB-16-001B						
Sample	< 0.04	< 0.03	< 0.01	0.03 +/- 0.01	< 0.3	< 200
Interlab Duplicate						220 +/- 120
USEPA	< 0.017	< 0.02	< 0.019	< 0.63	< 0.17	< 190
BB-16-002						
Sample	< 0.04	0.066 +/- 0.061	< 0.02	0.09 +/- 0.01	< 0.3	1100 +/- 100
Field Duplicate				0.12 +/- 0.02	< 0.2	
Lab Duplicate		< 0.04				
Interlab Duplicate						710 +/- 120
BB-16-003						
Sample	< 0.03	< 0.02	< 0.009	0.02 +/- 0.01	< 0.3	1300 +/- 300
Interlab Duplicate						1500 +/- 200
USEPA	0.0078 +/- 0.008					
BB-16-004						
Sample	0.34 +/- 0.04	< 0.07	< 0.03	0.15 +/- 0.02	< 0.3	1300 +/- 200
Interlab Duplicate						1600 +/- 200
DHS	0.60 +/- 0.03					1900 +/- 190
BB-16-005						
Sample	< 0.04	< 0.02	< 0.005	0.04 +/- 0.01	< 0.3	1500 +/- 200
Interlab Duplicate						1700 +/- 200
BBI	< 0.3			< 0.6		

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 9-39

Chemical Results for Surface Water Samples at Radioactive Materials Disposal Facility Watershed (BB-16)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-16-001B									
Sample	*	*	*	*	*	*	*	*	*
USEPA	Flouranthene=0.33	*	*	*	*	*	*	*	*
BB-16-RD30									
Sample		cis-1,2-Dichloroethene=13 Trichloroethene=38							

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Chemical analyses were not condcuted at BB-16-001A.
The RD30 sample was collected from a crack in the well casing. The well was under artesian conditions, and water was trickling through the crack.

TABLE 9-40

Radionuclide Results for Surface Water Samples at Radioactive Materials Disposal Facility Watershed (BB-16)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-16-001A								
Sample	< 3	< 0.8	< 0.6	1.1 +/- 0.3		1500 +/- 100	< 5	20 +/- 4
Lab Duplicate								
BB-16-001B								
Sample	< 2	< 0.2	< 0.06	1.8 +/- 0.5	< 1.8	< 100	< 5	25 +/- 4
Duplicate Count						130 +/- 70		
USEPA	< 4.7	< 0.039	< 0.026	7.8 +/- 0.50	< 2.5	< 191	2.5 +/- 1.6	18.5 +/- 2.1
BB-16-RD30								
Sample	< 4	< 0.3	< 0.3	< 0.3		< 100	< 4	9.4 +/- 3.2
USEPA	< 4.80	< 0.047	< 0.039	< 0.53		< 191	2.3 +/- 1.5	10.9 +/- 1.6

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
The RD30 sample was collected from a crack in the well casing. The well was under artesian conditions, and water was trickling through the crack.

9.17 Building 59 Watershed (BB-17)

The initial sample location (Block 001) was approximately 200 feet north of Building 59, the remaining sample locations (Blocks 002, 003, and 004) were northeast of Building 59, immediately below the Rocketdyne property line. There were two arms of drainage in this area. Block 001 was located closest to Building 59, within 20 feet of a sample collected during a previous study (Cehn, 1991) by the Brandeis-Bardin consultant. Additional samples were not collected here because of heavy growth of poison oak in the drainage. A second arm originated northeast of Building 59 and more approximate to Building 012. Block 003 and 004 were located beyond the confluence of the two drainages just below where emergent water appeared. The area downstream of Block 004 could not be sampled due to thick vegetation (mostly poison oak) and a steep drop.

On April 21, 1992, four sediment samples were collected according to the Workplan. A fifth sample was not collected because of the thick vegetation, the steep drop, and a lack of sighting any further areas of sediment deposition. The USEPA collected split samples at Block 001 and analyzed laboratory splits for the other three blocks. The DHS collected a split sediment sample at Block 003 and the Brandeis-Bardin consultant collected a split sediment sample at Block 004. The USEPA radiation survey ranged from 14 to 17 uR/hr. A field duplicate sample was collected (isotopic plutonium) at Block 004. The sample locations and the results are shown on Figure 9-17.

Sediment at the Building 59 Watershed was a dark brown sand, fine to medium grained, poorly to moderately graded, containing much organic matter with root fibers, and moist to wet. Tritium was detected in the sediment at Block 003 at 10,800 ±300 pCi/L and at Block 004 at 9,810 ±330 pCi/L. The USEPA interlaboratory split and the DHS split at Block 003 contained 10,700 ±300 and 12,380 ±371 pCi/L, respectively. A USEPA interlaboratory split at Block 004 contained 9,855 ±325 pCi/L of tritium. The split sediment sample taken

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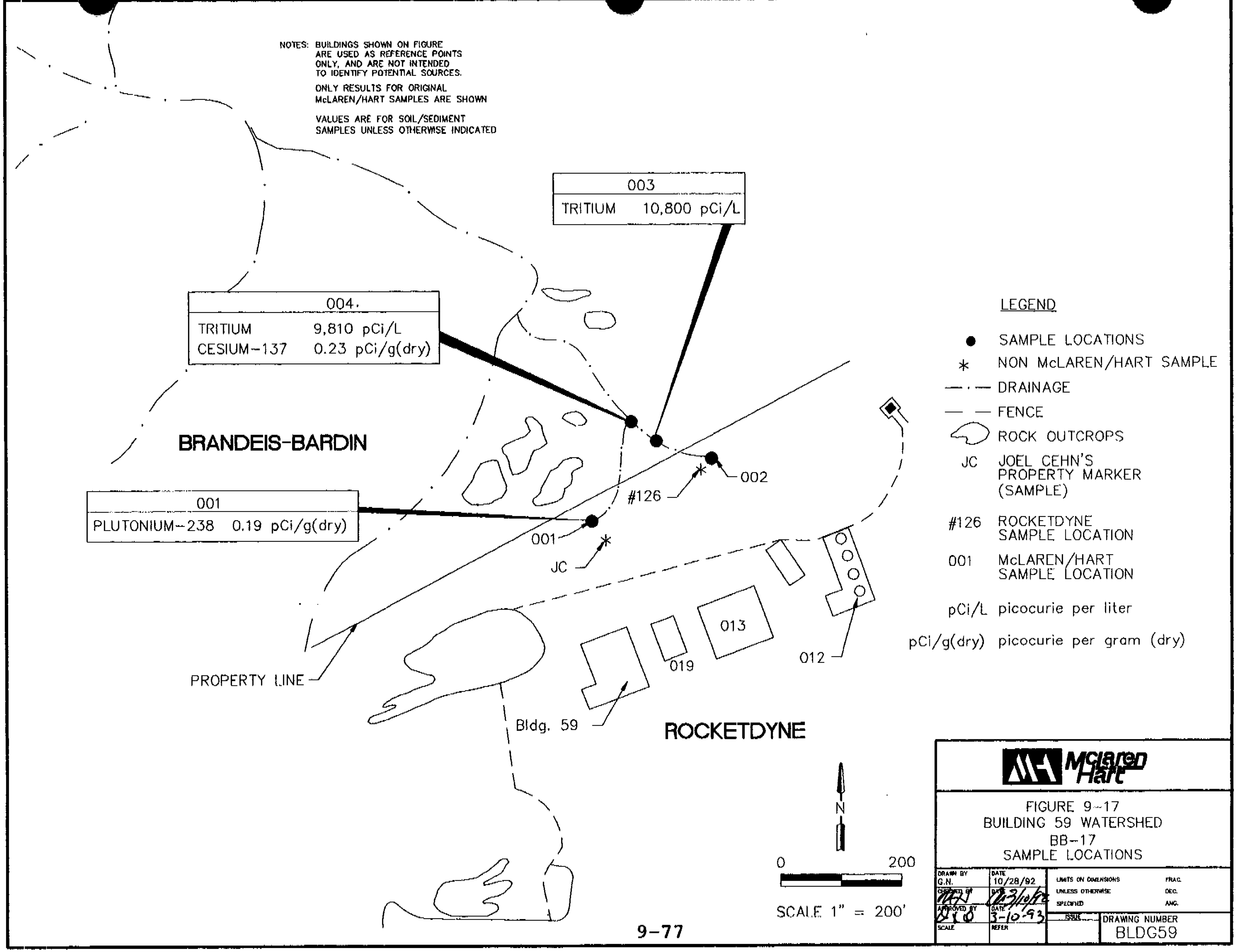
ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED



LEGEND

●	SAMPLE LOCATIONS
*	NON McLAREN/HART SAMPLE
—·—	DRAINAGE
— —	FENCE
	ROCK OUTCROPS
JC	JOEL CEHN'S PROPERTY MARKER (SAMPLE)
#126	ROCKETDYNE SAMPLE LOCATION
001	McLAREN/HART SAMPLE LOCATION
pCi/L	picocurie per liter
pCi/g(dry)	picocurie per gram (dry)

McLaren Hart

FIGURE 9-17
BUILDING 59 WATERSHED
BB-17
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY MH	DATE 3/10/93		
APPROVED BY DJO	DATE 3-10-93	ISSUE	DRAWING NUMBER BLDG59
SCALE	REFER		

by the consultant for Brandeis-Bardin at Block 004 had tritium detected at 12,720 ±4,300 pCi/L. Cesium-137 was detected at Block 004 at 0.23 ±0.03 pCi/g(dry). Plutonium-238 was detected at 0.19 ±0.06 pCi/g(dry) at Block 001. (See Section 11.0 for further discussion.) No other chemicals or radionuclides were detected in the Building 59 Watershed that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the sediment. Chemical and radionuclide results are summarized in Tables 9-41 and 9-42, respectively.

9.18 Sodium Burn Pit Watershed (BB-18)

The former Sodium Burn Pit Watershed was sampled approximately 200 to 400 feet north/northeast of the former Sodium Burn Facility. The sampled area was directly down stream of two run-off channels from the Facility. The natural drainage slopes away from the Sodium Burn Facility toward the north (toward the Brandeis-Bardin Institute); any runoff would collect into one of two channels. The first runs from the center of the former Sodium Burn Pit Facility and crosses the property line approximately 400 feet toward the north/northeast. The initial sampling location (Block 001B) in this channel was approximately 150 feet beyond the Rocketdyne property line. The second channel collects runoff from the western area of the former Sodium Burn Facility and crosses the property line approximately 650 feet towards the northeast. The initial sampling location (Block 001A) in this channel was approximately 25 feet beyond the Rocketdyne property line. At the location where these two channels converged and became confluent on the Brandeis-Bardin property, the initial sediment sample was collected at Block 001. These drainage channels are hydrologically connected to Campsite Area 1.

Leg B of the drainage area (Blocks 001B, 002B, and 003B) was a very narrow channel with relatively steep rock outcrops on either side. Leg A (Blocks 001A, 002A, and 003A) was less narrow but heavily vegetated with woody scrub, trees, and poison oak. The area around

TABLE 9-41

Chemical Results for Sediment Samples at the Building 59 Watershed (BB-17)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-17-001									
Sample	*	*	*	12	6.7	9.7	*	6.6	42
USEPA	*	*	*	13	13	4.5	*	9	54.4
BB-17-002									
Sample	*	*	*	16	8.6	11	*	8.4	46
BB-17-003									
Sample	*	*	*	12	8.3	14	*	8.6	40
BB-17-004									
Sample	*	*	*	14	8.3	14	*	8.3	43

ug/kg -- micrograms per kilogram of sediment
mg/kg -- milligrams per kilogram of sediment
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-42

Radionuclide Results for Sediment Samples at the Building 59 Watershed (BB-17)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-17-001						
Sample	0.077 +/- 0.032	0.19 +/- 0.06	< 0.02	0.01 +/- 0.01	< 0.3	130 +/- 80
Lab Duplicate		< 0.009				
Duplicate Count		0.15 +/- 0.05				
USEPA	0.086 +/- 0.016	0.027 +/- 0.030	< 0.008	< 0.66	< 0.17	< 190
BB-17-002						
Sample	0.16 +/- 0.04	0.055 +/- 0.024	< 0.005	0.02 +/- 0.01	< 0.2	< 100
Interlab Duplicate						< 100
USEPA						< 200
BB-17-003						
Sample	0.13 +/- 0.03	0.055 +/- 0.031	< 0.007	0.01 +/- 0.01	< 0.2	10800 +/- 300
Duplicate Count						11000 +/- 1000
DHS	< 8.0					10700 +/- 300
USEPA						12380 +/- 371
BB-17-004						
Sample	0.23 +/- 0.03	< 0.04	< 0.007	0.03 +/- 0.01	< 0.2	9810 +/- 330
Field Duplicate		0.33 +/- 0.08	< 0.01			
Lab Duplicate		< 0.06		0.02 +/- 0.01	< 0.2	
Duplicate Count		0.27 +/- 0.07				
BBI	< 0.3					12720 +/- 4300
USEPA						9855 +/- 325

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.
Duplicate Count -- A recount of the original aliquot of the sample.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

Block 001 was the most level and open, and below this point, the ravine narrowed again (Blocks 002 and 003).

On April 21, 1992, nine sediment samples were collected from the watershed according to the approved Workplan. The USEPA collected a split sediment sample at Block 001. The DHS collected a split sediment sample at Block 001A and the Brandeis-Bardin consultant collected split sediment samples at Block 001B. A field duplicate sample was collected at Block 003 (VOCs). The USEPA radiation survey of the area ranged from 14 to 15 uR/hr. The sample locations and the results are shown on Figure 9-18.

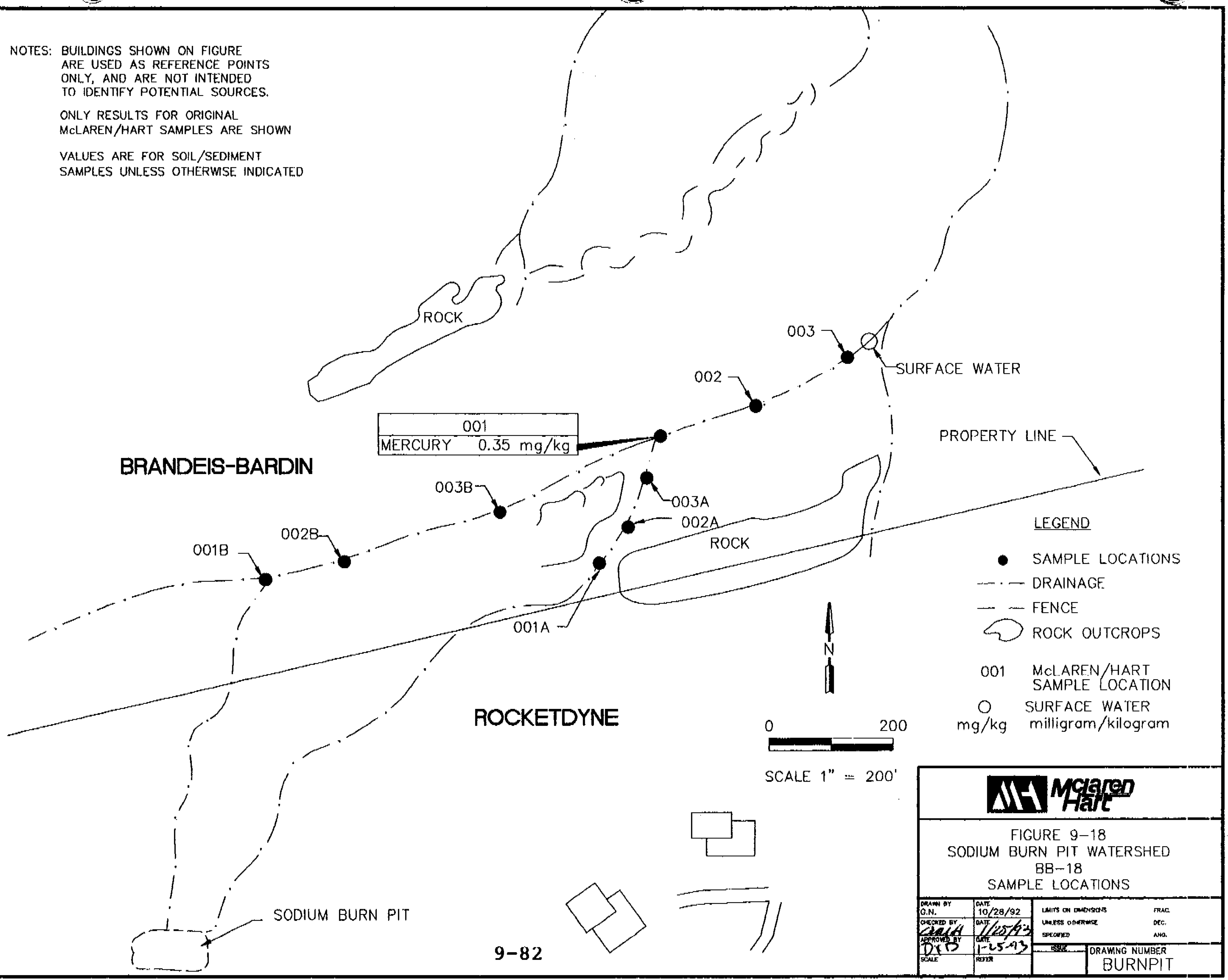
Sediment from the Sodium Burn Pit Watershed was a dark yellowish brown sand, fine to medium grained, loose/poorly graded, and moist to wet. Samples were collected in a ravine adjacent to or beneath standing water at six of the nine locations. Mercury was detected at 0.35 mg/kg at Block 001, which was confirmed by the USEPA split result of 0.40 mg/kg. (See Section 9.0 for further discussion.) No other chemicals were detected in the sediment at the Sodium Burn Pit Watershed that exceeded background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). Chemical and radionuclide results are summarized in Tables 9-43 and 9-44, respectively.

A surface water sample was collected from a pool of running water beyond Block 003. The water flowed along the rock and collected in a pool where the surface water samples were collected. Field duplicate surface water samples were collected for the full suite of analyses. The DHS collected split surface water samples at this location for tritium, a gamma scan, and gross alpha/gross beta analyses only. (See Section 9.0 for further discussion.) No chemicals or radionuclides were detected in the surface water samples from the Sodium Burn Pit Watershed above the reporting limits (chemicals and metals) or the detection limits (radionuclides). Analytical results for chemicals and radionuclides in the surface water samples are summarized in Tables 9-45 and 9-46.

NOTES: BUILDINGS SHOWN ON FIGURE ARE USED AS REFERENCE POINTS ONLY, AND ARE NOT INTENDED TO IDENTIFY POTENTIAL SOURCES.

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED



McLaren Hart

FIGURE 9-18
SODIUM BURN PIT WATERSHED
BB-18
SAMPLE LOCATIONS

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY	DATE 1/25/93		
APPROVED BY DKD	DATE 1-25-93	ISSUE	DRAWING NUMBER BURNPIT
SCALE	REFER		

TABLE 9-43

Chemical Results for Sediment Samples at the Sodium Burn Pit Watershed (BB-18)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-18-001 Sample USEPA	* *	* *	* *	9.3 7	6.1 4	26 6.5	0.35 0.40	6.2 5	32 22.4
BB-18-001A Sample	*	*	*	6.5	3.9	9.8	*	4.1	25
BB-18-001B Sample	*	*	*	6.5	4.1	5.3	*	4.2	36
BB-18-002 Sample	*	*	*	5.9	3.8	4.1	*	2.9	22
BB-18-002A Sample	*	*	*	11	6.9	10	*	7.3	41
BB-18-002B Sample	*	*	*	10	5.7	6	*	5.6	36
BB-18-003 Sample Field Duplicate	*	* *	*	4.8	2.9	4	*	2.7	19
BB-18-003A Sample	*	*	*	8.1	4.6	7.8	*	4.3	34
BB-18-003B Sample	*	*	*	4.9	3.4	5	*	2.9	19

ug/kg -- micrograms per kilogram of sediment
mg/kg -- milligrams per kilogram of sediment
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-44

Radionuclide Results for Sediment Samples at the Sodium Burn Pit Watershed (BB-18)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-18-001						
Sample	0.085 +/- 0.039	0.017 +/- 0.013	< 0.004	0.02 +/- 0.01	< 0.3	< 100
BBI	< 0.3			< 0.6		
USEPA	0.088 +/- 0.018	< 0.02	< 0.015	< 0.62	< 0.17	< 200
BB-18-001A						
Sample	0.11 +/- 0.03	0.043 +/- 0.04	< 0.02	0.02 +/- 0.01	< 0.3	120 +/- 80
DHS	0.07 +/- 0.02					< 260
BB-18-001B						
Sample	< 0.03	< 0.02	< 0.01	0.01 +/- 0.01	< 0.3	260 +/- 80
BBI				< 0.6		
BB-18-002						
Sample	0.057 +/- 0.023	< 0.02	< 0.01	< 0.01	< 0.3	< 100
BB-18-002A						
Sample	0.063 +/- 0.027	< 0.03	< 0.01	0.02 +/- 0.01	< 0.3	< 100
BB-18-002B						
Sample	< 0.05	< 0.02	< 0.007	0.02 +/- 0.01	< 0.3	440 +/- 80
BB-18-003						
Sample	< 0.03	< 0.1	< 0.03	0.01 +/- 0.01	< 0.2	< 100
BB-18-003A						
Sample	< 4	< 0.02	< 0.007	< 0.01	< 0.2	D
BB-18-003B						
Sample	0.060 +/- 0.028	< 0.02	< 0.009	< 0.01	< 0.3	200 +/- 70

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 9-45

Chemical Results for Surface Water Samples at the Sodium Burn Pit Watershed (BB-18)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-18-003									
Sample	*	*	*	*	*	*	*	*	*
Field Duplicate	*	Methylene Chloride=16	*	*	*	*	*	*	*

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Methylene chloride was also detected in the associated trip blank and is considered a laboratory contaminant.

TABLE 9-46

Radionuclide Results for Surface Water Samples at the Sodium Burn Pit Watershed (BB-18)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-18-003								
Sample	< 4	< 0.2	< 0.08	< 0.3	< 1.6	D	< 2	< 3
Field Duplicate	< 4	< 0.2	< 0.09	1.0 +/- 0.4	< 1.7	< 100		
DHS	< 8.0					< 260	< 0.40	< 2.50

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

9.19 Sodium Reactor Experiment Watershed (BB-19)

Building 143, the Sodium Reactor Experiment (SRE) Watershed was sampled immediately below the Rocketdyne property line. The sampled area was directly downstream from the SRE in the run-off creek bed. The SRE is surrounded on three sides by rock outcrops and any surface runoff from the area drained to the northeast.

The drainage area was heavily vegetated with woody scrub and large areas of poison oak. A path was made along the less vegetated western side of the ravine until the property line was reached. A path was cut along the creek bed between the property line and the cliff dropping off toward Brandeis-Bardin Institute. The sample locations relative to the property line were only an approximation, since the actual property line was not easy to ascertain from this area.

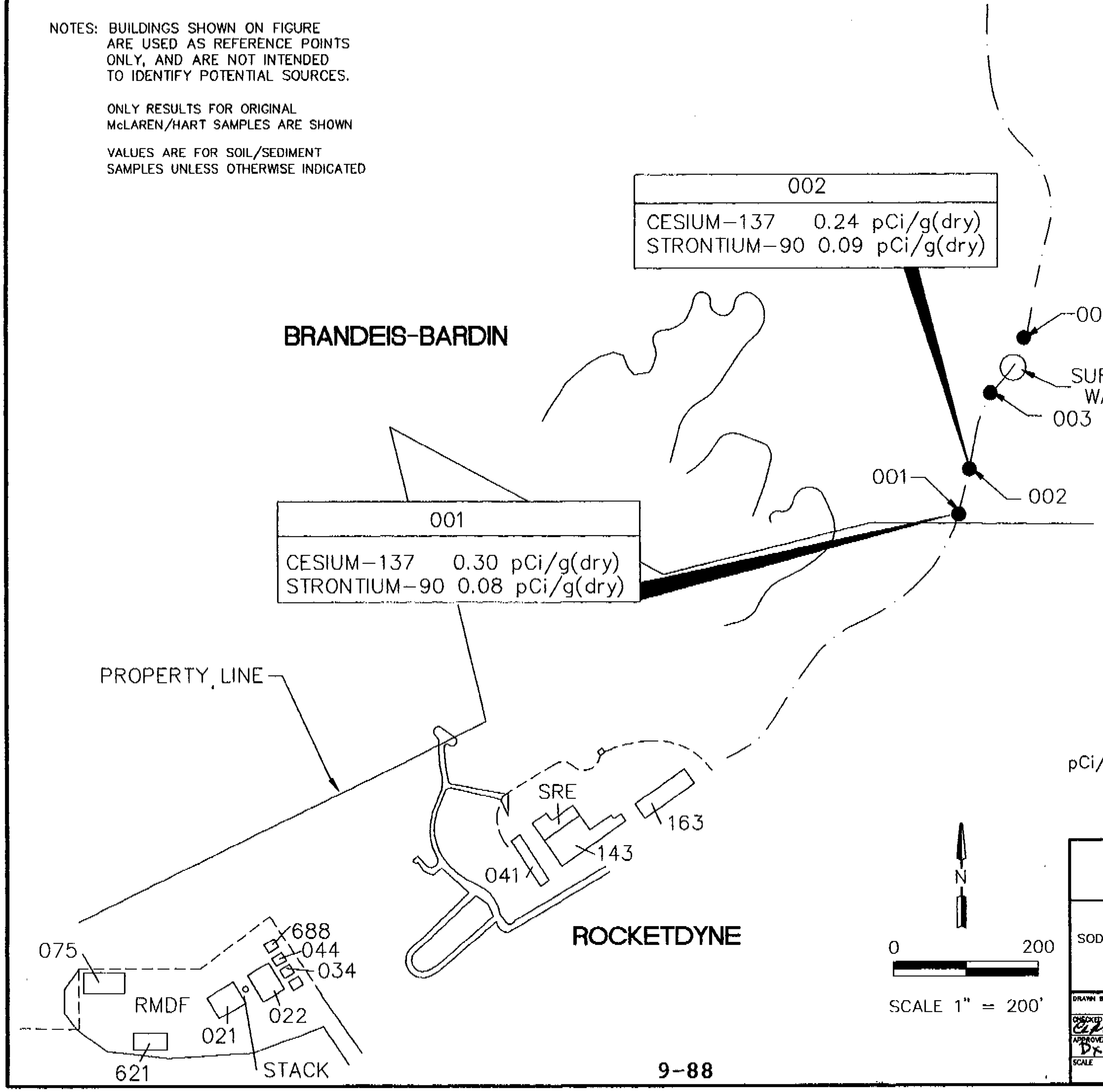
On April 23, 1992, four sediment samples were collected along the creek bed according to the approved Workplan. A fifth sampling location could not be identified. The USEPA collected split sediment samples at Block 003. The DHS collected a split sediment sample at Block 002 and the Brandeis-Bardin consultant collected a split sediment sample at Block 004. Field duplicate sediment samples were collected at Block 002 (metals) and Block 004 (isotopic plutonium).

Sediment from the SRE Watershed was a brown to dark brown, silty sand, fine grained, poorly graded, and moist to wet. The USEPA radiation survey of the area ranged from 13-16 uR/hr. The sample locations and the results are shown on Figure 9-19. The sediment at Block 001 had accumulated in a depression in the rock outcrop at the edge of the cliff and appeared to have contained high organic content. Cesium-137 was detected in the sediment at Blocks 001 and 002 at 0.30 ±0.05 and 0.24 ±0.06 pCi/g(dry), respectively. The DHS split at Block 002 confirmed the Cesium-137 results [0.28 ±0.03 pCi/g(dry)].

NOTES: BUILDINGS SHOWN ON FIGURE ARE USED AS REFERENCE POINTS ONLY, AND ARE NOT INTENDED TO IDENTIFY POTENTIAL SOURCES.

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED



002	
CESIUM-137	0.24 pCi/g(dry)
STRONTIUM-90	0.09 pCi/g(dry)

001	
CESIUM-137	0.30 pCi/g(dry)
STRONTIUM-90	0.08 pCi/g(dry)

LEGEND

●	SAMPLE LOCATIONS
— · —	DRAINAGE
— —	FENCE
	ROCK OUTCROPS
001	McLAREN/HART SAMPLE LOCATION
pCi/g(dry)	picocurie/gram(dry)
mg/kg	milligram per kilogram

McLaren Hart

FIGURE 9-19
SODIUM REACTOR EXPERIMENT (SRE) WATERSHED
BB-19
SAMPLE LOCATIONS

DRAWN BY	DATE	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY CLLY	DATE 1/25/93		
APPROVED BY DxD	DATE 1-25-93		
SCALE	REFER		DRAWING NUMBER REACTOR

Strontium-90 was detected in the sediment at Blocks 001 and 002 at 0.08 ±0.02 and 0.09 ±0.02 pCi/g(dry), respectively. The USEPA detected acetone (30 ug/kg) at sampling Block 003 in the sediment. (See Section 11.0 for further discussion.) No other chemicals were detected in the sediment at the SRE Watershed that exceeded background levels (for metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). Chemical and radionuclide results are summarized in Tables 9-47 and 9-48, respectively.

A surface water sample was collected from a pool of running water between Blocks 002 and 003. The water flowed along the rock and collected in a pool at the point where the samples were collected. Gross beta activity was detected at 4.9 ±2.5pCi/L. No chemicals or radionuclides were detected above the detection limits (radionuclides) or the reporting limits (volatile and semi-volatile organic compounds and metals) in the surface water samples at the SRE Watershed. Chemical and radionuclide results are summarized in Tables 9-49 and 9-50, respectively.

TABLE 9-47

Chemical Results for Sediment Samples at the Sodium Reactor Experiment Watershed (BB-19)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-19-001									
Sample	*	*	*	11	8.1	17	*	6.2	110
BB-19-002									
Sample	*	*	*	13	8.8	16	*	6.9	52
Field Duplicate			*	11	6.2	13	*	5.9	39
BB-19-003									
Sample	*	*	*	7.4	4.5	4.5	*	3.9	58
USEPA	*	Acetone=30	*	6	6	3.5	*	5	56
BB-19-004									
Sample	*	*	*	5.5	3.4	5.9	*	2.6	44

ug/kg -- micrograms per kilogram of sediment
mg/kg -- milligrams per kilogram of sediment
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-48

Radionuclide Results for Sediment Samples at the Sodium Reactor Experiment Watershed (BB-19)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
BB-19-001						
Sample	0.30 +/- 0.05	< 0.05	< 0.03	0.08 +/- 0.02	< 0.3	D
BB-19-002						
Sample	0.24 +/- 0.06	< 0.06	< 0.01	0.09 +/- 0.02	< 0.3	< 100
DHS	0.28 +/- 0.03					444 +/- 153
BB-19-003						
Sample	< 0.04	< 0.07	< 0.01	0.02 +/- 0.01	< 0.3	200 +/- 100
USEPA	0.055 +/- 0.010	0.03 +/- 0.05	< 0.020	< 0.74	< 0.17	< 200
BB-19-004						
Sample	0.18 +/- 0.03	< 0.04	< 0.01	0.03 +/- 0.01	< 0.3	< 100
Field Duplicate		0.03 +/- 0.02	< 0.005			
BBI	< 0.3			< 0.6		< 4500

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

D -- Sample was inadvertently dried by the laboratory and could not be analyzed.
Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 9-49

Chemical Results for Surface Water Samples at the Sodium Reactor Experiment Watershed (BB-19)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BB-19-003									
Sample	*	*	*	*	*	*	*	*	*

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 9-50

Radionuclide Results for Surface Water Samples at the Sodium Reactor Experiment Watershed (BB-19)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-19-003								
Sample	< 3	< 0.4	< 0.3	< 0.4	< 1.8	< 100	< 4	4.9 +/- 2.5

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

SECTION 10.0

SAMPLING RESULTS FROM THE SANTA MONICA MOUNTAINS CONSERVANCY

This section describes the sampling results from the Santa Monica Mountains Conservancy (Conservancy). Figure 10-1 shows the sample locations at the Conservancy.

The analytical results for each sample area are presented in the form of tables and figures. The first table for each sample area summarizes the results for the chemical analyses. Only results above the reporting limits are presented in this table. The second table summarizes the results for radionuclide analyses. The detection limit preceded by a "less than" (<) symbol is used to represent radionuclide results below detection limits (refer to Section 5.3.1.6 for a discussion on reporting limits and detection limits). For fruit analyses, one table is used to present all the data as only radionuclide analyses were conducted. The sample grid and sample locations are noted on the figures as well as relevant landmarks. Only sample results considered for further evaluation (results above reporting limits for volatile and semi-volatile organic compounds or background levels for metals and radionuclides) are shown on each figure. In some cases, all of the results for a particular analyte are presented on a figure, although some of those results are not considered significant, to show the trend in that particular area. Buildings represented on the figures or discussed in the text are intended for reference only, and do not necessarily indicate potential sources. Results of splits, duplicate counts, laboratory duplicates, and interlaboratory samples are only reported in the tables as they were used solely for quality assurance/quality control (QA/QC) purposes.

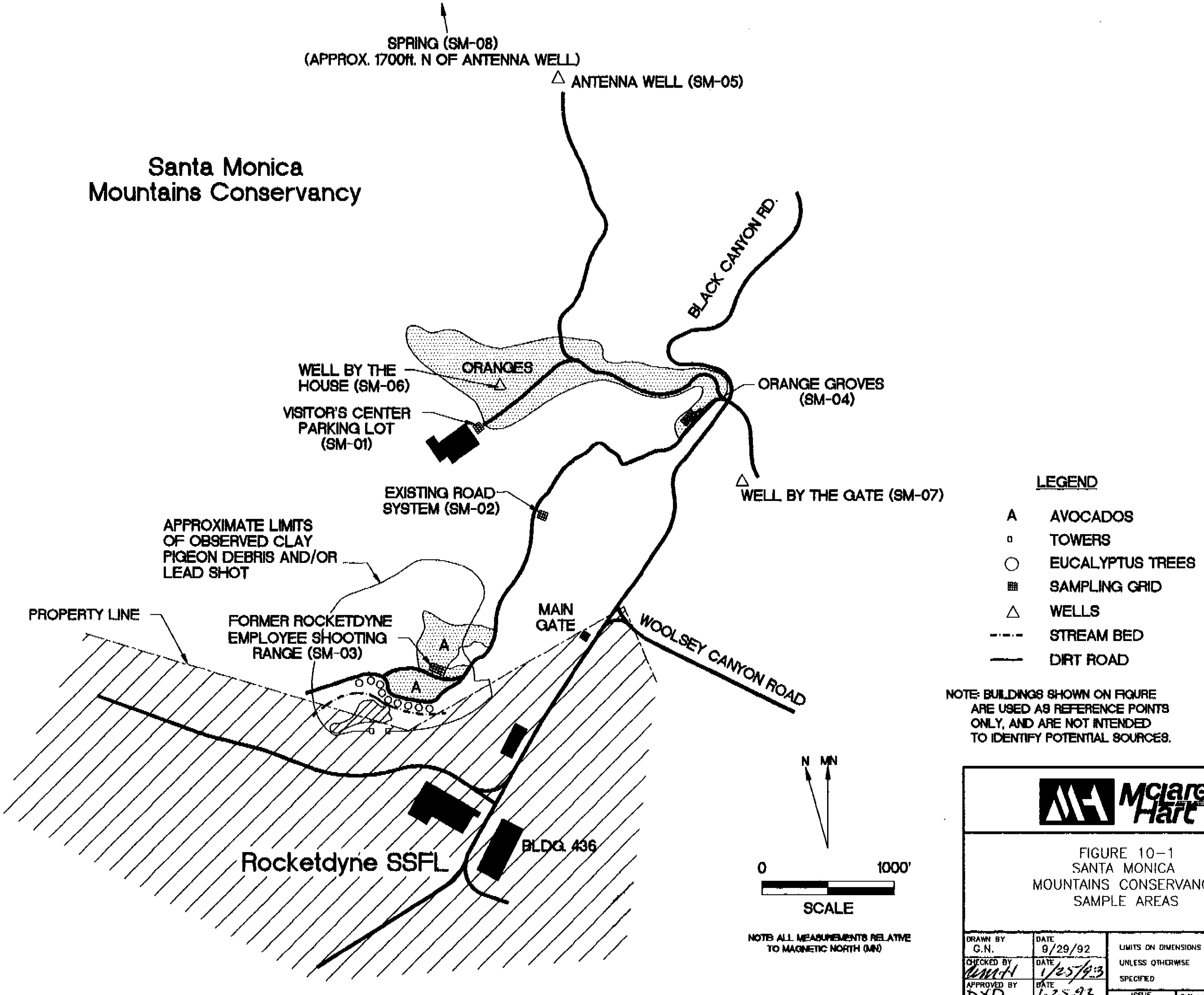


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FIGURE 10-1
SANTA MONICA
MOUNTAINS CONSERVANCY
SAMPLE AREAS

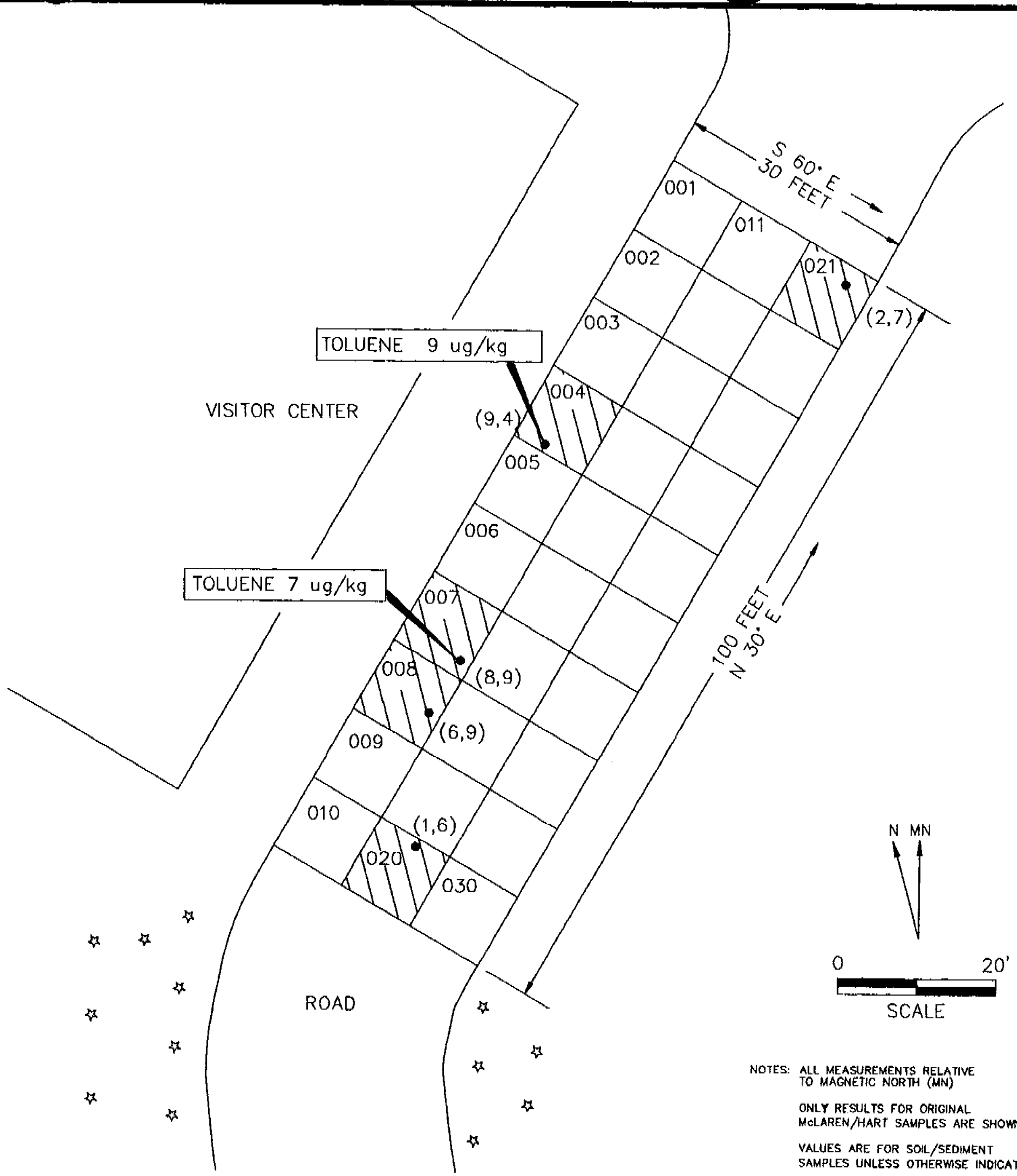
DRAWN BY G.N.	DATE 9/29/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY dmcH	DATE 1/25/93		
APPROVED BY DXD	DATE 1-25-93	ISSUE	DRAWING NUMBER CONSERV
SCALE	REFER		

10.1 Visitor Center Parking Lot (SM-01)

The Visitor Center Parking Lot was approximately 1,800 feet north of the main Rocketdyne gate, approximately 1,700 feet from the Rocketdyne property line. The area that was sampled was the portion of the road that passes through the orange groves as it widens at the visitor center to provide parking next to the building. The soil sampling grid was located on a level area southeast of the Visitor Center across from the orange trees. The road and parking lot were devoid of vegetation and covered with a layer of gravel.

On March 23, 1992, five soil samples were collected according to the approved Workplan. The United States Environmental Protection Agency (USEPA) collected a split soil sample at Block 004 and matrix spike/matrix spike duplicate (MS/MSD) sample at Block 007. For some analyses, the MS/MSD sample was reported as a split sample by the USEPA. Five rinsate blanks (one at each block) were collected at this area. The USEPA radiation survey of the area ranged from 12 to 15 microroentgens per hour (uR/hr). The sampling grid and the results are shown on Figure 10-2. A summary of the analytical results is presented in Tables 10-1 and 10-2.

Soil at the Visitor Center Parking Lot was a dark brown silt, fine grained, poorly graded, and moist. Toluene was reported in two of the five soil samples at concentrations of 7 and 9 micrograms per kilogram of soil (ug/kg). (See Section 11.0 for a further discussion of these results.) Methylene chloride, a typical laboratory contaminant, was detected by USEPA in these same two samples. No other chemicals were reported at the Visitor Center Parking Lot that exceeded measured background levels (radionuclides and metals) or the reporting limits (volatile and semi-volatile organic compounds) in the soil.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	ORANGE TREE
(2,7)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
ug/kg	micrograms per kilogram

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 10-2
VISITOR CENTER PARKING LOT
SM-01
SAMPLING LOCATION

DRAWN BY G.N.	DATE 9/29/92	UNITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY AMH	DATE 3/10/93		
APPROVED BY DXD	DATE 3-10-93	ISSUE	DRAWING NUMBER 05119202
SCALE	REFER		

TABLE 10-1

Chemical Results for Soil Samples at the Visitor Center Parking Lot (SM-01)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
SM-01-004 Sample USEPA	* *	Toluene=9 Methylene Chloride=6	* *	20 21	21 22	16 14	* *	15 15	62 67.1
SM-01-007 Sample USEPA	* *	Toluene=7 Methylene Chloride=7	*	21	23	19	*	16	64
SM-01-008 Sample	*	*	*	24	24	26	*	20	76
SM-01-020 Sample	*	*	*	24	34	17	*	18	70
SM-01-021 Sample	*	*	*	12	12	11	*	8.3	34

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 10-2

Radionuclide Results for Soil Samples at the Visitor Center Parking Lot (SM-01)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
SM-01-004 Sample USEPA	0.038 +/- 0.022 0.054 +/- 0.017	0.082 +/- 0.036 0.02 +/- 0.03	< 0.01 0.010 +/- 0.02	0.02 +/- 0.01 < 0.71	< 0.3 < 0.16	< 100 < 224
SM-01-007 Sample USEPA	< 0.04 0.069 +/- 0.014	< 0.05	< 0.02	0.02 +/- 0.01	< 0.3 < 0.16	< 100
SM-01-008 Sample	0.073 +/- 0.024	< 0.06	< 0.04	0.04 +/- 0.01	< 0.3	< 100
SM-01-020 Sample	< 0.04	< 0.02	< 0.008	0.01 +/- 0.01	< 0.3	< 200
SM-01-021 Sample	0.12 +/- 0.02	< 0.04	< 0.03	0.02 +/- 0.01	< 0.3	< 100

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

10.2 Existing Road System (SM-02)

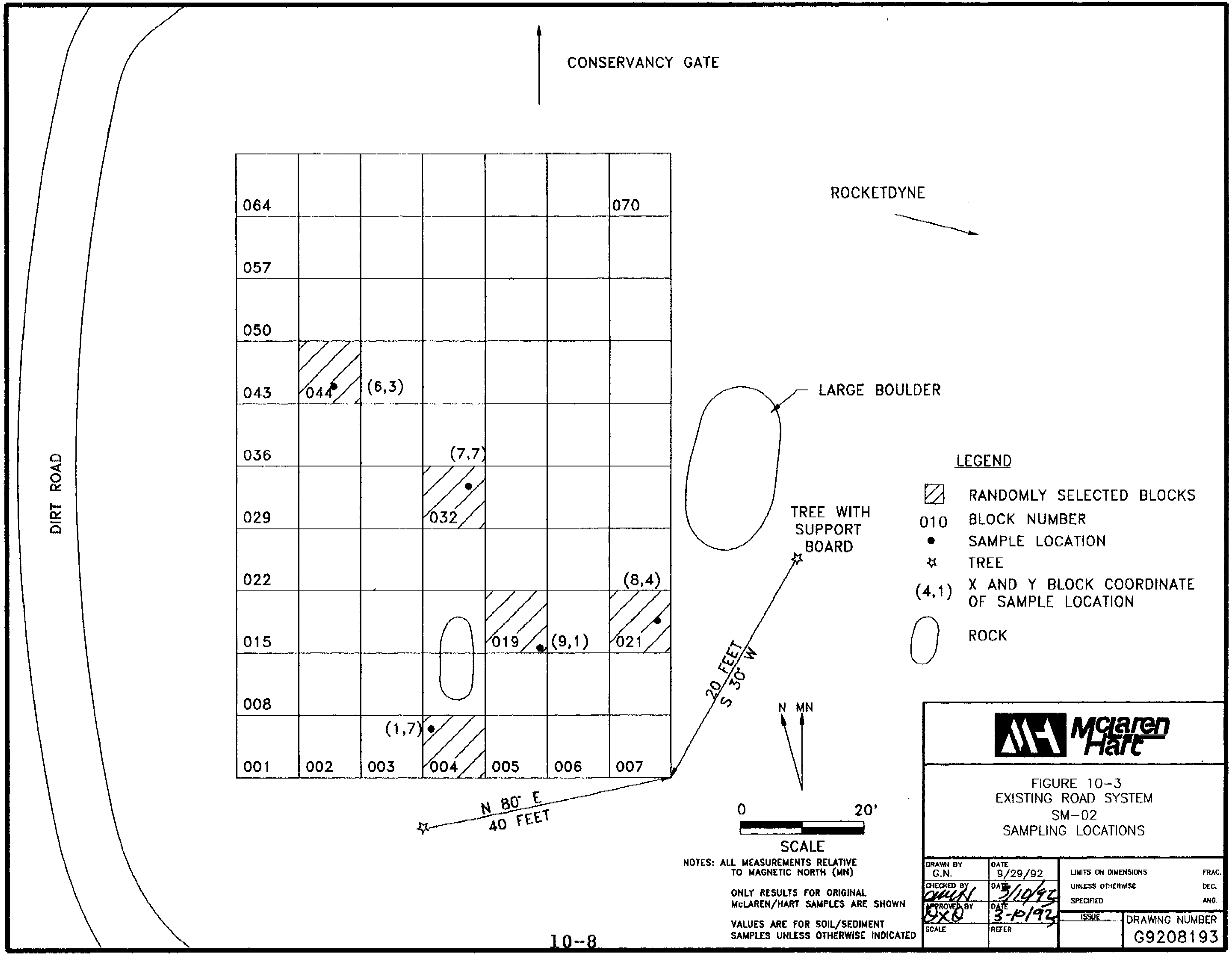
The Existing Road System was approximately 1,000 feet north of the main Rocketdyne gate, approximately 900 feet from the property line. The soil sampling grid was located adjacent to the dirt road running parallel to Black Canyon Road and the Rocketdyne property line. The soil was covered with a moderate growth of annual grasses and forbs and two small trees.

On March 11, 1992, five soil samples were collected according to the approved Workplan. One field duplicate sample was collected at Block 032 (isotopic plutonium) and two rinsate blanks were collected at Blocks 004 and 044. The USEPA collected a split soil sample at Block 019. The USEPA radiation survey of the area showed 13 uR/hr in the one reading taken. The sampling grid is shown on Figure 10-3. A summary of the analytical results is presented in Tables 10-3 and 10-4.

The soil collected at the Existing Road System was a silty sand, dark yellowish brown, medium to fine grained, poorly graded, and moist. No chemicals were reported in the soil at the Existing Road System that exceeded measured background levels (heavy metals and radionuclides) or the reporting limits (for volatile and semivolatile organic compounds).

10.3 Former Rocketdyne Employee Shooting Range (SM-03)

The Former Rocketdyne Employee Shooting Range was approximately 1,700 feet west of the main Rocketdyne gate, bordering the property line. The soil sampling grid was located on a level area on the north/northeast side of the dirt road where lead shot was observed and was only one block wide. The location of the grid was changed from the area designated in the Workplan, after discussion with Ms. Jennifer Schroll, of the California



NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 10-3
EXISTING ROAD SYSTEM
SM-02
SAMPLING LOCATIONS

DRAWN BY G.N.	DATE 9/29/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY ~~OWH~~	DATE 3/10/93		
APPROVED BY DXO	DATE 3-10/93	ISSUE	DRAWING NUMBER G9208193
SCALE	REFER		

TABLE 10-3

Chemical Results for Soil Samples at the Existing Road System (SM-02)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
SM-02-004 Sample	*	*	*	14	9.7	13	*	10	44
SM-02-019 Sample USEPA	* *	* *	0.52 *	14 12	11 10	13 10.8	* *	11 10	47 40.3
SM-02-021 Sample	*	*	*	16	13	11	*	12	49
SM-02-032 Sample	*	*	*	16	11	11	*	12	46
SM-02-044 Sample	*	*	*	13	8.3	7.6	*	9.2	38

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 10-4

Radionuclide Results for Soil Samples at the Existing Road System (SM-02)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
SM-02-004 Sample	< 0.06	< 0.04	< 0.007	0.03 +/- 0.01	< 0.1	< 100
SM-02-019 Sample USEPA	0.12 +/- 0.03 0.12 +/- 0.01	< 0.01 < 0.43	< 0.009 < 0.032	0.05 +/- 0.01 < 0.75	< 0.2 < 0.27	< 100 < 200
SM-02-021 Sample	0.052 +/- 0.026	< 0.01	< 0.008	0.03 +/- 0.01	< 0.2	< 100
SM-02-032 Sample Field Duplicate	< 0.04	< 0.02 < 0.01	< 0.005 < 0.004	0.02 +/- 0.01	< 0.2	< 100
SM-02-044 Sample	< 0.04	< 0.02	< 0.007	0.02 +/- 0.01	< 0.1	< 100

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

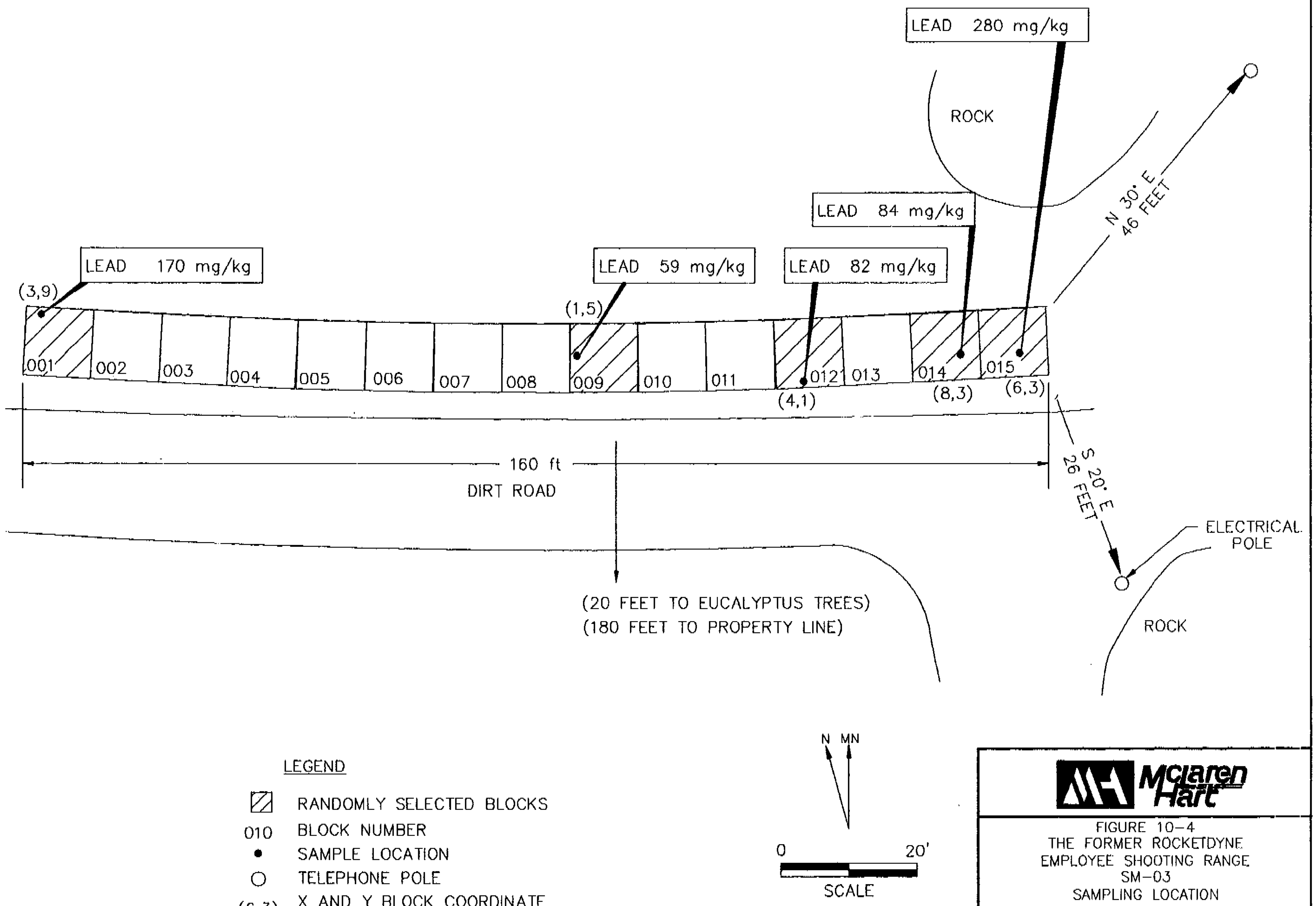
Environmental Protection Agency, Department of Toxic Substances Control (Cal-EPA-DTCS), to sample an area more likely to have lead shot residues. The area had moderate growth of annual grasses and forbs.

On March 11, 1992, five soil samples were collected according to the approved Workplan. Field duplicate samples were collected at Block 014 (tritium, gamma scan, and volatile organic compounds), and one rinsate blank was collected at Block 014. The USEPA collected a split soil sample at Block 001. The sampling grid and the results are shown on Figure 10-4. A summary of the analytical results is presented in Tables 10-5 and 10-6.

Soil at the Former Rocketdyne Employee Shooting Range was a very dark grayish brown, very fine to coarse sand, well graded, wet, with organic material and roots. Lead was detected in all five soil samples [59 milligrams per kilogram of soil (mg/kg) to 280 mg/kg] at levels higher than at the measured background areas. The USEPA split soil sample detected acetone (23 ug/kg) and lead (225 mg/kg) at Block 001. The USEPA lead concentration in the soil confirmed the lead detected in the scheduled sample (170 mg/kg) at Block 001. (See Section 11.0 for further discussion of these results.) No other chemicals were detected at the Former Rocketdyne Employee Shooting Range that exceeded measured background levels (for heavy metals and radionuclides) or the reporting limits (for volatile and semivolatile organic compounds) in the soil.

10.4 Orange Groves (SM-04)

The Orange Groves were approximately 1,900 feet north/northeast of the main Rocketdyne gate on the north side of Black Canyon Road, approximately 1,400 feet from the property line. The soil sampling grid was located in the Orange Groves adjacent to the dirt road parallel to Black Canyon Road, in an area that sloped upward from the dirt road. The area



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
○	TELEPHONE POLE
(6,3)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
mg/kg	milligram per kilogram

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 10-4
THE FORMER ROCKETDYNE
EMPLOYEE SHOOTING RANGE
SM-03
SAMPLING LOCATION

DRAWN BY G.N.	DATE 9/29/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY	DATE 1/25/93		
APPROVED BY DKD	DATE 1-25-93	ISSUE	DRAWING NUMBER 05149215
SCALE	REFER		

TABLE 10-5

Chemical Results for Soil Samples at the Former Rocketdyne Employee Shooting Range (SM-03)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
SM-03-001									
Sample	*	*	*	9.4	7.4	170	*	5.7	34
USEPA	*	Acetone=23	*	8	7	225	*	6	28.8
SM-03-009									
Sample	*	*	*	11	8.3	59	*	7.2	37
SM-03-012									
Sample	*	*	*	12	12	82	*	8.1	41
SM-03-014									
Sample	*	*	*	10	8.6	84	*	6.8	39
Field Duplicate		*							
SM-03-015									
Sample	*	*	*	11	8.9	280	*	7.6	43

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 10-6

Radionuclide Results for Soil Samples at the Former Rocketdyne Employee Shooting Range (SM-03)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
SM-03-001 Sample USEPA	0.19 +/- 0.05 0.17 +/- 0.02	< 0.02 < 0.029	< 0.02 < 0.027	0.07 +/- 0.01 < 0.69	< 0.2 < 0.27	< 100 < 200
SM-03-009 Sample	0.13 +/- 0.04	< 0.02	< 0.005	0.03 +/- 0.01	< 0.2	< 100
SM-03-012 Sample	0.13 +/- 0.03	< 0.02	< 0.004	0.02 +/- 0.01	< 0.1	< 100
SM-03-014 Sample Field Duplicate	0.10 +/- 0.03 0.083 +/- 0.026	< 0.02	< 0.005	0.02 +/- 0.01	< 0.1	< 100 < 100
SM-03-015 Sample Interlab Duplicate	0.27 +/- 0.04	< 0.04	< 0.01	0.05 +/- 0.01	< 0.1	< 200 < 869

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Interlab Duplicate -- A sample collected adjacent to the original sample and shipped between laboratories for additional analyses.

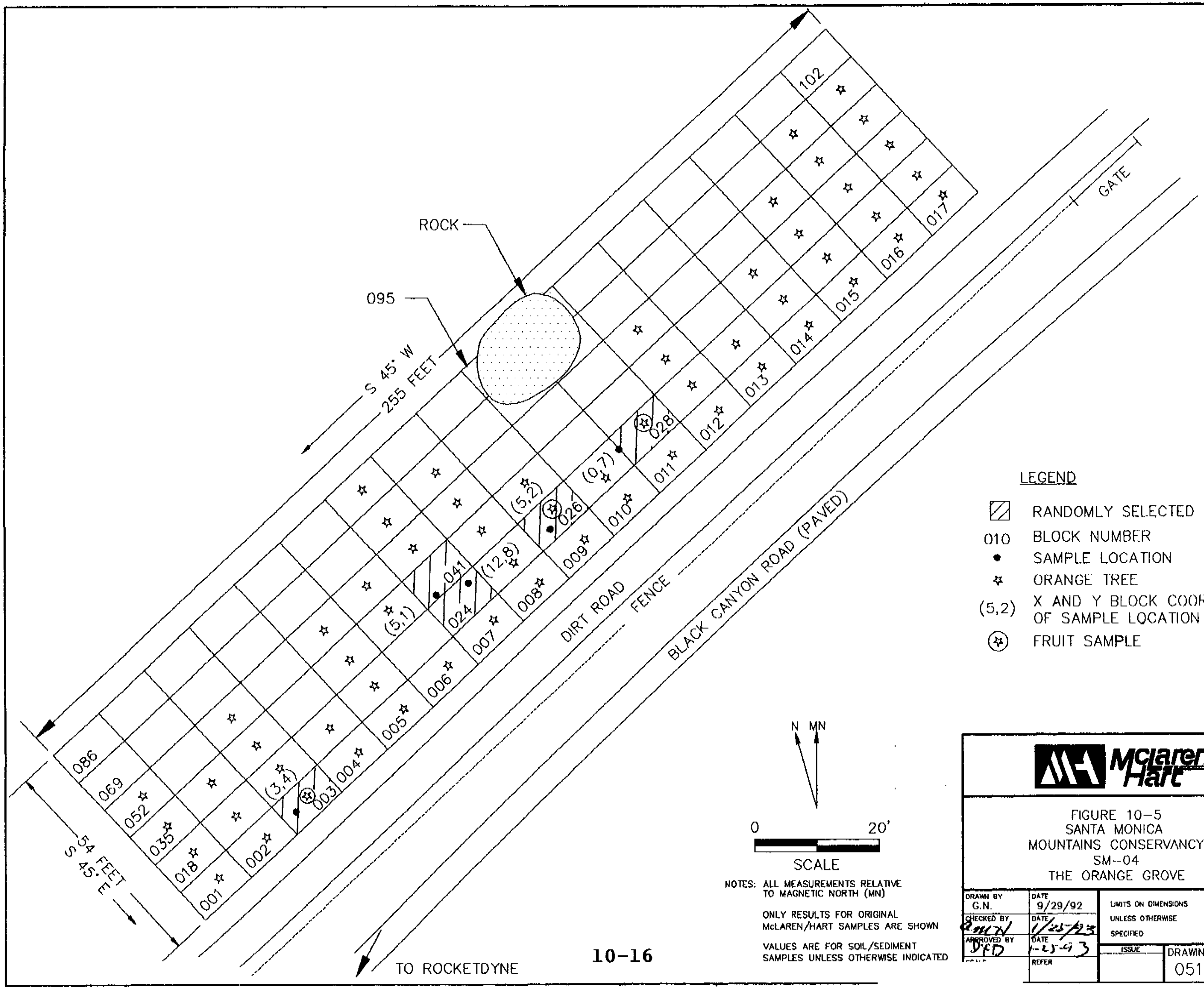
Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

was shaded with orange trees and the soil was covered with a moderate growth of annual grasses and forbs. In accordance with the Workplan, sample Block 041 was substituted for Block 095 which was covered by a large rock outcrop over the proposed sampling location.

On March 11, 1992, five soil samples were collected according to the approved Workplan. Field duplicates were collected at Block 003 (semi-volatile organic compounds), Block 024 (priority pollutant metals), and Block 041 (iodine 129 and strontium-90). The USEPA radiation survey of the area was 14 uR/hr for all five readings. The sampling grid is shown on Figure 10-5.

Soil at the Orange Groves was a silty sand, dark brown to black, fine to medium grained, poorly graded, plastic, moist, with organic material and roots. No chemicals were detected at the Orange Groves that exceeded measured background levels (for metals and radionuclides) in the soil and fruit or the reporting limits (for volatile and semi-volatile organic compounds) in the soil. A summary of the analytical results for soil samples is presented in Tables 10-7 and 10-8.

Three fruit (oranges) samples and three field duplicates were collected at Blocks 003, 026, and 028 in this area. The USEPA took a split of the fruit sample collected at Block 003. No radionuclides were detected in the fruit (oranges) at these sampling locations that exceeded measured background levels. A summary of the analytical results for the fruit samples is presented in Table 10-9.



LEGEND

▨	RANDOMLY SELECTED BLOCKS
010	BLOCK NUMBER
●	SAMPLE LOCATION
☆	ORANGE TREE
(5,2)	X AND Y BLOCK COORDINATE OF SAMPLE LOCATION
⊛	FRUIT SAMPLE

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

VALUES ARE FOR SOIL/SEDIMENT SAMPLES UNLESS OTHERWISE INDICATED

McLaren Hart

FIGURE 10-5
SANTA MONICA
MOUNTAINS CONSERVANCY
SM-04
THE ORANGE GROVE

DRAWN BY G.N.	DATE 9/29/92	LIMITS ON DIMENSIONS UNLESS OTHERWISE SPECIFIED	FRAC. DEC. ANG.
CHECKED BY	DATE 1/25/93		
APPROVED BY	DATE 1-25-93	ISSUE	DRAWING NUMBER 05129206
	REFER		

TABLE 10-7

Chemical Results for Soil Samples at the Orange Groves (SM-04)

	Semi-Volatile Organic Compounds (ug/kg)	Volatile Organic Compounds (ug/kg)	Metals (mg/kg) Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
SM-04-003									
Sample	*	*	0.55	14	17	16	*	10	50
Field Duplicate	*								
SM-04-024									
Sample	*	*	*	16	21	26	*	12	58
Field Duplicate			*	16	20	26	*	11	60
SM-04-026									
Sample	*	*	*	16	17	13	*	12	53
SM-04-028									
Sample	*	*	0.52	14	16	13	*	10	55
SM-04-041									
Sample	*	*	*	14	13	21	*	11	48

ug/kg -- micrograms per kilogram of soil
mg/kg -- milligrams per kilogram of soil

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 10-8

Radionuclide Results for Soil Samples at the Orange Groves (SM-04)

	Cesium-137 [pCi/g(dry)]	Plutonium-238 [pCi/g(dry)]	Plutonium-239 [pCi/g(dry)]	Strontium-90 [pCi/g(dry)]	Iodine-129 [pCi/g(dry)]	Tritium (pCi/L)
SM-04-003 Sample	0.17 +/- 0.05	< 0.02	< 0.01	0.04 +/- 0.01	< 0.1	380 +/- 120
SM-04-024 Sample Lab Duplicate	0.42 +/- 0.06 0.39 +/- 0.04	< 0.03	< 0.007	0.1 +/- 0.01	< 0.2	460 +/- 110
SM-04-026 Sample	< 0.05	< 0.02	< 0.005	0.03 +/- 0.01	< 0.3	280 +/- 80
SM-04-028 Sample	0.12 +/- 0.04	< 0.02	< 0.005	0.03 +/- 0.01	< 0.2	460 +/- 100
SM-04-041 Sample Field Duplicate	0.29 +/- 0.05	< 0.06	< 0.01	0.14 +/- 0.02 0.15 +/- 0.02	< 0.3 < 0.1	230 +/- 200

pCi/g(dry) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below detection limit
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.
Lab Duplicate -- A reanalysis of the sample including extraction and counting.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

TABLE 10-9

Radionuclide Results for Orange Samples at the Orange Groves (SM-04)

	Cesium-137 [pCi/g(wet)]	Plutonium-238 [pCi/g(wet)]	Plutonium-239 [pCi/g(wet)]	Strontium-90 [pCi/g(wet)]	Iodine-129 [pCi/g(wet)]	Tritium (pCi/L)
SM-04-003						
Sample	< 0.006	< 0.0004	< 0.0001	< 0.005	< 0.02	< 100
Field Duplicate	< 0.007	< 0.0003	< 0.0001	< 0.003	< 0.03	< 100
USEPA	< 0.013	< 0.0001	< 0.0001	< 0.005	< 0.082	350 +/- 200
SM-04-026						
Sample	< 0.008	< 0.0002	< 0.0001	< 0.005	< 0.02	< 100
Field Duplicate	< 0.008	< 0.0009	< 0.0006	< 0.008	< 0.03	< 100
SM-04-028						
Sample	< 0.007	< 0.0002	< 0.0001	< 0.005	< 0.02	< 100
Field Duplicate	< 0.006	< 0.0003	< 0.00008	< 0.006	< 0.03	180 +/- 90

pCi/g(wet) -- Picocuries per gram of undried sample
pCi/L -- Picocuries per liter of water
< -- Less than

* -- Below reporting limits
Blank -- Not analyzed
+/- -- Plus or minus

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory split sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.
Field Duplicate - A duplicate sample is collected and mixed in the field and submitted under an anonymous sample identifier.

10.5 Antenna Well (SM-05)

The Antenna Well is approximately 4,300 feet north of the main Rocketdyne gate. The groundwater at the Antenna Well was sampled three different times, on March 11, March 18, and April 23, 1992. The groundwater sample taken on March 11 was analyzed for volatile organic compounds with a preservative [hydrochloric acid (HCl)] and without a preservative. The USEPA split samples (with and without HCL) were collected on March 11, 1992. A field duplicate sample was collected on April 23, 1992.

Methylene chloride was not detected in the first round of sampling taken on March 11, 1992, but it was detected in the second round taken on March 18, 1992 at 7 ug/L. Although methylene chloride was not detected in the corresponding trip blank (register number 196832-35), methylene chloride is a common laboratory contaminant. To verify that the methylene chloride was most likely a laboratory contaminant an additional round of sampling (including a field duplicate) was conducted on April 23, 1992, under the direction of Ms. Jennifer Schroll from the Department of Toxic Substances Control of the California Environmental Protection Agency. Methylene chloride was not detected in the scheduled samples in the first and third rounds, in the USEPA split sample collected during the first round, or in the field duplicate collected in the third round. These results suggested that the methylene chloride detected on March 18, 1992 was due to laboratory contamination. No other chemicals were detected in the groundwater at the Antenna Well that exceeded measured background levels (for metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). The location of the Antenna Well is shown on Figure 10-1. Tables 10-10 and 10-11 are a summary of the analytical data from this well.

TABLE 10-10

Chemical Results for Groundwater Samples at the Antenna Well (SM-05)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)
SM-05-001		
Sample	*	* *
USEPA	*	* *
SM-05-002		
Sample	*	Methylene Chloride=7
SM-05-003		
Sample		*
Field Duplicate		*

ug/L -- micrograms per liter of water
* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Methylene chloride is a typical laboratory contaminant.

TABLE 10-11

Radionuclide Results for Groundwater Samples at the Antenna Well (SM-05)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
SM-05-001								
Sample	< 5	< 0.2	< 0.09	< 0.4	< 0.7	< 100	< 7.00	7.90 +/- 3.20
USEPA	< 5.5	< 0.062	< 0.05	< 0.74	< 3.3	< 200	< 3.80	< 5.47
SM-05-002								
Sample	< 4	< 0.1	< 0.09	< 0.4	< 1.1	< 200	2.90 +/- 2.70	8.30 +/- 3.40

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

10.6 Well by the House (SM-06)

The Well by the House is approximately 800 feet north/northeast of the Visitor Center, approximately 2,100 feet north of the Rocketdyne main gate. This well was not functional and was not on-line during this sampling phase; therefore, it was not included in the data collection for this study.

10.7 Well by the Gate (SM-07)

The Well by the Gate is approximately 500 feet south of the Conservancy gate across Black Canyon Road and approximately 1,000 feet northeast of the main Rocketdyne gate. The groundwater from this well was sampled on March 11 and March 18, 1992. The USEPA collected a split sample on March 11, 1992. The USEPA radiation survey of the area showed a reading of 13 uR/hr.

Trichloroethene (TCE) was found in the groundwater at concentrations of 10 micrograms per liter of water (ug/L) and 9 ug/L. The USEPA split sample confirmed the first round result of 10 ug/L of trichloroethene in the groundwater at the Well by the Gate with a result of 13 ug/L. No other chemicals were detected in the groundwater at the Well by the Gate that exceeded measured background levels (for metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds). The approximate location of the Well by the Gate is shown on Figure 10-1. Tables 10-12 and 10-13 are a summary of the analytical data from this well. (See Section 11.0 for a further discussion of these results.)

TABLE 10-12

Chemical Results for Groundwater Samples at the Well by the Gate (SM-07)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)
SM-07-001		
Sample	*	Trichloroethene=10
USEPA	*	Trichloroethene=13
SM-07-002		
Sample	*	Trichloroethene=9

ug/L -- micrograms per liter of water
* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

TABLE 10-13

Radionuclide Results for Groundwater Samples at the Well by the Gate (SM-07)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
SM-07-001								
Sample	< 5	< 0.2	< 0.09	< 0.4	< 0.9	< 100	< 3.00	3.80 +/- 2.30
USEPA	< 4.6	< 0.040	< 0.033	< 0.86	< 3.3	< 200	< 4.40	< 5.03
SM-07-002								
Sample	< 5	< 0.2	< 0.04	< 0.3	< 1.1	< 100	5.50 +/- 3.10	5.70 +/- 2.80

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

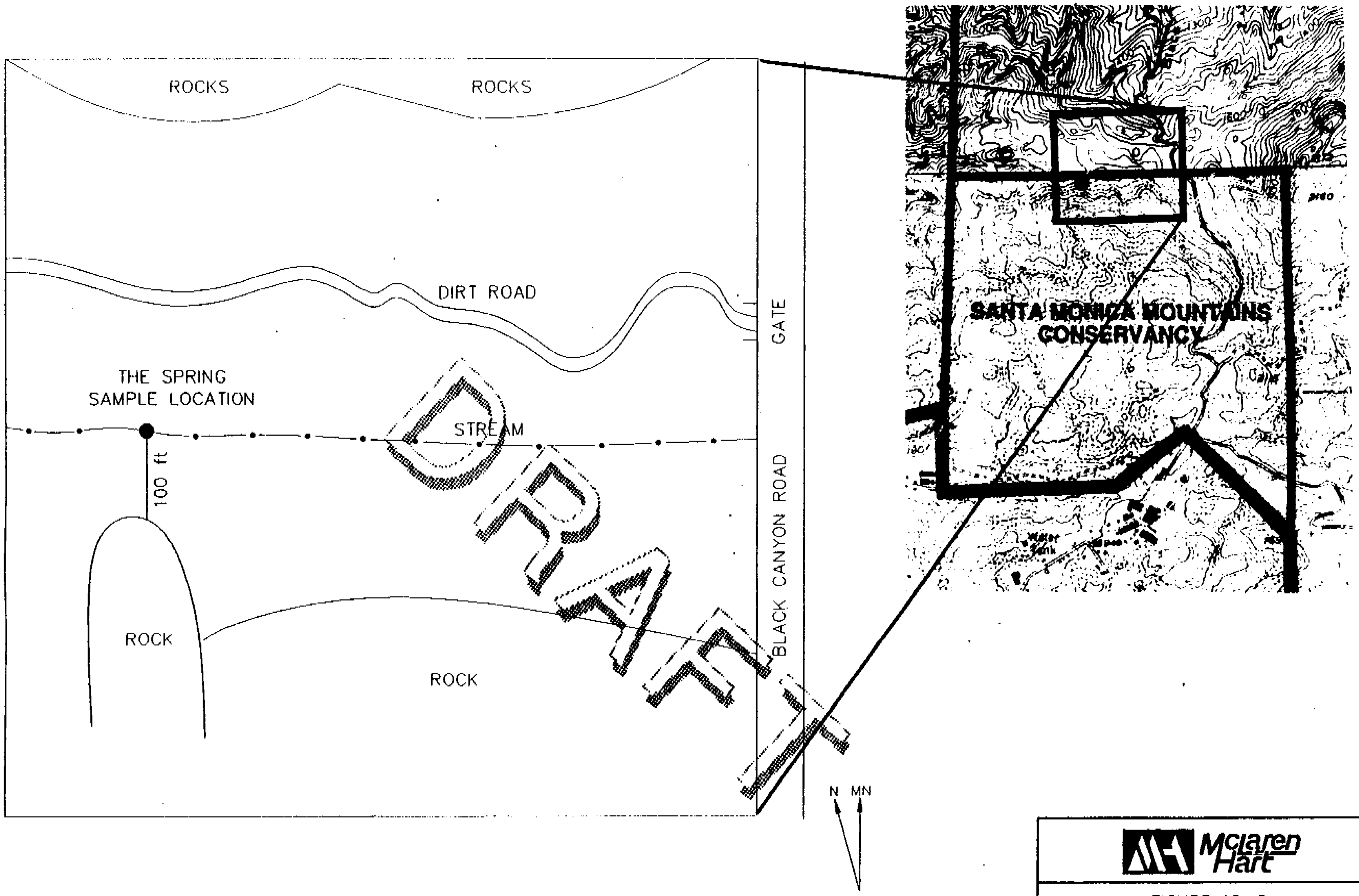
BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

10.8 The Spring (SM-08)

The Spring was a natural spring approximately 6,000 feet north of the Rocketdyne main gate. Newts, small semi-aquatic salamanders, were observed in the spring. The Spring was sampled on March 18, 1992. The USEPA collected split samples at this location. The USEPA radiation survey for the area showed a reading of 15 uR/hr. No radionuclides or chemicals were detected in the Spring that exceeded measured background levels (for metals and radionuclides) or the reporting limits (for volatile and semi-volatile organic compounds) in the surface water.

The approximate location of the spring is shown on Figure 10-6. Tables 10-14 and 10-15 are a summary of the analytical data from this spring.



NOT TO SCALE

NOTES: ALL MEASUREMENTS RELATIVE TO MAGNETIC NORTH (MN)

ONLY RESULTS FOR ORIGINAL McLAREN/HART SAMPLES ARE SHOWN

McLaren Hart

FIGURE 10-6
THE SPRING
SM-08
SAMPLE LOCATIONS

DRAWN BY C.N.	DATE 10/28/92	UNITS ON DIMENSIONS	FRAC
CHECKED BY	DATE 1/25/93	UNLESS OTHERWISE	DEC.
APPROVED BY DXD	DATE 1-25-93	SPECIFIED	ANG
SCALE	REFER	ISSUE	DRAWING NUMBER SPRING

TABLE 10-14

Chemical Results for Surface Water Samples at the Spring (SM-08)

	Semi-Volatile Organic Compounds (ug/L)	Volatile Organic Compounds (ug/L)	Metals (ug/L)						
			Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
SM-08-001									
Sample	*	*	*	*	*	*	*	*	*
USEPA	*	*	*	*	*	*	*	*	23

ug/L -- micrograms per liter of water

* -- Below reporting limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split sample

Field Duplicate - A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

TABLE 10-15

Radionuclide Results for Surface Water Samples at the Spring (SM-08)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
SM-08-001								
Sample	< 5	< 0.2	< 0.1	< 0.4	< 1.1	300 +/- 180	3.4 +/- 2.4	< 4
USEPA	< 4.3	< 0.082	< 0.019	< 0.80	< 3.3	< 200	< 4.6	< 4.6

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

SECTION 11.0

DISCUSSION OF RESULTS

In Section 6.0, the quality assurance/quality control (QA/QC) results were presented, and in Sections 8.0, 9.0, and 10.0, the sampling results were discussed by Sampling Area. After summarizing the results of the QA/QC samples, a generalized discussion of all the results by analysis and sampling media is presented in this section.

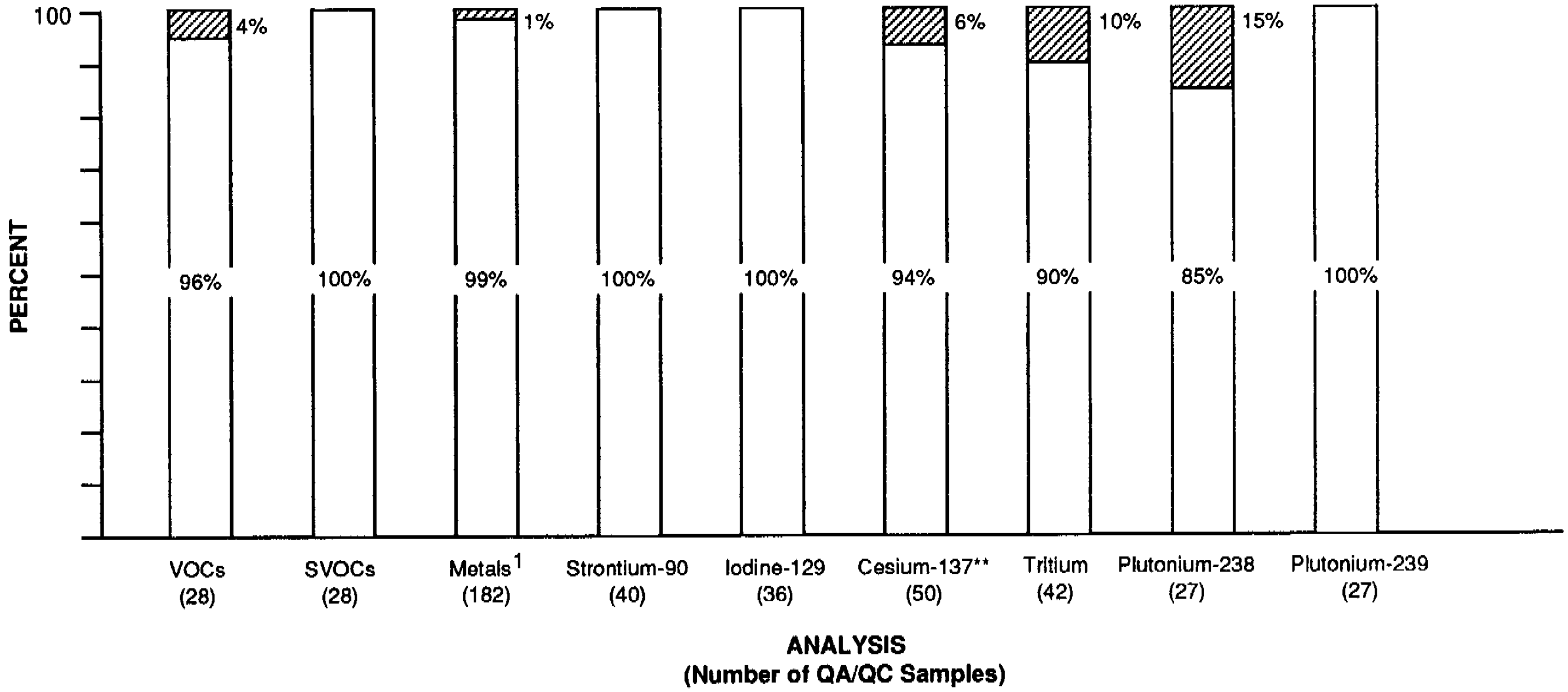
11.1 Quality Assurance/Quality Control

As discussed in Section 6.0, quality assurance/quality control (QA/QC) samples were collected throughout the project to ensure that the results of the study were an accurate representation of concentrations of chemicals and radionuclides in the sampling areas. Although six types of QA/QC samples were collected and analyzed, the duplicates and split samples (including interlaboratory split samples) are key representations of data quality because the samples were analyzed blindly as if they came from different sources and, in the case of split samples, were analyzed by entirely different laboratories. A summary of the percentage that duplicate and split samples were in agreement [1] or not in agreement with the respective scheduled sample for each analyte is presented in Figure 11-1 for soil/sediment samples, in Figure 11-2 for water samples, and in Figure 11-3 for fruit samples.

---

[1] In agreement for samples analyzed for chemicals means that the difference between the sample results was less than 50 percent. In agreement for samples analyzed for radionuclides means that the difference between the sample results was less than the sum of the standard deviations of the sample results.

Figure 11-1
Quality Assurance / Quality Control (QA/QC) Summary for Key Analyses*
(Soil/Sediment Samples)



* Field duplicate, field split and interlaboratory split QA/QC samples compared to their respective scheduled sample.

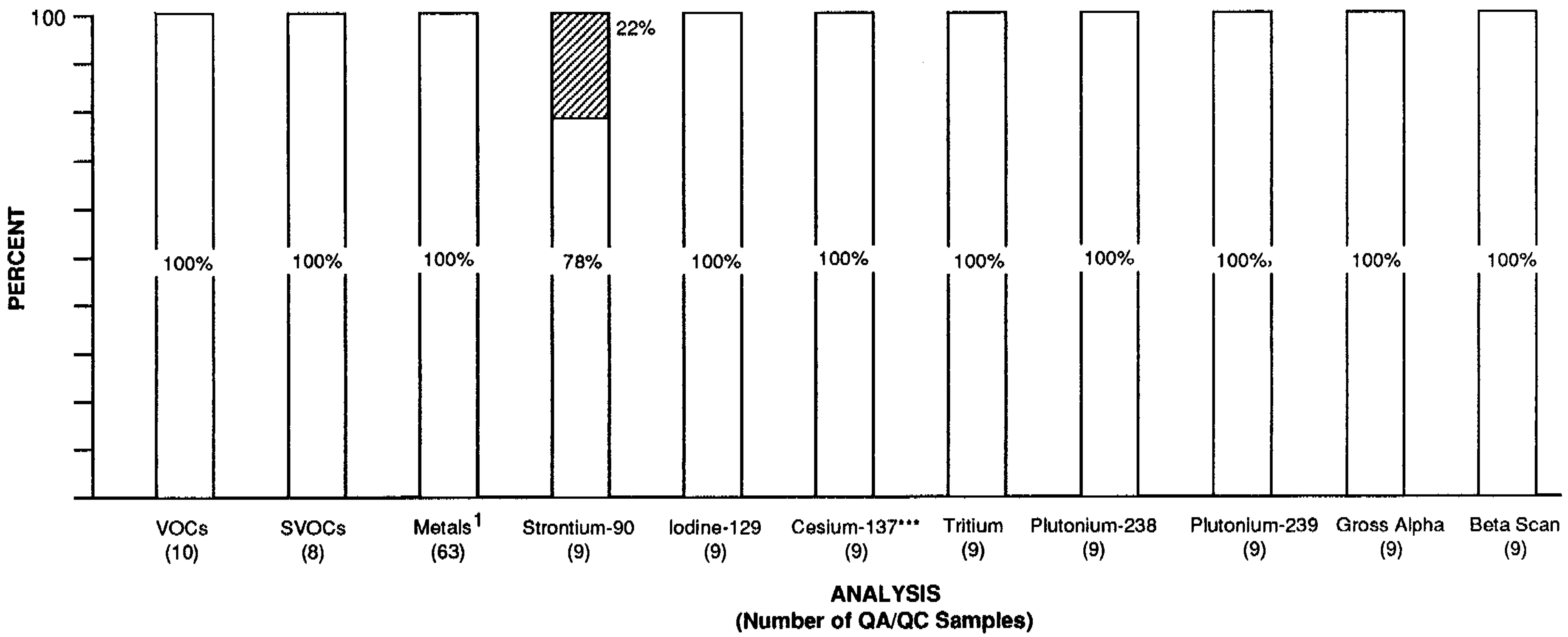
** Cesium-137 was the only man-made radionuclide detected in the gamma-scan analysis.

[1] Includes individually the seven metals of interest.

[2] "In agreement" for samples analyzed for chemicals means that the difference between the sample results was less than 50 percent. "In agreement" for samples analyzed for radionuclides means that the difference between the sample results was less than the sum of the standard deviations of the sample results.

SVOCs Semi-Volatile Organic Compound.
VOCs Volatile Organic Compound.

Figure 11-2
Quality Assurance / Quality Control (QA/QC) for Key Analyses*
(Water Samples)**



☐ In Agreement [2]
▨ Not in Agreement

* Includes groundwater and surface water.

** Field duplicate, field split and interlaboratory split QA/QC samples compared to their respective scheduled sample.

*** Cesium-137 was the only man-made radionuclide detected in the gamma-scan analysis.

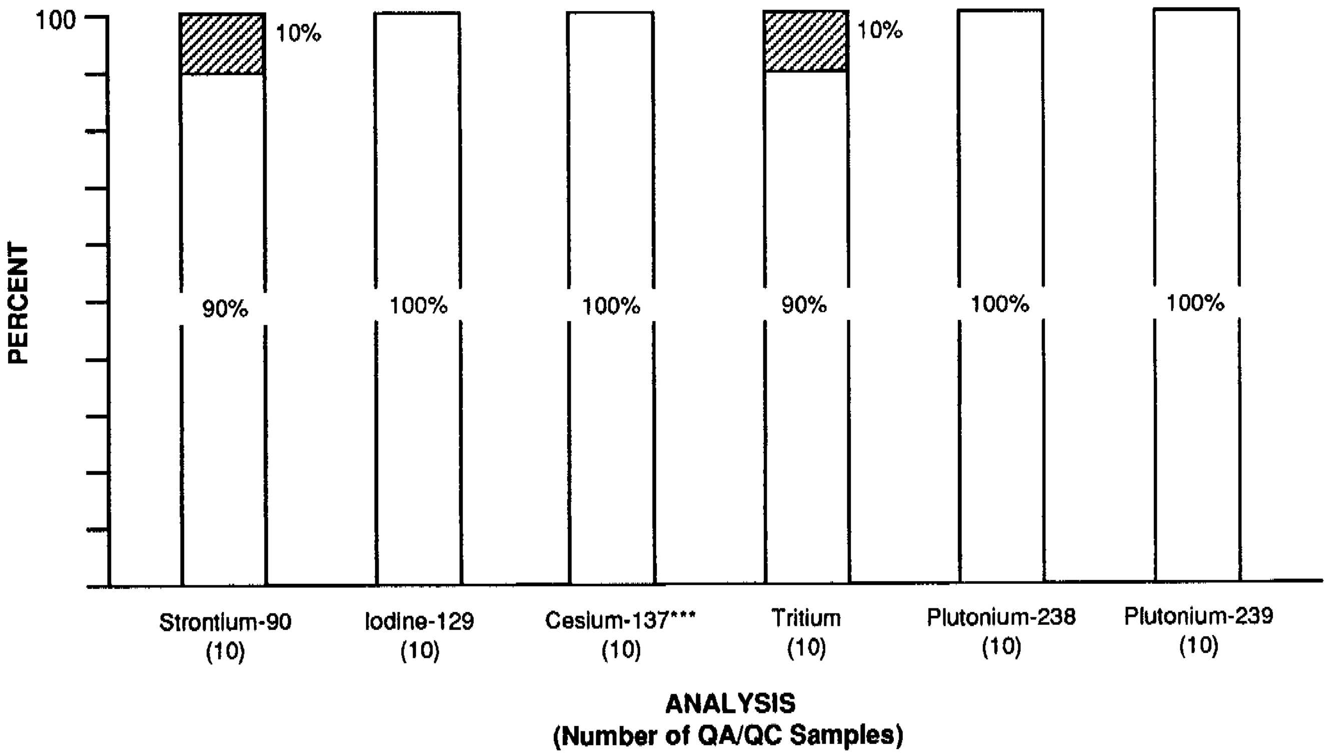
[1] Includes individually the seven metals of interest.

[2] "In agreement" for samples analyzed for chemicals means that the difference between the sample results was less than 50 percent. "In agreement" for samples analyzed for radionuclides means that the difference between the sample results was less than the sum of the standard deviations of the sample results.

SVOCs Semi-Volatile Organic Compound.
VOCs Volatile Organic Compound.

E9211021

Figure 11-3
Quality Assurance / Quality Control (QA/QC) for Key Analyses* (Fruit Samples)**



☐ In Agreement [1]
▨ Not in Agreement

* Field duplicate, field split and interlaboratory split QA/QC samples compared to their respective scheduled sample.
** Includes avocados, oranges, lemons and tangerines.
*** Cesium-137 was the only man-made radionuclide detected in the gamma-scan analysis.

[1] "In agreement" for samples analyzed for chemicals means that the difference between the sample results was less than 50 percent. "In agreement" for samples analyzed for radionuclides means that the difference between the sample results was less than the sum of the standard deviations of the sample results.

SVOCs Semi-Volatile Organic Compound.
VOCs Volatile Organic Compound.

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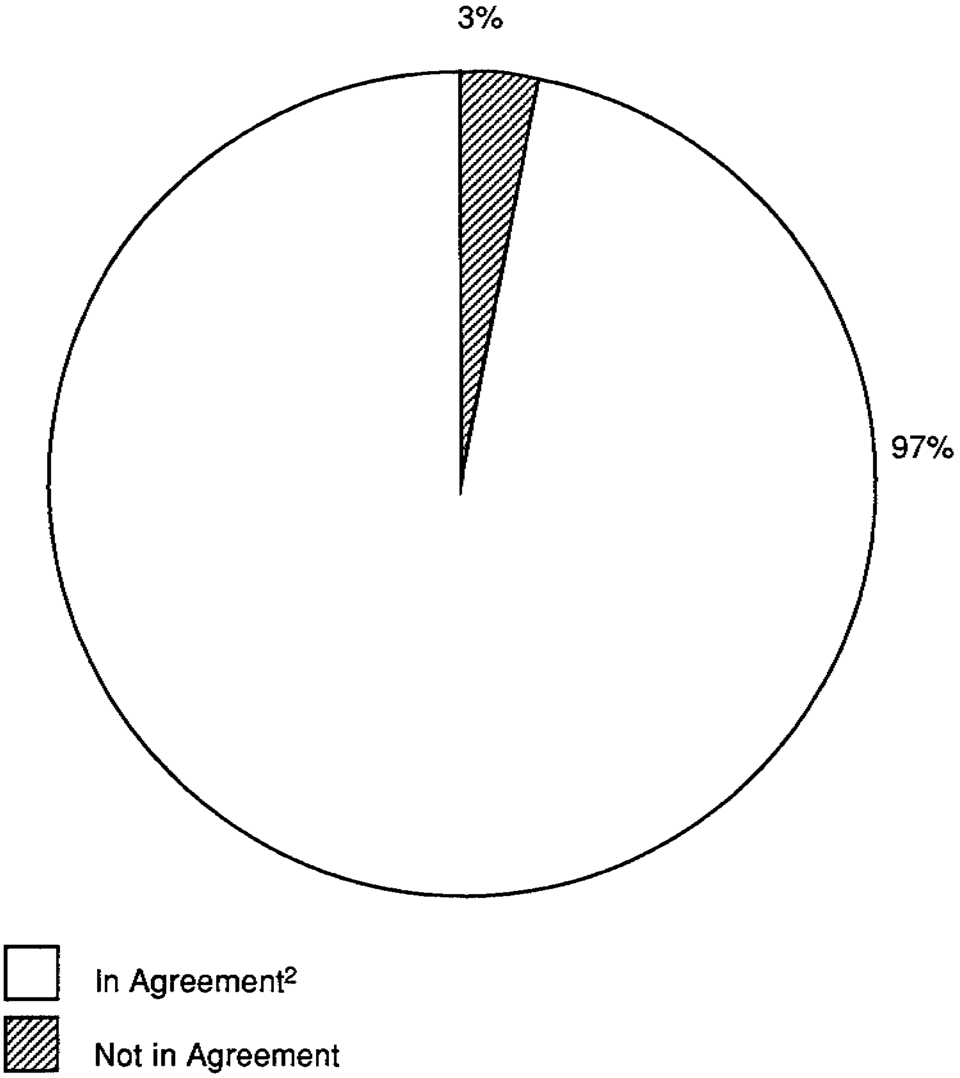
As shown in Figure 11-1, the soil/sediment samples were in 100 percent agreement for semi-volatile organic compounds (SVOCs), strontium-90, iodine-129, and plutonium-239. As shown in Figure 11-2, the water samples (i.e., groundwater and surface water) were in 100 percent agreement for VOCs, SVOCs, metals, iodine-129, cesium-137, tritium, plutonium-238, plutonium-239, and the gross alpha and gross beta radioactivity scans. The strontium-90 samples were in agreement 78 percent of the time, which is equivalent to two samples not being in agreement with their respective scheduled sample. This 22 percent difference is reflective of the small number of water samples and QA/QC samples for water. As shown in Figure 11-3, the fruit samples were in agreement 100 percent of the time for iodine-129, cesium-137, and isotopic plutonium (i.e, plutonium-238 and plutonium-239). The strontium-90 and tritium analyses were in agreement 90 percent of the time.

An appropriate measure of overall project QA/QC is completeness. Completeness refers to the percentage of all QA/QC sample results that are consistent or in agreement. As shown in Figure 11-4, 97 percent of the QA/QC samples, i.e, field duplicates, field split duplicates, and interlaboratory split samples compared to their respective scheduled sample, were in agreement. The matrix spike/matrix spike duplicates (MS/MSD) indicated that there may have been some matrix interference (approximately 11 percent) in the metals analyses for soil/sediment samples; however, the high agreement among the field duplicates, split samples and interlaboratory splits compared to their respective scheduled samples suggested that the matrix interference did not significantly affect the sample results. Equipment reinstates indicated that cross contamination between samples analyzed for metals may have occurred, but was insignificant compared to the concentrations in the soil/sediment. One trip blank showed methylene chloride. Methylene chloride in samples associated with this trip blank was considered to be due to secondary laboratory contamination. Overall, the QA/QC samples strongly validated the data.

Figure 11-4
Overall Quality Assurance / Quality Control (QA/QC) Summary for All Media* / All Analyses**



* All media includes soil/sediment, groundwater, surface water and fruit samples (i.e., avocado, oranges, lemons and tangerines).

** Field duplicate, field split and interlaboratory split QA/QC samples compared to their respective scheduled sample. All analyses includes volatile organic compounds, semivolatile organic compounds, metals, Strontium-90, Iodine-129, Cesium-137, Tritium, Plutonium-238, Plutonium-239, gross alpha scan, and gross beta scan.

[2] "In agreement" for samples analyzed for chemicals means that the difference between the sample results was less than 50 percent. "In agreement" for samples analyzed for radionuclides means that the difference between the sample results was less than the sum of the standard deviations of the sample results.

The tritium results presented in this report were validated by the laboratory and by the QA/QC protocol established for this project. Sixteen of the original 136 (including 18 soil samples at the background areas and 118 soil/sediment samples at the study areas) tritium soil/sediment sample results were withdrawn by the laboratory because the laboratory could not validate the tritium concentration that had been obtained when the gas counting analytical method was used. Ten of those 16 samples were reanalyzed by the liquid scintillation method using interlaboratory samples prior to the conclusion of the final data validation. The results of the ten reanalyses were used in this report upon the consensus of the representative of the USEPA, the DHS, and the consultant to Brandeis-Bardin.

11.2 Organic Chemicals

Observations of organic chemicals in soil were limited to four areas: the Dormitory Area (BB-02), the Counselor-in-Training Area (BB-07), and the Vegetable Garden (BB-11) at the Brandeis-Bardin Institute, and at the Visitor Center Parking Lot (SM-01) at the Conservancy. Organic chemicals were detected in groundwater at the Antenna Well (SM-05) and at the Well by the Gate (SM-07) at the Conservancy and at RD-30 above the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16). No other organic chemicals were detected in the other 19 soil/sediment sampling areas or the 7 surface water sampling locations.

11.2.1 4-Methylphenol

4-Methylphenol (also called p-cresol) was found in one of five soil samples at the Dormitory Area (BB-02) at Brandeis-Bardin at a concentration of 670 micrograms per kilogram of soil (ug/kg). This compound is associated with a variety of uses, including disinfectants and herbicides (Sax and Lewis, 1987).

11.2.2 Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate was found in all five soil samples at the Counselor-in-Training Area (BB-07) at Brandeis-Bardin. The concentrations ranged from 370 to 8,500 ug/kg. This chemical is one of the two most abundantly produced plasticizers (Amdur, Doull, and Klaassen, 1991) and is commonly found in plastic hoses, plastic buckets, etc.

11.2.3 4,4'-Dichlorodiphenyldichloroethene (4,4'-DDE)

One of five soil samples from the Vegetable Garden (BB-11) at Brandeis-Bardin contained 4,4'-DDE at a concentration of 340 milligrams per kilogram (mg/kg) of soil. (The duplicate of a different sample had 360 mg/kg of 4,4'-DDE). 4,4'-DDE is a breakdown product of the pesticide dichlorodiphenyldichloroethane (DDT) (Sax and Lewis, 1987).

11.2.4 Toluene

Low levels of toluene (7 and 9 ug/kg) were found in two of the five soil samples at the Visitor Center Parking Lot (SM-01) at the Conservancy. Toluene is a component of gasoline, and is commonly found in partially combusted gasoline, such as automobile exhaust.

11.2.5 Chlorinated Solvents

Methylene chloride was detected at 7 micrograms per liter of water (ug/L) in the groundwater at the Antenna Well (SM-05) at the Conservancy. Methylene chloride was not detected in the first or third rounds of sampling. Methylene chloride is a common laboratory contaminant.

Trichloroethene (TCE) was observed in the groundwater at the Well by the Gate (SM-07) at the Conservancy at concentrations of 10 and 9 ug/L; the United States Environmental Protection Agency (USEPA) duplicate sample contained 13 ug/L. These concentrations exceed the California drinking water standard for TCE of 5 ug/L (22 CCR 64444.5). This chemical was used by Rocketdyne and is known to be present in groundwater beneath the SSFL.

The TCE and cis-(1,2)-dichloroethene detected in a groundwater monitoring well (RD-30) at the SSFL have been detected in previous sampling events at this well under the Rocketdyne groundwater monitoring program. RD-30 will continue to be monitored as part of this program (see Section 9.16).

11.3 Heavy Metals

The data indicated that three metals were present off-site. Zinc was detected slightly above measured background at the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16) at Brandeis-Bardin. Mercury was detected at the Sodium Burn Pit Watershed (BB-18) at Brandeis-Bardin. Lead was detected above measured background levels at the Former Rocketdyne Employee Shooting Range (SM-03) at the Conservancy. The other twenty soil/sediment sampling areas did not contain metals above measured background concentrations. Metals were not detected above measured background concentrations at the 7 surface water sampling locations.

11.3.1 Zinc

Zinc was detected above measured background in one of the sediment samples (120 mg/kg) at the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16). The ninety-fifth percentile of the measured background for zinc was 112 mg/kg. Two samples from the Bell Canyon Background Area (BG-03) also had zinc at 120 mg/kg.

11.3.2 Mercury

Mercury was found in one (0.35 mg/kg) of nine sediment samples collected in the Sodium Burn Pit Watershed (BB-18) at Brandeis-Bardin. The results from this sample were confirmed by a USEPA split sample at the same location, which had a concentration of 0.40 mg/kg. Mercury was not found in any other samples in this study, including measured background samples. Mercury was known to be present in the Sodium Burn Pit, at SSFL.

11.3.3 Lead

Lead (59 mg/kg to 280 mg/kg) in the soil at the Former Rocketdyne Employee Shooting Range (SM-03) at the Conservancy resulted from an accumulation of lead shot from years of skeet and trap shooting practice. A split sample taken by the USEPA showed lead at 225 mg/kg compared to the corresponding sample concentration of 170 mg/kg, confirming the results of the scheduled sample. Although the samples were collected from only one small area, lead shot was visible over a much larger area (refer to Figure 3-3).

11.4 Radionuclides

Radionuclides were not detected above measured background levels in any of the 95 soil samples collected by McLaren/Hart in the human activity areas sampled on the Brandeis-Bardin or the Conservancy properties. Iodine-129 and plutonium-239 were not detected above the detection limits in any media sampled in the background and study areas, i.e.,the 136 soil/sediment samples, the 11 groundwater or surface water sampling locations, or in the 24 fruit samples. As discussed below, some radionuclides were detected in the watersheds sampled adjacent to the SSFL-Brandeis-Bardin property border above the ninety-fifth percentile of the measured background levels.

11.4.1 Tritium

Of the 118 soil/sediment samples collected for tritium, 111 samples had concentrations within the measured background levels. Tritium was found in the Building 59 Watershed (BB-17) and the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16) sediments at levels above measured background. The measured background concentration of tritium was 552 pCi/L at the ninety-fifth percentile. Concentrations of tritium in the Building 59 Watershed ranged from less than 100 to 10,800 ±300 picocuries per liter of water (pCi/L) and in the RMDF Watershed from less than 190 to 1,500 ± 200 pCi/L. Specifically, the concentrations above the ninety-fifth percentile of the measured background were (in pCi/L): 1) 990 ± 150; 1,100 ± 100; 1,300 ± 300; 1,300 ± 200; and 1,500 ± 200 in the sediment in the RMDF Watershed and 2) 10,800±300 and 9,810± 330 in the sediment in the Building 59 Watershed. These values were confirmed by split samples and interlaboratory splits by the USEPA, the California Department of Health Services (DHS), and the Brandeis-Bardin consultant.

Tritium was not detected above the detection limits in the background surface water sample, in six of the seven surface water samples collected at the study areas, or in groundwater at the wells. One surface water sample in the RMDF Watershed (BB-16) at Brandeis-Bardin had a tritium concentration of 1,500 ±100 pCi/L, which is below the California drinking water standard of 20,000 pCi/L (22 California Code of Regulations (CCR) 64443).

Tritium was not detected above the measured background levels in any of the fruit samples collected.

11.4.2 Strontium-90

Of the 118 soil/sediment samples collected in the study areas, 113 were below the ninety-fifth percentile of the measured background concentration for strontium-90 of approximately 0.07 picocuries per gram of dried sediment [pCi/g(dry)]. Strontium-90 was observed in sediment in two of the four sediment samples at the Sodium Reactor Experiment (SRE) Watershed (BB-19) [0.08 ±0.02 pCi/g(dry) and 0.09 ±0.02 pCi/g(dry)]. Three of the six sediment samples greater than the ninety-fifth percentile of the background data at the RMDF Watershed had the following concentrations: 0.08 ±0.01 pCi/g(dry); 0.09 ±0.01 pCi/g(dry); and 0.15 ±0.02 pCi/g(dry).

Strontium-90 was not detected above the detection limits (less than 0.3 pCi/L to less than 0.4 pCi/L) in any groundwater sample. Of the eight surface water sampling locations (including the background sampling location) strontium-90 was detected at the two sampling locations at the RMDF Watershed (BB-16) at 1.1 ±0.3 pCi/L and 1.8 ±0.5 pCi/L. The USEPA split sample at the RMDF contained 7.8 ±0.5 pCi/L of strontium-90 compared with 1.8 ±0.5 pCi/L in the McLaren/Hart sample. (Refer to Section 6.0 for a discussion

Tritium was not detected above the detection limits in the background surface water sample, in six of the seven surface water samples collected at the study areas, or in groundwater at the wells. One surface water sample in the RMDF Watershed (BB-16) at Brandeis-Bardin had a tritium concentration of 1,500 ±100 pCi/L, which is below the California drinking water standard of 20,000 pCi/L (22 California Code of Regulations (CCR) 64443).

Tritium was not detected above the measured background levels in any of the fruit samples collected.

11.4.2 Strontium-90

Of the 118 soil/sediment samples collected in the study areas, 113 were below the ninety-fifth percentile of the measured background concentration for strontium-90 of approximately 0.07 picocuries per gram of dried sediment [pCi/g(dry)]. Strontium-90 was observed in sediment in two of the four sediment samples at the Sodium Reactor Experiment (SRE) Watershed (BB-19) [0.08 ±0.02 pCi/g(dry) and 0.09 ±0.02 pCi/g(dry)]. Three of the six sediment samples greater than the ninety-fifth percentile of the background data at the RMDF Watershed had the following concentrations: 0.08 ±0.01 pCi/g(dry); 0.09 ±0.01 pCi/g(dry); and 0.15 ±0.02 pCi/g(dry).

Strontium-90 was not detected above the detection limits (less than 0.3 pCi/L to less than 0.4 pCi/L) in any groundwater sample. Of the eight surface water sampling locations (including the background sampling location) strontium-90 was detected at the two sampling locations at the RMDF Watershed (BB-16) at 1.1 ±0.3 pCi/L and 1.8 ±0.5 pCi/L. The USEPA split sample at the RMDF contained 7.8 ±0.5 pCi/L of strontium-90 compared with 1.8 ±0.5 pCi/L in the McLaren/Hart sample. (Refer to Section 6.0 for a discussion regarding differences between split samples and the scheduled sample.) Strontium-90 was below measured background levels in all fruit samples.

The strontium-90 results should be evaluated in light of the following facts:

1) The detection levels used by the USEPA for soil/sediment ranged from 0.62 to 0.74 pCi/g(dry), a value four to five times higher than the highest concentration of strontium-90 detected in soil or sediment in this study (USEPA, 1993).

2) A historical spill/release of radioactive materials occurred in the RMDF Watershed on the SSFL which contained strontium-90. This was cleaned up in 1978. Potential exposure pathways and doses were evaluated and the results summarized in an environmental evaluation report in February, 1982. The evaluation concluded that the potential doses of residual radionuclides in the soil were orders-of-magnitude lower than the release limits for unrestricted use.

3) The drinking water standard for strontium-90 is 8.0 pCi/L (22 CCR 64443). USEPA has proposed a drinking water standard for strontium-90 of 42.0 pCi/L based on a revised estimate of strontium-90 dose (Federal Register 56, 1991).

4) Background concentrations of strontium-90 in soil reported in published literature are in the range of 0.16 to 0.32 pCi/g(dry) (Eisenbud, 1987; UNSCEAR, 1969; and Ritchie and McHenry, 1977).

5) Sediment data from the ravines were not statistically compared to background. Instead, individual sediment samples were compared to the ninety-fifth percentile of the background soil samples resulting in five strontium-90 values being reported as different from background. When the t-test was run on the strontium-90 data from the ravines, they were not different from background.

11.4.3 Cesium-137

Four of the 118 soil/sediment samples collected were determined to be above the ninety-fifth percentile of the measured background concentrations for cesium-137 of 0.21 pCi/g(dry). Cesium-137 was observed in sediment from the RMDF Watershed (BB-16) at 0.34 ±0.04 pCi/g(dry) and in the corresponding DHS duplicate sediment sample at 0.60 ±0.03 pCi/g(dry), the Building 59 Watershed (BB-17) at 0.23 ±0.03 pCi/g(dry) and the SRE Watershed (BB-19) at 0.30 ±0.05 pCi/g(dry) and 0.24 ±0.06 pCi/g(dry). Cesium-137 was below the detection limits for all water and fruit samples.

The cesium-137 results should be evaluated in light of the following facts:

1) Background concentrations of cesium-137 in soil reported in the published literature are in the range of 0.01 to 0.39 pCi/g(dry) (Layton, 1990), 0.1 - 0.80 pCi/g(dry) (Gustafson; 1969, 1970), and 0.3 - 1.4 pCi/g(dry) (Ritchie and McHenry; 1977, 1982). The observed concentrations in this study were within these ranges.

2) A historical spill/release of radioactive materials occurred in the RMDF Watershed on the SSFL which contained cesium-137. This was cleaned up in 1978. Potential exposure pathways and doses were evaluated and the results summarized in an environmental evaluation report in February, 1982. The evaluation concluded that the potential doses of residual radionuclides in the soil were orders-of-magnitude lower than the release limits for unrestricted use.

3) Sediment data from the ravines were not statistically compared to background. Instead, individual sediment samples were compared to the ninety-fifth percentile of the background soil samples resulting in four cesium-137 values being reported as different from background. When the t-test was run on the cesium-137 data from the ravines, they were not different from background.

11.4.4 Plutonium-238

Two of the 118 soil/sediment samples collected were above the ninety-fifth percentile of the measured background, of 0.10 pCi/g(dry). Plutonium-238 was detected above measured background in one of four sediment sample locations at the Building 59 Watershed (BB-17) [0.19 ±0.06 pCi/g(dry)] and in one of five sediment sample locations at the RD-51 Watershed (BB-15) [0.22 ±0.07 pCi/g(dry)]. Plutonium-238 was not detected in the seven surface water sampling locations, in groundwater sampling locations, or in the nine fruit samples.

The plutonium-238 data should be evaluated in light of the following facts:

1) All plutonium used at the SSFL was highly enriched in the plutonium-239 isotope and not the plutonium-238 isotope. Plutonium-239 was not detected in any medium even though the plutonium-239 detection limit was up to seven times lower (more sensitive) than that for plutonium-238.

2) Isotopic plutonium from nuclear weapons testing fallout is retained in the upper 2-3 inches of soil (Eisenbud, 1987), rainfall would selectively erode plutonium-containing soil particles which would then accumulate in the sediments.

3) Global background for plutonium-238 in the published literature ranged from 0.00004 to 0.0018 pCi/g(dry) (Beck, 1992). The samples from Beck's study were collected between 1958 and 1960, and, therefore, do not reflect radionuclide deposition from atmospheric nuclear testing between 1960 and 1963 or the re-entry of the TRANSIT 5A satellite in 1964 which deposited twice the amount of plutonium-238 than for all weapons fallout (Eisenbud, 1987).

4) Sediment data from the ravines were not statistically compared to background. Instead, individual sediment samples were compared to the ninety-fifth percentile of the background soil samples resulting in two plutonium-238 values being reported as different from background. When the t-test was run on the plutonium-238 data from the ravines, they were not different from background.

SECTION 12.0

CONCLUSIONS

In this study, 118 soil/sediment samples, 9 fruit samples, 3 groundwater samples, and 7 surface water samples were collected from Study Areas at Brandeis-Bardin and the Conservancy. The soil/sediment samples were analyzed for 37 volatile organic compounds (VOCs) [USEPA Method 8240], 67 semi-volatile organic compounds (SVOCs) [USEPA Method 8270], 13 priority pollutant metals [USEPA Methods 6000 and 7000 series], tritium, isotopic plutonium (plutonium-238 and plutonium-239), iodine-129, strontium-90, and a gamma scan which measured 75 other radionuclides, both naturally occurring (e.g., potassium-40) and man made (e.g., cesium-137). Fruit samples were analyzed only for the radionuclides cited above. Surface water was analyzed for the full suite of chemicals and radionuclides listed above as well as for gross alpha/beta radioactivity. Groundwater was analyzed for the same compounds as surface water except for metals. The results were compared to 18 soil samples, 15 fruit samples, and one surface water sample from Background Areas analyzed for the same suites of compounds listed above to determine if the values in the Study Areas exceeded the values in the Background Areas.

Methylene chloride was detected in a trip blank, which was indicative of laboratory contamination. Zinc, copper, iron, and chromium were detected in a few of the equipment rinsate blanks at relatively low concentrations. Some matrix interferences were documented in the metals analyses for some of the soil/sediment samples. There was a high agreement between field duplicates, split samples and interlaboratory split samples with their respective scheduled sample, which indicated that overall matrix interferences were not significant. None of these observations were large enough or consistent enough to affect the validity of the data.

A comparison of the split field duplicates, the blind field duplicates, and the interlaboratory split duplicates with the scheduled samples indicated that the overall agreement of these QA/QC samples with the scheduled samples was 97%. The data in this report were determined to be valid and representative. The conclusions based on the data in this report are summarized below. The data presented below are illustrated on Figure 12-1.

4-methylphenol, bis(2-ethylhexyl)phthalate, 4,4'-dichlorodiphenyldichloroethene (4,4'-DDE), and zinc were reported in the soil/sediment at the Brandeis-Bardin and toluene was reported in the soil at the Conservancy. These were not related to off-site migration and/or deposition from the SSFL. (See Section 11.0 for further discussion.)

Methylene chloride was reported in the second round of groundwater sampling at the Antenna Well (SM-05) at the Conservancy but not in the first or third rounds of sampling. The methylene chloride in the second round was most likely due to laboratory contamination. This well has been included in the ongoing groundwater monitoring program conducted by Rocketdyne.

Trichloroethene (TCE) was reported in the groundwater in the Well by the Gate (SM-07). This was a result of off-site migration of this chemical, since it was well documented that the groundwater below the SSFL contains TCE. This well has been included in the ongoing groundwater monitoring program conducted by Rocketdyne.

Lead was reported in the soil at the Former Rocketdyne Employee Shooting Range (SM-03) sample area at the Conservancy. This lead was due to Rocketdyne's employee shooting range activities (i.e., skeet and trap shooting). Rocketdyne assumed responsibility for the cleanup. Cleanup of the lead shot was begun by Rocketdyne on October 19, 1992.

Mercury was reported in the one sediment sample in the Sodium Burn Pit Watershed (BB-18) at Brandeis-Bardin. This mercury was from the SSFL, since mercury was known to be contained in the former Sodium Burn Pit. Excavation and cleanup of the former Sodium Burn Pit is in progress. The total volume of sediment at the sampling location where the mercury was detected was very small (approximately one cubic yard). It was recommended that it be removed by Rocketdyne and properly disposed.

Tritium was detected in three sediment samples in the Radioactive Materials Disposal Facility (RMDF) Watershed (BB-16) and in two sediment samples in the Building 59 Watershed (BB-17) at Brandeis-Bardin. The tritium was due to off-site migration from the SSFL.

The strontium-90 and tritium concentrations detected in the RMDF Watershed surface water were less than their corresponding maximum contaminant levels (MCLs) for drinking water.

It could not be definitively concluded whether the concentrations of strontium-90, cesium-137 and plutonium-238 in the sediment samples detected above the ninety-fifth percentile of the measured background were due to off-site migration from the SSFL, because when the t-tests were run, the concentrations of these radionuclides in the ravines were not different from background.

Additional sampling may be warranted, for example, to monitor the RMDF and Building 59 Watersheds areas. Recommendations will be solicited by Rocketdyne after review of this report by the regulatory agencies, the SSFL work group, and the public and appropriate follow-up activities will be conducted.

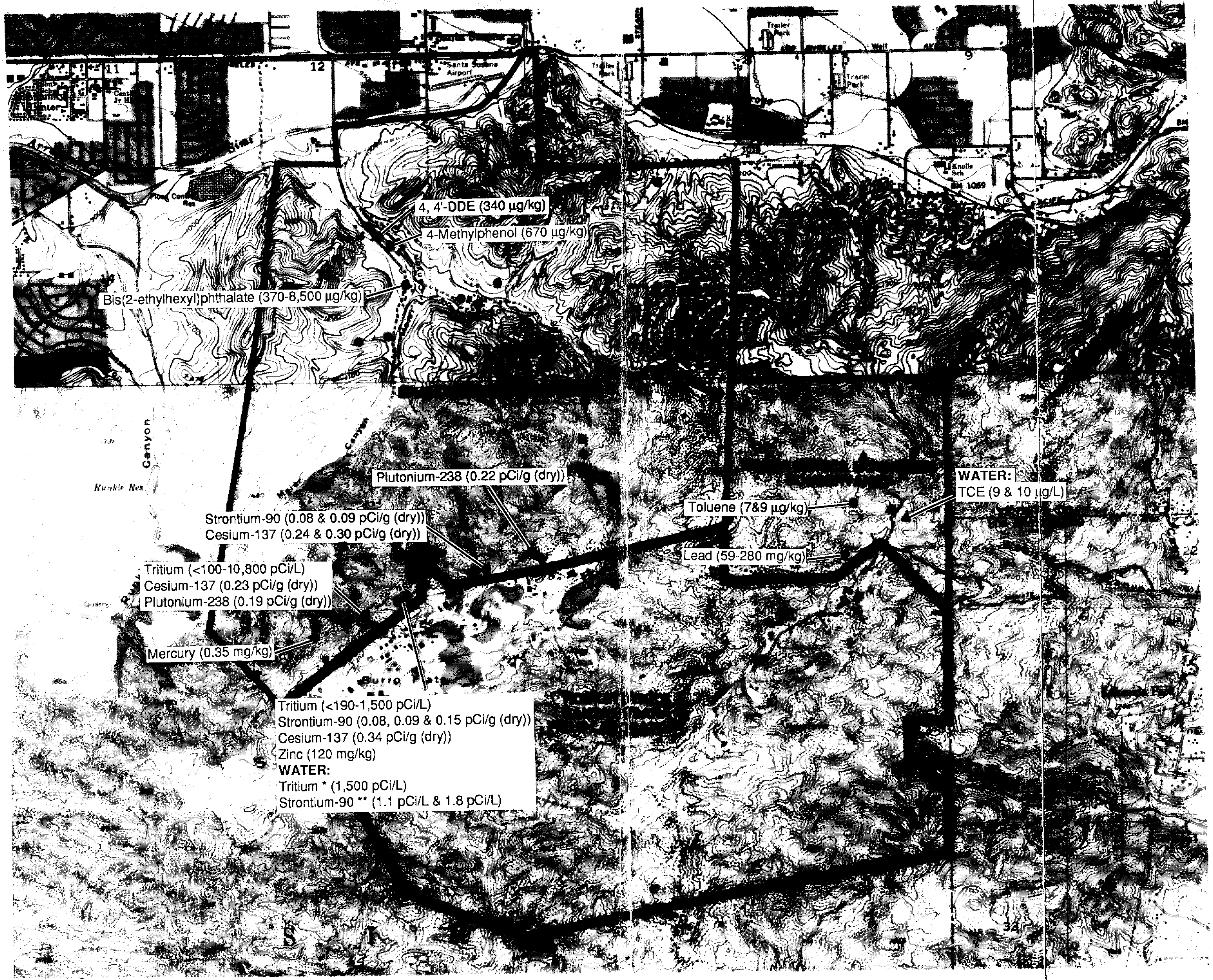


FIGURE 12-1
SUMMARY OF
MULTI-MEDIA SAMPLING

LEGEND

▲	Groundwater Sample
●	Soil / Sediment Sample
■	Surface Water Sample
µg/kg	Micrograms Per Kilogram
µg/L	Micrograms Per Liter
mg/kg	Milligrams Per Kilogram
pCi/L	Picocuries Per Liter
pCi/g (dry)	Picocuries Per Gram (Dry
DDE	Dichlorodiphenyldichloro-ethene
TCE	Trichloroethene
<	Less Than
*	Below The Maximum Contaminant Limit (MCL) of 20,000 pCi/L
**	Below The MCL of 8 pCi/

NOTE: Only McLaren/Hart results are shown. Results are for so samples unless otherwise indicated.

N

0 2,350'

SCALE

McLaren Hart

SECTION 13.0

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13.2 Recommended Reading

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13.3 Glossary

Analysis of Variance (ANOVA) - Analysis of variance was used to test the hypothesis that the means of all the Background Areas are the same. The method evaluates how much of the total variance in the Background Area samples comes from the differences between the sample area mean and the total Background Area mean and how much of the variance comes from the differences between the individual data points within a sample area and the sample area mean.

Accuracy - The degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference (or true) value, T. Accuracy is usually expressed as the difference between the two values expressed as a percentage of the reference (or true) value [100*(X-T)/T]. Accuracy is a measure of the bias in a system.

Behrens-Fisher t-Test - A hypothesis test used to identify whether the means of two small sample sets from approximately normally distributed populations are the same.

Blind Field Duplicates - Blind field duplicate samples were collected in the field by collecting twice the amount of a media (soil, water, fruit) as was necessary for the analysis. The media was thoroughly mixed in the field and split between two sample containers. One container was labeled with the appropriate identifier for the location and the other was labeled so its identity could not be traced. The results of the separate analyses should have been very similar and were compared to verify the quality of the data.

Chemicals - A general term used in this report to refer to volatile organic compounds, semi-volatile organic compounds, and priority pollutant metals analyzed using the USEPA methods described in this report.

Completeness - A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under ideal conditions.

Control Limit - Acceptance limits set within the laboratory to determine whether sample results for matrix spike and matrix spike duplicate sample recoveries were acceptable. Control limits varied between analytes depending upon the analytical method and the laboratory's prior experience with matrix interference for the analyte.

Detection Limit - The minimum level detected by the analytical equipment. The value of the detection limit for a particular analyte in a specific analysis may vary with factors such as extraction method, the matrix, and the analytical equipment. The detection limit was the minimum reported value for radionuclide analyses.

Duplicate Count - A second count of the radioactivity for the same sample aliquot.

Error - For radionuclide analytical results, the error is reported as two standard deviations above and below the reported value. The error represents the range of possible values based on the counting statistics only. The error does account for other systematic or random errors during the analysis process.

Field Blank Samples - Field blank samples consisted of distilled water poured into the sample containers (bottles) to ensure the containers did not affect sample results.

Field Rinsate Samples - Field rinsate samples were collected to ensure proper rinsing of field equipment. After sampling equipment was decontaminated, rinsate samples were collected, by pouring distilled water over the equipment (e.g. sample driver and brass sleeve and collecting the water in appropriate sample containers.

Holding Time - The length of time a between sample collection and sample analysis during which the integrity of the sample is not affected. Holding times vary between analyses.

Interlaboratory Duplicate (Laboratory Split) - A sample collected in the field and analyzed using Method "A" at laboratory "X" which was transported to laboratory "Y" and analyzed using Method "B". The samples were collected from the same location approximately adjacent to one another. For example, a soil sample collected and shipped to the Teledyne laboratory in Illinois and analyzed for strontium-90 and iodine-129. The remainder of which was shipped to the Teledyne laboratory in New Jersey for tritium analysis was a interlaboratory duplicate (laboratory split) sample.

Laboratory Blank Samples - Laboratory blank samples were aliquots of distilled water analyzed to ensure that the analytical instrument or residuals from previous analyses did not contribute to sample analytical results.

Laboratory Control Sample - Laboratory control samples are a known matrix (sand, distilled water) spiked with compound(s) representative of the target analytes. This analysis is used to document laboratory performance.

Matrix Spike - Matrix spike samples are collected in the field and analyzed by the laboratory. A known amount ("spike") of the chemical(s) of interest is added to the sample.

The percent recovery of the chemical is an estimate of the accuracy of the sample measurements and the affect of the environmental matrix.

Matrix Spike Duplicate - Matrix spike duplicate samples are a portion of the original matrix spike sample which were "spiked" with the same amount of the chemical(s) of interest as the matrix spike sample. The percent recovery is again an estimate of the accuracy of the sample measurements. A comparison between the matrix spike and matrix spike duplicate sample (relative percent difference) measures the precision of the measurements.

Significance probability (p-value) - The test statistic used in the ANOVA to determine whether the hypothesis that the Background Areas had the same mean is accepted or rejected.

Radionuclides - A general term used in this report used to refer to iodine-129, strontium-90, isotopic plutonium, gamma-emitting radionuclides (specifically cesium-137), and tritium.

Relative Percent Difference (RPD) - A quantitative measure of the precision between sample results which should be identical. If sample result 1 is "X" and sample result 2 is "Y", then the relative percent difference is $|X-Y|/\{(X+Y)/2\}$. The symbol "$|x|$" refers to the absolute value of x.

Reporting Limit - For chemical analyses, VOCs, SVOCs, and priority pollutant metals, this is the minimum detectable concentration that is reproducible. The reporting limit is the minimum value reported for chemical analyses.

Precision - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the relative percent difference and/or the standard deviation.

Sampling Area - This term refers to an area within one of the study or background areas from which samples were collected.

Sampling Block - This term refers to the randomly selected blocks within a sampling area grid or from the non-random sample locations in the ravine areas from which discrete soil samples were collected.

Sampling Location - This term refers to a specific point where a soil sample (within a sampling block or at a designated location in a drainage sampling area) or surface water sample was collected, or the specific tree or well from which samples were obtained.

Significant Differences - The definition of significant differences was used to determine whether blind field duplicate or split samples were in agreement. For radionuclide analyses, samples were considered significantly different if the sum of the standard errors for the two results did not account for the difference between the two analytical values. For chemical samples, samples were considered significantly different if the values differed by greater than 50 percent.

Standard Deviation - A statistical representation of the variation between a set of values from the same population. For normal distributions, 95 percent of the potential values fall within two standard deviations of the mean value.

Split Samples - Split samples were collected using the same procedure described under "Blind Field Duplicate" samples. Rather than send both samples to the same lab under separate identification, one sample was analyzed by the project laboratory and one sample was analyzed by a separate laboratory under the direction of USEPA, DHS, or the Brandeis-Bardin consultant.

Surrogate - An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples.

Trip Blanks - Trip blanks were distilled water samples collected prior to sampling which traveled with the samples from the field to the laboratory. Trip blanks were analyzed for volatile organic compounds to ensure sample integrity was maintained throughout transport and in the laboratory.

APPENDIX A

REPORTING OR DETECTION LIMITS FOR EACH ANALYSIS

REPORTING LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOCs) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8240

VOC	MEDIA	
	SOIL (ug/kg)	WATER (ug/L)
1,1-Dichloroethane	5	5
1,1-Dichloroethene	5	5
1,1,1-Trichloroethane	5	5
1,1,2-Trichloroethane	5	5
1,1,2,2-Tetrachloroethane	5	5
1,2-Dichlorobenzene {b}	5	5
1,2-Dichloroethane	5	5
1,2-Dichloropropane	5	5
1,3-Dichlorobenzene {b}	5	5
1,4-Dichlorobenzene {b}	5	5
2-Butanone	25	25
2-Chloroethylvinylether	10	10
2-Hexanone	25	25
4-Methyl-2-pentanone	25	25
Acetone	25	25
Benzene	5	5
Bromodichloromethane	5	5
Bromoform	5	5
Bromomethane	10	10
Carbon Disulfide	5	5
Carbon Tetrachloride	5	5
Chlorobenzene	5	5
Chloroethane	10	10
Chloroform	5	5
Chloromethane	10	10

REPORTING LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOCS) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8240

VOC	MEDIA	
	SOIL (ug/kg)	WATER (ug/L)
cis-1,2-Dichloroethene {b}	5	5
cis-1,3-Dichloropropene	5	5
Dibromochloromethane	5	5
Ethylbenzene	5	5
m & p-Xylene	5	5
Methylene Chloride	5	5
o-Xylene	5	5
Styrene	5	5
Tetrachloroethene	5	5
Toluene	5	5
trans-1,2,Dichloroethene	5	5
trans-1,3-Dichloropropene	5	5
Trichloroethene	5	5
Trichlorofluoromethane	10	10
Vinyl Chloride	10	10

ug/kg - Micrograms per kilogram
ug/L - Micrograms per liter

REPORTING LIMITS FOR SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8270 OR 610

SVOC	SOIL (ug/kg) USEPA METHOD 8270	WATER (ug/L)	
		USEPA METHOD 8270	USEPA METHOD 610
1,2-Dichlorobenzene	330	10	NA
1,2,4-Trichlorobenzene	330	10	NA
1,3-Dichlorobenzene	330	10	NA
1,4-Dichlorobenzene	330	10	NA
2-Chloronaphthalene	330	10	NA
2-Methylnaphthalene	330	10	NA
2-Chlorophenol	330	10	NA
2-Methylphenol	330	10	NA
2-Nitroaniline	1600	50	NA
2-Nitrophenol	330	10	NA
2,4-Dichlorophenol	330	10	NA
2,4-Dimethylphenol	330	10	NA
2,4-Dinitrophenol	1600	50	NA
2,4-Dinitrotoluene	330	10	NA
2,4,5-Trichlorophenol	330	10	NA
2,4,6-Trichlorophenol	330	10	NA
2,6-Dinitrotoluene	330	10	NA
3-Nitroaniline	1600	50	NA
3,3'-Dichlorobenzidine	660	20	NA
4-Bromophenyl phenyl ether	330	10	NA
4-Chloro-3-methylphenol	330	10	NA
4-Chloroaniline	330	10	NA
4-Chlorophenyl phenyl ether	330	10	NA
4-Methylphenol	330	10	NA
4-Nitroaniline	1600	50	NA

REPORTING LIMITS FOR SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8270 OR 610

SVOC	SOIL (ug/kg) USEPA METHOD 8270	WATER (ug/L)	
		USEPA METHOD 8270	USEPA METHOD 610
4-Nitrophenol	1600	50	NA
4,4'-DDD {b}	330	10	NA
4,4'-DDE {b}	330	10	NA
4,4'-DDT {b}	330	10	NA
4,6-Dinitro-2-methylphenol	1600	50	NA
Acenaphthene	330	10	10
Acenaphthylene	330	10	10
Aldrin {b}	330	10	NA
alpha-BHC {b}	330	10	NA
Anthracene	330	10	10
Benzo(a)anthracene	330	10	20
Benzo(a)pyrene	330	10	20
Benzo(b)fluoranthene	330	10	20
Benzo(g,h,i)perylene	330	10	50
Benzo(k)fluoranthene	330	10	20
Benzoic Acid	1600	50	NA
Benzyl Alcohol	330	10	NA
beta-BHC {b}	330	10	NA
Bis(2-ethylhexyl)phthalate	330	10	NA
Bis(2-chloroisopropyl)ether	330	10	NA
Bis(2-chloroethoxy)methane	330	10	NA
Bis(2-chloroethyl) ether	330	10	NA
Butyl benzyl phthalate	330	10	NA
Chrysene	330	10	20
Delta-BHC {b}	330	10	NA

REPORTING LIMITS FOR SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8270 OR 610

SVOC	SOIL (ug/kg) USEPA METHOD 8270	WATER (ug/L)	
		USEPA METHOD 8270	USEPA METHOD 610
Di-n-butylphthalate	330	10	NA
Di-n-octylphthalate	330	10	NA
Dibenzo(a,h)anthracene	330	10	50
Dibenzofuran	330	10	NA
Dieldrin {b}	330	10	NA
Diethylphthalate	330	10	NA
Dimethylphthalate	330	10	NA
Endosulfan sulfate	330	10	NA
Endrin {b}	330	10	NA
Fluoranthene	330	10	10
Fluorene	330	10	10
Heptachlor {b}	330	10	NA
Heptachlor Epoxide	330	10	NA
Hexachlorobenzene	330	10	NA
Hexachlorobutadiene	330	10	NA
Hexachlorocyclopentadiene	330	10	NA
Hexachloroethane	330	10	NA
Indeno(1,2,3-c,d)pyrene	330	10	50
Isophorone	330	10	NA
Lindane {b}	330	10	NA
N-Nitrosodiphenylamine	330	10	NA
N-Nitroso-di-n-propylamine	330	10	NA
Naphthalene	330	10	10
Nitrobenzene	330	10	NA
Pentachlorophenol	1600	50	NA

REPORTING LIMITS FOR SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) REPORTED BY MCLAREN/HART ANALYTICAL LABORATORY USING USEPA METHOD 8270 OR 610

SVOC	SOIL (ug/kg) USEPA METHOD 8270	WATER (ug/L)	
		USEPA METHOD 8270	USEPA METHOD 610
Phenanthrene	330	10	10
Phenol	330	10	NA
Pyrene	330	10	10

NA - Not analyzed in USEPA Method 610
ug/kg - Micrograms per kilogram
ug/L - Micrograms per liter

REPORTING LIMITS FOR METALS

METALS	MEDIA	
	SOIL (mg/kg)	WATER (ug/L)
Antimony	2.5	50
Arsenic	2.5	10
Beryllium	.25	5
Cadmium	.50	10
Chromium	1.0	10
Copper	1.0	20
Lead	2.5	3
Mercury	.25	.5
Nickel	1.0	20
Selenium	.25	5
Silver	1.0	10
Thallium	.50	10
Zinc	1.0	20

mg/kg - Milligrams per kilogram
ug/L - Micrograms per liter

RANGE OF DETECTION LIMITS FOR MAN-MADE RADIONUCLIDES DISCUSSED IN THE REPORT

Radionuclides	Media		
	Soil	Water	Fruit
Cesium-137*	0.03-0.07 pCi/g(dry)	2-5 pCi/L	0.003-0.008 pCi/g(wet)
Gross Beta	NA	3-4 pCi/L	NA
Gross Alpha	NA	2-7 pCi/L	NA
Iodine-129	0.1-0.4 pCi/g(dry)	0.7-1.8 pCi/L	0.01-0.04 pCi/g(wet)
Isotopic Plutonium	0.006-0.08 pCi/g(dry)	0.2-0.8 pCi/L	0.0009-0.002 pCi/g(wet)
Strontium-90	0.01 pCi/g(dry)	0.3-0.4 pCi/L	0.002-0.008 pCi/g(wet)
Tritium	100-300 pCi/L	100-200 pCi/L	100-200 pCi/L

* Cesium-137 was the only man-made radionuclide detected by the gamma scan analysis.

pCi/g(dry) - Picocuries per gram of dried sample
pCi/g(wet) - Picocuries per gram of undried sample
pCi/L - Picocuries per liter

RANGE OF DETECTION LIMITS FOR RADIONUCLIDES INCLUDED IN THE GAMMA SCAN ANALYSIS (OTHER THAN CESIUM-137)

RADIONUCLIDE	MEDIA		
	SOIL PCI/G(DRY)	WATER PCI/L	FRUIT PCI/G(WET)
Beryllium-7	0.3-1.0	30-50	0.04.0.5
Potasium-40	*	50-60	**
Manganese-54	0.03-0.06	3	0.005-0.04
Cobalt-58	0.03-0.1	3-5	0.004-0.006
Iron-59	0.08-0.4	9-10	0.01
Cobalt-60	0.03-0.06	3-4	0.004-0.006
Zinc-65	0.08-0.2	5-8	0.009-0.1
Zironium-95	0.04-0.1	3-6	0.004-0.006
Ruthenium-103	0.03-0.2	5-8	0.005-0.006
Rutheniumn-106	0.3-0.5	20-30	0.04-0.05
Iodine-131	0.1-0.6	20-300	0.01
Cesium-134	0.03-0.07	3-4	0.004-0.006
Barium-140	0.08-0.5	1-4	0.006-0.008
Cerium-141	0.06-0.4	9-20	0.007-0.01
Cerium-144	0.2-0.4	20-30	0.01-0.05
Radium-226	*	60-80	0.05-0.1
Thorium-228	*	6-7	0.007-0.01

* Potassium-40, Radium-226, and Thorium-228 (naturally occurring radionuclides in soil) were detected at natural background levels in soil samples.

** Potassium-40 (a naturally occurring radionuclide in fruit) was detected at natural backgorund levels in fruit samples.

pCi/g(dry) - Picocuries per gram of dried sample
pCi/g(wet) - Picocuries per gram of undried sample
pCi/L - Picocuries per liter of water

APPENDIX B

RANDOM NUMBER TABLES

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 01
PERIMETER OF PLAYGROUND

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	56	4	6	51	4	9	6
2	70	5	1	52	13	6	5
3	41	8	1	53	1	4	10
4	85	3	5	54	71	1	7
5	70	5	9	55	99	3	8
6	52	3	8	56	16	4	5
7	20	9	2	57	13	9	1
8	15	5	8	58	53	6	4
9	96	6	3	59	27	6	6
10	10	5	10	60	38	9	8
11	1	3	4	61	45	7	6
12	51	8	8	62	32	1	1
13	68	2	10	63	82	9	10
14	56	0	0	64	31	7	6
15	49	7	Π	65	23	0	9
16	27	1	9	66	72	5	7
17	50	9	9	67	90	9	3
18	67	1	0	68	38	10	6
19	19	10	7	69	53	3	2
20	38	2	4	70	58	10	9
21	11	9	8	71	9	4	0
22	38	3	0	72	75	7	4
23	43	5	7	73	65	7	6
24	56	2	7	74	70	0	5
25	48	7	3	75	55	7	4
26	44	5	0	76	76	8	1
27	50	5	7	77	59	7	2
28	97	1	8	78	98	4	5
29	54	2	4	79	15	3	8
30	86	5	0	80	69	5	5
31	27	7	6	81	52	2	0
32	35	3	5	82	48	2	5
33	8	5	3	83	64	8	0
34	10	9	6	84	25	6	0
35	80	3	8	85	54	3	10
36	65	4	1	86	48	9	10
37	52	0	6	87	3	9	4
38	58	3	5	88	48	5	1
39	78	3	4	89	59	6	9
40	27	0	4	90	37	2	8
41	61	3	2	91	85	7	7
42	47	5	10	92	26	5	6
43	56	1	6	93	4	2	1
44	33	2	9	94	13	9	3
45	20	4	0	95	77	9	8
46	37	3	7	96	84	2	9
47	64	8	4	97	11	1	0
48	8	0	9	98	98	3	7
49	59	4	2	99	71	9	7
50	67	10	8	100	41	1	9

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.
☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 02
DORMITORY AREA

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	81	8	0	51	36	7	8
2	71	4	5	52	83	2	1
3	45	1	6	53	22	10	7
4	86	8	0	54	23	3	5
5	60	9	2	55	31	1	0
6	75	7	9	56	66	7	8
7	98	3	2	57	10	0	1
8	78	8	8	58	20	6	0
9	87	1	2	59	3	9	0
10	14	7	6	60	40	9	1
11	62	0	0	61	62	8	7
12	84	4	3	62	48	8	7
13	76	5	9	63	37	9	7
14	90	6	6	64	83	9	6
15	44	1	6	65	64	5	2
16	89	3	1	66	98	6	2
17	27	6	8	67	48	3	9
18	77	1	9	68	34	1	5
19	80	1	0	69	42	5	7
20	2	3	1	70	54	7	6
21	20	2	3	71	86	5	6
22	21	1	6	72	60	1	8
23	90	8	4	73	19	9	6
24	30	9	9	74	57	6	6
25	38	9	4	75	61	0	8
26	45	4	3	76	34	4	9
27	67	7	2	77	65	1	7
28	24	7	9	78	33	10	2
29	96	6	6	79	2	2	9
30	37	10	8	80	96	2	8
31	9	3	9	81	60	0	0
32	32	7	1	82	72	5	5
33	38	9	5	83	59	8	4
34	88	7	8	84	46	6	8
35	24	5	1	85	69	9	9
36	49	7	3	86	16	8	3
37	49	2	1	87	31	7	6
38	36	3	6	88	38	2	5
39	52	8	7	89	49	1	10
40	13	3	5	90	97	4	7
41	1	7	6	91	93	3	2
42	8	2	3	92	28	0	10
43	1	5	2	93	87	8	0
44	0	2	0	94	20	6	8
45	1	5	1	95	31	10	2
46	3	9	0	96	7	5	4
47	21	1	0	97	96	1	5
48	5	6	3	98	65	5	2
49	85	3	3	99	54	5	8
50	66	7	7	100	26	5	7

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

□ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 03
CAMPSITE AREA 1

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	25	0	2	51	49	6	3
2	54	3	1	52	56	10	9
3	92	5	9	53	73	3	1
4	69	2	2	54	70	9	7
5	53	9	5	55	62	7	9
6	68	9	0	56	14	3	1
7	25	0	0	57	86	4	0
8	79	4	2	58	11	1	9
9	67	4	1	59	15	2	6
10	67	8	5	60	42	4	1
11	17	4	4	61	62	8	4
12	5	4	3	62	26	9	2
13	72	9	2	63	60	8	10
14	63	8	3	64	47	5	1
15	74	9	4	65	86	3	9
16	3	8	6	66	21	5	8
17	26	6	7	67	88	2	6
18	96	7	9	68	74	7	8
19	29	2	4	69	34	4	10
20	60	2	6	70	88	3	0
21	66	5	2	71	57	8	4
22	83	4	7	72	55	8	4
23	97	3	7	73	10	3	5
24	59	10	3	74	54	5	0
25	81	10	2	75	43	9	2
26	67	7	1	76	34	6	1
27	1	7	8	77	24	7	1
28	6	3	3	78	41	9	9
29	4	9	5	79	64	1	0
30	58	9	1	80	65	0	4
31	51	1	4	81	40	4	8
32	13	8	3	82	88	5	1
33	54	1	5	83	4	9	6
34	85	4	6	84	34	2	6
35	45	2	6	85	48	5	0
36	7	6	10	86	95	7	8
37	53	6	4	87	96	8	8
38	79	4	7	88	8	1	5
39	8	8	7	89	6	1	2
40	94	3	7	90	1	0	7
41	42	10	9	91	48	2	8
42	92	4	9	92	53	8	1
43	51	6	5	93	60	9	9
44	48	7	9	94	20	6	5
45	80	5	8	95	94	8	4
46	68	1	9	96	16	3	7
47	72	6	4	97	36	3	6
48	67	8	9	98	69	8	6
49	9	9	6	99	35	1	7
50	78	9	6	100	96	3	4

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 04
CAMPSITE AREA 2

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	21	8	2	51	76	5	3
2	23	3	2	52	30	7	7
3	97	0	3	53	47	1	9
4	92	5	3	54	88	0	0
5	26	3	1	55	59	7	1
6	62	10	5	56	25	6	4
7	79	1	6	57	56	9	6
8	84	6	3	58	51	6	0
9	78	6	1	59	61	1	8
10	49	1	3	60	31	2	5
11	25	1	0	61	38	7	1
12	76	2	7	62	18	0	4
13	28	2	4	63	36	1	10
14	11	2	5	64	52	5	7
15	30	7	5	65	64	4	4
16	5	1	2	66	20	1	1
17	14	4	10	67	96	6	4
18	95	1	0	68	62	4	10
19	34	1	7	69	69	2	3
20	16	6	4	70	80	6	7
21	79	0	8	71	80	5	2
22	32	2	7	72	85	7	0
23	37	2	0	73	65	3	6
24	57	9	9	74	72	4	2
25	34	2	5	75	41	2	7
26	97	8	6	76	54	9	9
27	27	0	9	77	46	2	1
28	62	1	9	78	9	3	3
29	52	4	10	79	80	2	0
30	81	6	5	80	54	4	0
31	25	8	0	81	44	1	5
32	81	8	1	82	27	8	3
33	62	8	7	83	43	2	9
34	81	5	5	84	28	2	0
35	4	0	9	85	76	4	9
36	92	8	8	86	91	4	7
37	19	0	9	87	87	6	3
38	56	5	4	88	77	4	4
39	94	7	5	89	19	9	10
40	50	2	2	90	56	2	4
41	56	4	5	91	81	1	2
42	62	4	5	92	81	2	10
43	94	4	7	93	35	7	8
44	81	7	2	94	72	7	3
45	58	9	8	95	39	3	2
46	87	0	8	96	27	2	9
47	8	8	9	97	89	9	7
48	30	9	3	98	59	3	4
49	92	8	4	99	82	3	9
50	37	6	9	100	34	7	5

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 05
PICNIC AREA

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	3	2	7	51	62	2	7
2	89	2	6	52	51	9	9
3	6	9	2	53	66	1	1
4	57	3	7	54	6	4	2
5	77	9	2	55	64	7	1
6	65	3	5	56	48	6	8
7	85	3	4	57	43	3	8
8	80	6	8	58	43	5	6
9	89	5	8	59	88	8	8
10	32	5	7	60	56	8	0
11	95	0	2	61	43	5	8
12	40	8	3	62	61	4	9
13	45	9	2	63	47	0	2
14	53	7	5	64	12	8	2
15	26	10	7	65	33	4	2
16	1	0	4	66	16	8	5
17	99	6	9	67	38	6	3
18	30	0	4	68	3	6	3
19	11	7	3	69	51	5	8
20	23	10	5	70	73	3	2
21	21	1	6	71	28	2	9
22	96	7	1	72	85	3	0
23	36	2	4	73	23	7	8
24	88	3	3	74	31	4	2
25	60	5	3	75	7	8	6
26	100	2	0	76	34	9	1
27	27	3	6	77	81	8	7
28	90	2	1	78	25	7	2
29	78	2	4	79	78	3	7
30	74	3	9	80	76	7	6
31	36	5	2	81	17	9	8
32	26	9	1	82	82	3	1
33	84	10	8	83	45	1	9
34	87	3	6	84	71	8	4
35	43	5	3	85	81	6	7
36	29	4	3	86	64	3	2
37	68	3	2	87	56	6	8
38	67	0	5	88	56	0	5
39	40	5	5	89	99	4	7
40	83	8	2	90	30	6	6
41	1	3	2	91	28	7	6
42	16	4	9	92	19	2	3
43	98	1	4	93	48	3	5
44	81	4	4	94	22	8	8
45	29	7	5	95	85	10	7
46	97	5	7	96	88	0	8
47	49	8	7	97	97	9	6
48	94	0	4	98	26	2	1
49	75	6	7	99	30	2	3
50	59	7	1	100	98	8	6

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 06
VEGETABLE GARDEN

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	15	5	10	51	72	6	5
2	18	5	1	52	41	4	4
3	61	7	8	53	53	7	9
4	57	6	0	54	90	5	6
5	32	1	5	55	53	6	7
6	6	0	9	56	19	8	2
7	57	7	0	57	4	3	6
8	26	7	4	58	79	4	4
9	73	8	4	59	92	7	5
10	11	9	3	60	56	8	2
11	68	3	3	61	97	3	1
12	29	8	7	62	96	7	10
13	13	3	8	63	42	0	5
14	14	8	7	64	64	8	6
15	55	2	6	65	20	6	7
16	45	1	2	66	21	2	4
17	8	1	7	67	73	9	10
18	21	2	9	68	70	2	2
19	76	7	7	69	27	6	10
20	61	0	10	70	49	7	7
21	34	5	2	71	57	6	1
22	41	4	1	72	86	1	1
23	31	4	2	73	20	6	3
24	96	9	1	74	43	1	2
25	28	3	10	75	60	8	2
26	38	9	6	76	98	2	5
27	91	5	4	77	80	7	4
28	82	8	6	78	70	5	1
29	63	6	7	79	56	7	4
30	6	3	1	80	32	10	5
31	27	9	0	81	8	1	2
32	77	4	1	82	91	4	4
33	6	5	8	83	61	10	9
34	95	5	8	84	44	1	8
35	68	2	2	85	67	9	0
36	86	7	3	86	37	4	6
37	42	10	1	87	31	2	8
38	97	4	1	88	66	5	1
39	98	2	5	89	29	9	6
40	37	10	8	90	92	1	7
41	33	1	9	91	49	1	6
42	9	4	4	92	43	1	10
43	20	2	7	93	48	4	9
44	67	4	6	94	36	0	2
45	21	8	8	95	60	9	7
46	51	1	3	96	25	6	4
47	22	9	7	97	64	3	5
48	60	5	3	98	26	1	1
49	95	10	1	99	61	3	7
50	53	6	5	100	68	5	1

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 07
MAIN HOUSE ORCHARD

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	58	2	17	51	87	11	2
2	93	1	14	52	84	13	9
3	79	2	3	53	68	13	0
4	31	19	14	54	80	14	8
5	90	19	4	55	14	1	15
6	85	15	18	56	63	6	14
7	47	8	1	57	83	16	15
8	48	7	14	58	32	2	1
9	2	3	19	59	3	12	7
10	52	20	5	60	19	9	16
11	72	13	7	61	50	10	5
12	46	12	4	62	46	1	4
13	42	14	9	63	45	15	18
14	59	15	2	64	14	19	2
15	6	20	5	65	6	15	9
16	19	20	3	66	35	21	19
17	49	15	15	67	92	18	11
18	81	7	18	68	17	7	1
19	78	20	4	69	37	6	1
20	57	19	8	70	19	4	5
21	67	11	19	71	67	18	4
22	23	20	13	72	22	10	10
23	29	9	2	73	45	0	4
24	50	3	7	74	30	13	1
25	76	5	5	75	68	11	4
26	39	6	2	76	73	17	1
27	95	5	4	77	57	14	12
28	66	12	16	78	7	4	2
29	20	17	2	79	96	17	3
30	3	4	15	80	82	18	2
31	5	20	18	81	40	7	19
32	47	5	12	82	32	0	9
33	35	17	15	83	3	0	1
34	98	1	5	84	11	9	7
35	73	4	13	85	89	7	11
36	61	17	17	86	51	19	6
37	88	5	7	87.	40	1	9
38	93	17	13	88	98	17	3
39	79	5	4	89	18	17	14
40	89	10	17	90	23	22	12
41	79	11	2	91	33	7	6
42	6	15	7	92	63	18	15
43	87	6	15	93	58	15	19
44	26	17	0	94	69	16	1
45	49	14	19	95	1	22	12
46	46	12	5	96	39	6	4
47	71	13	17	97	19	21	1
48	23	16	8	98	58	6	11
49	25	15	14	99	66	12	14
50	34	13	17	100	73	7	8

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 08
AVOCADO GROVE

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	60	2	1	51	11	8	7
2	24	8	9	52	10	7	10
3	43	1	12	53	67	2	3
4	70	5	8	54	38	9	7
5	37	2	11	55	39	9	8
6	39	5	11	56	82	1	3
7	77	7	2	57	69	5	11
8	44	8	8	58	12	10	1
9	93	8	9	59	10	3	4
10	71	5	3	60	87	1	15
11	60	0	2	61	94	1	11
12	85	10	10	62	71	4	8
13	11	8	8	63	77	6	1
14	10	5	1	64	23	10	15
15	66	9	2	65	94	0	14
16	60	3	11	66	41	3	2
17	51	0	13	67	17	4	3
18	64	6	13	68	95	7	9
19	44	3	0	69	97	1	1
20	85	10	9	70	85	4	8
21	9	1	9	71	70	4	7
22	59	2	7	72	34	7	9
23	76	4	13	73	49	1	11
24	4	5	4	74	81	1	5
25	98	9	15	75	99	8	11
26	80	9	1	76	32	9	7
27	2	2	8	77	55	0	10
28	56	9	6	78	35	7	4
29	64	4	1	79	19	8	8
30	33	3	11	80	99	8	13
31	80	6	12	81	31	8	9
32	71	6	4	82	4	5	8
33	65	2	11	83	23	7	0
34	68	4	7	84	64	10	13
35	2	0	10	85	55	8	4
36	78	7	5	86	95	8	13
37	58	8	5	87	72	9	6
38	80	5	3	88	17	9	0
39	8	5	12	89	28	0	14
40	51	9	10	90	35	3	14
41	17	1	4	91	2	3	11
42	43	9	4	92	99	2	10
43	10	4	15	93	46	7	0
44	48	9	11	94	62	6	7
45	33	4	12	95	46	7	6
46	16	3	7	96	59	4	4
47	27	5	9	97	15	2	10
48	58	9	12	98	44	5	11
49	41	0	5	99	76	5	11
50	30	5	6	100	42	3	12

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 09
HOUSE OF THE BOOK

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	17	7	5	51	44	2	3
2	7	7	0	52	89	0	5
3	53	10	9	53	55	7	7
4	92	1	5	54	36	3	4
5	66	2	9	55	87	7	7
6	96	10	6	56	37	7	9
7	13	9	7	57	59	9	9
8	18	9	9	58	52	10	7
9	8	5	6	59	46	1	5
10	48	6	6	60	41	9	8
11	56	5	3	61	12	2	7
12	84	5	0	62	59	3	6
13	32	4	1	63	87	8	9
14	40	7	6	64	36	10	5
15	88	3	7	65	17	6	2
16	44	6	7	66	95	6	10
17	71	1	1	67	62	6	10
18	52	2	2	68	15	1	8
19	53	1	6	69	21	6	9
20	26	1	8	70	30	0	8
21	60	7	7	71	95	2	3
22	55	10	8	72	61	9	6
23	36	8	10	73	83	3	6
24	45	2	5	74	1	2	1
25	47	10	5	75	88	2	0
26	3	4	8	76	8	10	5
27	19	6	1	77	24	4	7
28	91	3	1	78	34	3	5
29	3	4	1	79	93	1	9
30	31	7	4	80	63	9	1
31	82	1	3	81	52	6	4
32	53	6	2	82	97	3	7
33	75	1	4	83	34	9	5
34	98	0	0	84	96	0	5
35	2	10	6	85	87	8	9
36	57	3	5	86	85	1	5
37	28	3	8	87	63	9	3
38	64	1	9	88	9	5	4
39	61	8	1	89	7	7	1
40	72	6	9	90	59	3	8
41	54	1	8	91	28	2	5
42	33	10	3	92	11	1	7
43	30	3	2	93	41	4	8
44	39	8	8	94	0	2	3
45	30	6	5	95	43	6	2
46	2	8	8	96	69	10	9
47	7	2	7	97	71	4	8
48	54	6	9	98	45	3	7
49	32	5	1	99	87	7	4
50	72	8	2	100	53	10	9

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 10
OLD WELL CAMPSITE

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	37	6	6	51	90	4	10
2	88	10	6	52	3	7	5
3	41	8	9	53	64	4	5
4	79	2	4	54	49	8	8
5	94	3	8	55	36	2	2
6	44	1	3	56	43	1	1
7	4	6	2	57	11	7	7
8	95	4	0	58	62	10	2
9	76	10	2	59	72	7	7
10	85	6	8	60	41	5	2
11	29	0	2	61	41	7	2
12	57	10	3	62	33	5	8
13	71	10	7	63	36	5	4
14	35	1	7	64	22	8	2
15	97	1	8	65	2	8	5
16	92	1	5	66	9	0	3
17	27	5	2	67	34	9	7
18	2	1	5	68	13	3	5
19	96	6	8	69	54	0	9
20	10	2	6	70	83	5	10
21	86	3	10	71	93	8	5
22	25	7	2	72	59	9	1
23	28	10	8	73	16	8	4
24	28	3	1	74	1	5	3
25	33	7	3	75	3	9	7
26	18	1	7	76	53	0	1
27	23	5	4	77	23	3	5
28	37	2	3	78	67	8	2
29	91	6	7	79	97	10	6
30	35	5	0	80	86	0	4
31	2	10	9	81	61	2	0
32	9	4	10	82	21	3	4
33	84	5	5	83	26	8	10
34	70	5	5	84	60	2	7
35	89	6	2	85	34	4	3
36	70	4	1	86	44	0	3
37	96	7	0	87	35	8	1
38	8	5	5	88	7	5	1
39	36	6	4	89	27	7	2
40	94	3	5	90	100	8	8
41	34	8	10	91	33	2	4
42	52	7	8	92	33	6	8
43	79	6	3	93	97	9	9
44	40	6	7	94	34	10	8
45	40	9	2	95	7	10	8
46	35	6	6	96	64	4	2
47	1	9	6	97	22	8	3
48	86	5	0	98	95	6	4
49	32	7	8	99	93	9	6
50	10	2	7	100	7	9	4

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 11
COUNSELOR-IN-TRAINING AREA

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	35	5	5	51	4	2	1
2	36	5	8	52	96	6	10
3	58	4	2	53	12	9	1
4	85	4	4	54	28	0	10
5	12	3	9	55	39	3	10
6	38	8	8	56	58	4	4
7	21	9	3	57	11	5	3
8	45	6	5	58	5	9	5
9	21	2	2	59	95	9	2
10	95	0	9	60	65	7	2
11	96	8	8	61	64	2	7
12	41	8	9	62	9	4	3
13	15	2	4	63	79	2	2
14	47	4	7	64	48	7	0
15	94	6	5	65	12	10	7
16	16	1	4	66	17	5	1
17	46	9	6	67	88	9	9
18	80	0	4	68	55	8	1
19	79	3	8	69	43	2	7
20	82	6	6	70	81	10	3
21	8	10	9	71	56	5	1
22	2	8	7	72	46	9	3
23	67	6	0	73	72	5	2
24	28	9	1	74	38	9	1
25	39	3	9	75	43	0	6
26	92	4	6	76	84	5	5
27	45	2	5	77	58	5	5
28	89	0	8	78	79	2	2
29	83	7	4	79	36	1	6
30	51	9	6	80	40	8	3
31	51	3	4	81	54	2	7
32	32	1	5	82	12	6	2
33	45	2	2	83	82	9	8
34	85	5	10	84	53	10	1
35	73	5	2	85	61	1	3
36	11	1	2	86	31	9	10
37	14	5	0	87	89	1	4
38	63	6	1	88	57	8	3
39	85	5	10	89	87	2	2
40	63	1	7	90	47	7	7
41	49	2	6	91	18	1	1
42	15	1	0	92	90	1	10
43	33	4	4	93	48	6	1
44	2	9	4	94	30	6	8
45	24	4	1	95	99	5	4
46	13	6	9	96	27	8	4
47	32	8	8	97	68	6	2
48	45	3	10	98	87	3	10
49	27	8	9	99	85	9	3
50	0	7	8	100	83	0	3

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 12
POTENTIAL DEVELOPMENT SITE 1

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	34	3	5	51	32	0	4
2	35	6	6	52	52	2	8
3	3	4	3	53	95	5	3
4	22	4	1	54	40	0	7
5	38	4	5	55	91	9	4
6	42	4	4	56	39	0	5
7	79	7	7	57	9	8	3
8	99	7	4	58	44	10	8
9	10	3	8	59	60	6	6
10	79	10	1	60	69	1	8
11	21	6	6	61	88	5	3
12	45	2	7	62	42	8	9
13	32	4	5	63	47	8	8
14	22	6	9	64	33	9	8
15	88	5	7	65	1	0	4
16	98	8	2	66	31	8	9
17	9	3	1	67	34	0	4
18	52	1	3	68	16	3	1
19	70	5	1	69	69	3	7
20	36	8	9	70	59	6	2
21	29	9	4	71	42	3	2
22	64	9	7	72	58	9	1
23	17	3	2	73	8	9	9
24	64	8	10	74	18	6	3
25	49	2	1	75	23	2	2
26	78	3	10	76	57	3	0
27	29	1	9	77	69	7	3
28	38	5	0	78	22	9	6
29	6	3	8	79	3	2	3
30	62	5	6	80	50	8	5
31	29	9	7	81	79	9	7
32	37	1	6	82	42	10	6
33	59	7	1	83	64	10	7
34	19	9	0	84	0	1	7
35	72	1	10	85	41	10	3
36	3	6	5	86	41	6	1
37	8	5	7	87	19	4	4
38	61	4	5	88	15	7	5
39	15	10	7	89	40	6	1
40	15	2	7	90	95	8	7
41	76	8	1	91	71	10	9
42	47	2	6	92	58	6	10
43	50	3	9	93	41	6	5
44	44	2	8	94	31	7	1
45	8	5	5	95	87	7	7
46	87	4	1	96	91	2	2
47	22	10	9	97	53	7	5
48	16	2	5	98	24	9	10
49	14	7	9	99	15	7	3
50	65	9	9	100	9	8	2

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 13
POTENTIAL DEVELOPMENT SITE 2

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	70	3	2	51	82	10	7
2	92	6	4	52	31	8	4
3	31	4	8	53	3	6	4
4	99	10	7	54	81	8	2
5	87	4	10	55	96	3	8
6	61	2	6	56	12	3	1
7	100	7	9	57	26	4	1
8	35	2	1	58	28	1	5
9	94	6	2	59	57	0	6
10	67	2	8	60	75	6	7
11	46	7	5	61	51	2	7
12	99	1	2	62	82	2	9
13	95	6	4	63	55	6	9
14	2	9	6	64	99	9	3
15	44	7	4	65	18	4	8
16	63	9	8	66	43	2	0
17	81	9	6	67	53	0	5
18	30	2	10	68	99	6	8
19	68	8	6	69	61	3	9
20	54	1	0	70	43	4	8
21	50	4	1	71	97	6	5
22	46	10	0	72	50	8	4
23	97	10	9	73	65	9	7
24	21	5	1	74	83	5	3
25	24	3	8	75	62	1	7
26	47	4	6	76	95	6	2
27	65	2	1	77	71	0	3
28	72	3	1	78	65	5	8
29	95	4	3	79	48	7	1
30	38	0	3	80	55	9	3
31	97	3	1	81	53	5	1
32	13	4	8	82	61	2	4
33	29	4	7	83	14	4	5
34	31	8	5	84	28	2	9
35	2	2	10	85	48	8	5
36	34	4	1	86	70	3	10
37	94	1	7	87	53	6	1
38	60	9	9	88	4	1	5
39	12	4	8	89	99	5	9
40	98	10	9	90	46	4	7
41	93	10	1	91	65	8	7
42	97	9	3	92	90	6	8
43	37	1	10	93	52	5	4
44	92	6	1	94	36	2	7
45	98	3	1	95	55	8	10
46	22	1	6	96	43	9	8
47	84	4	0	97	81	3	10
48	51	5	3	98	41	2	2
49	82	0	9	99	9	8	3
50	79	7	2	100	90	2	7

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BRANDEIS-BARDIN INSTITUTE
SAMPLE AREA 14
POTENTIAL DEVELOPMENT SITE 3

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	67	1	9	51	40	2	3
2	79	7	7	52	62	5	4
3	81	4	4	53	73	10	2
4	23	1	2	54	20	2	4
5	29	3	6	55	5	1	5
6	71	9	3	56	25	3	7
7	65	3	2	57	36	9	7
8	69	4	9	58	92	5	9
9	79	2	6	59	55	7	1
10	32	8	2	60	41	3	9
11	18	9	10	61	63	3	5
12	2	5	2	62	83	7	4
13	19	10	1	63	14	4	8
14	72	1	4	64	76	1	7
15	66	8	3	65	27	4	5
16	65	1	5	66	33	6	1
17	25	6	3	67	24	6	9
18	92	1	2	68	56	7	3
19	56	9	6	69	6	9	7
20	64	0	3	70	48	4	7
21	95	9	6	71	18	4	9
22	41	5	8	72	78	7	6
23	73	7	4	73	18	3	4
24	26	8	0	74	97	7	0
25	8	3	9	75	18	4	4
26	62	5	1	76	57	5	3
27	36	2	1	77	43	8	5
28	18	8	5	78	64	1	8
29	24	4	5	79	30	9	5
30	89	2	3	80	98	5	4
31	55	7	3	81	28	5	9
32	13	9	8	82	7	4	2
33	81	0	3	83	26	4	3
34	93	1	1	84	54	9	0
35	4	6	7	85	96	8	1
36	32	1	0	86	86	8	10
37	30	10	1	87	24	8	7
38	91	8	7	88	77	9	3
39	81	0	2	89	31	9	8
40	16	9	3	90	66	4	2
41	68	6	2	91	38	1	5
42	60	6	0	92	88	10	3
43	65	7	0	93	34	2	0
44	71	1	6	94	59	2	6
45	97	4	3	95	74	7	6
46	59	4	2	96	64	5	6
47	76	3	3	97	26	1	3
48	2	3	4	98	9	3	2
49	12	1	2	99	46	7	2
50	67	0	7	100	82	8	0

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATIONS
SAMPLE AREA 01
ROCKY PEAK

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	58	6	10	51	63	1	9
2	100	3	6	52	33	1	8
3	5	3	2	53	17	4	5
4	8	2	8	54	30	0	7
5	34	8	7	55	30	5	3
6	82	8	4	56	14	1	6
7	87	4	3	57	54	9	9
8	16	3	5	58	46	0	8
9	90	8	3	59	64	5	8
10	65	6	9	60	5	7	2
11	75	2	4	61	16	10	0
12	60	9	2	62	52	3	3
13	27	1	3	63	46	3	4
14	43	1	6	64	3	0	1
15	72	2	5	65	29	3	3
16	5	10	5	66	21	0	8
17	82	4	4	67	82	3	1
18	52	5	3	68	7	10	9
19	59	5	6	69	64	1	9
20	100	9	10	70	70	8	10
21	19	4	1	71	85	0	8
22	26	8	5	72	28	4	0
23	21	2	3	73	38	8	1
24	77	5	8	74	62	1	9
25	97	7	2	75	67	3	4
26	97	5	2	76	99	4	5
27	72	9	5	77	24	4	7
28	53	8	2	78	9	7	0
29	39	9	3	79	33	1	1
30	91	7	2	80	79	1	4
31	48	9	0	81	27	4	3
32	0	9	9	82	30	0	9
33	68	4	1	83	51	9	1
34	32	5	0	84	31	0	3
35	5	6	4	85	75	6	7
36	63	0	6	86	99	4	2
37	90	6	2	87	49	1	2
38	45	9	2	88	1	1	3
39	30	2	8	89	37	2	0
40	21	3	5	90	47	9	4
41	66	9	1	91	64	3	10
42	73	9	8	92	99	9	3
43	54	2	8	93	18	9	5
44	6	1	2	94	30	1	2
45	71	3	9	95	60	2	7
46	29	8	7	96	98	4	10
47	4	5	2	97	42	8	2
48	42	10	1	98	33	2	6
49	53	4	7	99	35	1	7
50	10	9	8	100	74	1	8

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATION
SAMPLE AREA 02
SANTA SUSANA PARK

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	76	4	7	51	19	3	1
2	7	1	4	52	69	3	7
3	74	2	1	53	48	6	9
4	17	7	4	54	70	1	4
5	85	5	7	55	30	4	4
6	25	2	5	56	37	2	8
7	37	1	10	57	80	3	1
8	21	9	9	58	36	8	9
9	68	1	3	59	73	9	8
10	78	1	6	60	2	0	7
11	50	3	7	61	95	9	10
12	38	4	1	62	79	6	6
13	86	7	7	63	61	10	0
14	97	5	7	64	98	2	3
15	53	2	5	65	38	5	2
16	31	0	9	66	91	5	7
17	35	2	5	67	72	5	9
18	26	7	7	68	60	9	1
19	52	5	2	69	27	4	7
20	85	8	3	70	46	8	8
21	94	9	1	71	65	6	10
22	16	0	3	72	84	3	9
23	17	5	7	73	23	9	7
24	37	5	5	74	81	5	6
25	27	4	7	75	72	4	2
26	47	6	0	76	64	9	7
27	5	4	5	77	11	4	5
28	29	7	10	78	62	8	5
29	59	7	0	79	13	3	6
30	67	8	7	80	30	3	4
31	70	8	6	81	60	6	8
32	38	7	9	82	36	3	7
33	14	8	4	83	90	6	7
34	74	5	1	84	92	3	6
35	72	8	4	85	14	6	8
36	54	6	6	86	6	6	8
37	76	10	2	87	79	6	6
38	38	9	2	88	55	2	7
39	84	5	1	89	2	6	1
40	16	3	3	90	57	0	2
41	75	7	5	91	32	5	9
42	28	1	4	92	0	9	0
43	35	6	2	93	99	7	5
44	49	2	8	94	70	5	6
45	97	3	9	95	93	8	3
46	26	2	5	96	38	4	4
47	83	9	7	97	24	0	2
48	36	1	4	98	53	5	5
49	47	10	4	99	36	7	7
50	8	8	5	100	6	5	0

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATION
SAMPLE AREA 03
BELL CANYON

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	1	1	8	51	51	4	3
2	19	4	4	52	32	8	7
3	59	2	7	53	5	5	0
4	28	3	7	54	50	7	8
5	41	9	1	55	82	4	10
6	91	2	2	56	90	6	8
7	29	8	1	57	32	7	8
8	33	9	4	58	36	4	8
9	23	6	9	59	58	3	3
10	6	4	2	60	71	2	10
11	85	8	3	61	38	6	5
12	44	6	4	62	52	9	6
13	65	4	3	63	38	2	4
14	94	6	8	64	81	3	1
15	50	9	6	65	100	1	6
16	74	8	2	66	92	0	5
17	58	8	2	67	63	2	0
18	33	8	9	68	98	2	1
19	17	9	9	69	76	6	8
20	19	6	3	70	52	0	0
21	48	9	7	71	64	8	8
22	54	1	7	72	49	1	3
23	10	3	7	73	2	4	0
24	37	6	0	74	37	1	8
25	60	10	7	75	22	4	8
26	70	5	5	76	58	6	1
27	52	7	2	77	94	7	8
28	41	2	1	78	91	5	1
29	44	1	8	79	97	6	9
30	10	4	4	80	16	6	4
31	34	1	8	81	94	8	2
32	30	5	8	82	68	8	9
33	89	4	4	83	93	9	9
34	79	8	0	84	6	4	9
35	93	6	3	85	9	6	7
36	75	1	1	86	7	0	1
37	50	9	0	87	18	8	3
38	56	4	3	88	37	6	3
39	19	7	9	89	18	9	1
40	98	1	9	90	35	9	8
41	83	5	3	91	54	6	8
42	45	9	3	92	23	4	4
43	80	9	6	93	9	1	3
44	74	4	1	94	35	5	5
45	96	5	7	95	51	4	4
46	24	3	2	96	49	6	0
47	98	2	2	97	21	3	5
48	17	4	6	98	99	1	9
49	49	5	10	99	24	10	3
50	38	10	10	100	19	4	2

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATION
SAMPLE AREA 04
WESTERN LOCATION

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	25	4	7	51	11	4	2
2	90	9	8	52	60	4	3
3	29	5	3	53	48	4	6
4	76	3	8	54	22	6	6
5	37	2	6	55	31	7	6
6	12	10	3	56	74	2	1
7	23	2	5	57	39	3	1
8	36	2	1	58	20	9	10
9	27	3	5	59	80	9	3
10	60	3	0	60	34	8	8
11	19	4	2	61	57	8	6
12	85	6	4	62	21	9	4
13	22	3	2	63	28	5	8
14	95	5	10	64	84	7	2
15	21	3	5	65	17	3	8
16	76	4	4	66	60	1	10
17	87	10	10	67	4	0	10
18	23	2	4	68	47	4	9
19	15	9	9	69	90	1	8
20	14	6	6	70	5	8	4
21	86	3	8	71	85	1	3
22	71	6	5	72	80	9	4
23	48	9	8	73	25	4	4
24	55	9	2	74	14	2	1
25	74	6	3	75	83	1	5
26	47	7	3	76	20	3	3
27	82	1	2	77	76	1	6
28	60	10	1	78	1	3	8
29	73	1	7	79	54	2	9
30	12	9	10	80	43	7	1
31	23	2	3	81	82	10	3
32	97	9	7	82	43	3	9
33	95	9	10	83	77	6	1
34	72	3	6	84	8	10	8
35	47	3	8	85	9	7	9
36	66	8	3	86	26	1	7
37	79	2	4	87	66	3	10
38	96	7	5	88	23	6	1
39	9	0	2	89	12	0	1
40	51	1	9	90	83	8	7
41	61	7	5	91	85	7	4
42	70	8	7	92	62	7	5
43	54	2	4	93	20	3	4
44	11	3	0	94	98	0	8
45	78	3	1	95	35	4	3
46	79	6	1	96	17	1	0
47	86	2	2	97	18	5	9
48	61	9	8	98	95	1	6
49	20	9	9	99	11	3	6
50	61	3	4	100	24	5	5

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.
☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATION
SAMPLE AREA 05
HAPPY CAMP

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	84	8	10	51	80	6	1
2	44	10	3	52	70	4	8
3	74	7	3	53	38	1	6
4	26	0	3	54	97	1	7
5	16	9	7	55	70	6	3
6	50	1	4	56	26	8	8
7	51	3	5	57	87	2	5
8	56	3	2	58	4	4	4
9	90	8	1	59	12	4	1
10	62	2	7	60	63	8	3
11	19	5	10	61	22	0	2
12	39	7	6	62	69	5	6
13	87	9	0	63	58	0	4
14	42	2	4	64	65	2	7
15	21	2	5	65	63	5	4
16	30	9	3	66	92	5	7
17	9	4	6	67	10	2	1
18	63	4	7	68	12	3	8
19	24	5	3	69	44	8	3
20	66	5	3	70	81	5	2
21	12	7	1	71	8	5	1
22	46	3	7	72	61	3	1
23	98	6	2	73	23	2	1
24	62	4	6	74	58	4	7
25	63	2	8	75	78	10	7
26	69	1	4	76	15	9	7
27	69	5	5	77	40	0	7
28	57	2	5	78	1	8	8
29	59	1	6	79	63	9	2
30	48	8	4	80	13	10	0
31	60	4	4	81	50	3	3
32	42	7	5	82	28	8	4
33	78	5	2	83	95	8	10
34	43	4	1	84	43	2	2
35	88	10	4	85	54	3	5
36	20	5	7	86	23	7	7
37	76	1	1	87	21	7	8
38	42	0	1	88	55	2	0
39	74	9	4	89	6	8	8
40	2	7	5	90	66	9	2
41	48	2	1	91	42	4	6
42	91	2	9	92	61	1	7
43	86	4	6	93	91	9	10
44	84	2	5	94	78	8	5
45	33	1	2	95	57	4	9
46	33	7	8	96	83	7	8
47	84	4	6	97	72	9	4
48	21	10	9	98	66	1	9
49	25	1	3	99	68	5	3
50	11	7	0	100	27	6	6

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.
☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

BACKGROUND SAMPLE LOCATION
SAMPLE AREA 06
SANTA MONICA MOUNTAINS NATIONAL RECREATION AREA

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	42	2	10	51	98	5	5
2	98	9	0	52	89	8	4
3	67	8	10	53	43	9	8
4	89	4	1	54	3	6	8
5	8	0	10	55	77	3	6
6	33	8	0	56	79	4	0
7	59	2	7	57	68	10	6
8	16	2	7	58	63	9	7
9	22	2	8	59	73	6	8
10	70	8	3	60	91	3	1
11	58	5	4	61	23	6	7
12	84	4	1	62	57	7	6
13	30	0	7	63	96	1	1
14	79	8	6	64	62	4	5
15	83	9	7	65	66	9	1
16	0	0	5	66	68	7	4
17	4	7	5	67	27	9	3
18	57	4	4	68	7	4	2
19	6	5	2	69	97	0	4
20	69	7	3	70	13	5	7
21	91	9	4	71	88	4	1
22	11	6	6	72	42	3	10
23	97	2	1	73	39	8	2
24	19	8	2	74	78	0	6
25	28	2	2	75	9	0	6
26	10	2	1	76	96	7	6
27	67	8	0	77	3	1	3
28	26	2	8	78	54	2	7
29	49	10	1	79	5	9	2
30	63	3	2	80	68	9	7
31	7	2	7	81	34	10	7
32	3	0	2	82	62	5	8
33	52	1	7	83	35	9	6
34	29	2	9	84	23	6	9
35	26	0	2	85	77	2	3
36	26	7	2	86	77	3	9
37	5	4	8	87	72	6	6
38	62	0	3	88	86	6	9
39	87	1	9	89	61	7	1
40	42	2	7	90	47	4	1
41	81	6	9	91	43	7	4
42	41	5	6	92	86	5	6
43	12	9	4	93	21	0	1
44	33	9	0	94	8	5	9
45	65	7	6	95	24	6	2
46	0	7	0	96	24	3	5
47	74	8	0	97	60	6	7
48	44	2	7	98	14	3	8
49	86	5	3	99	69	0	3
50	42	4	1	100	67	3	5

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

SANTA MONICA MOUNTAINS CONSERVANCY
SAMPLE AREA 01
VISITOR CENTER PARKING LOT

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	87	8	0	51	62	0	3
2	63	10	8	52	93	1	9
3	80	8	7	53	9	3	4
4	53	9	2	54	88	0	9
5	67	3	9	55	7	2	3
6	61	2	4	56	42	4	2
7	87	3	6	57	81	1	7
8	59	6	1	58	47	6	5
9	8	6	9	59	63	7	7
10	47	1	7	60	54	3	7
11	21	2	7	61	46	1	1
12	37	9	7	62	96	10	10
13	56	7	4	63	49	1	6
14	99	0	6	64	28	8	3
15	96	2	9	65	41	10	2
16	83	1	4	66	76	6	4
17	20	1	6	67	61	3	2
18	4	9	4	68	96	3	5
19	38	8	2	69	40	9	8
20	7	8	9	70	66	8	9
21	62	5	9	71	49	10	2
22	26	3	0	72	12	9	6
23	60	6	1	73	11	6	3
24	17	3	3	74	8	5	8
25	85	10	1	75	17	9	7
26	76	3	1	76	52	5	5
27	42	1	1	77	23	1	0
28	23	10	3	78	68	3	7
29	88	1	3	79	87	9	3
30	11	8	10	80	25	0	2
31	31	9	1	81	32	9	1
32	68	10	4	82	83	6	9
33	52	6	7	83	79	8	2
34	4	8	3	84	76	3	7
35	64	3	2	85	11	4	8
36	0	7	10	86	41	9	9
37	26	5	2	87	55	4	4
38	80	2	2	88	84	8	3
39	92	6	6	89	38	9	8
40	77	2	6	90	57	7	6
41	31	2	1	91	82	5	10
42	94	10	0	92	26	6	6
43	26	4	7	93	71	7	2
44	74	8	8	94	12	7	4
45	1	7	8	95	3	0	3
46	20	6	10	96	39	6	9
47	93	7	9	97	60	10	8
48	74	6	9	98	37	3	7
49	3	5	6	99	35	7	5
50	10	1	2	100	67	9	2

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

SANTA MONICA MOUNTAINS CONSERVANCY
SAMPLE AREA 02
SELECTED AREA ALONG EXISTING ROAD

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	17	10	8	51	78	8	8
2	44	6	3	52	55	2	7
3	4	1	7	53	69	4	4
4	32	7	7	54	14	6	9
5	21	8	4	55	81	3	2
6	19	9	1	56	43	4	4
7	50	4	8	57	20	7	9
8	47	4	5	58	87	2	2
9	71	9	4	59	7	5	3
10	22	8	5	60	71	9	1
11	45	3	6	61	50	8	0
12	75	2	6	62	82	5	1
13	45	6	1	63	93	9	6
14	21	3	4	64	14	0	4
15	25	5	0	65	19	3	5
16	36	7	9	66	83	10	5
17	33	2	6	67	24	0	3
18	35	5	9	68	64	0	10
19	16	1	10	69	43	8	3
20	12	1	5	70	60	5	3
21	26	2	6	71	1	9	0
22	91	4	6	72	0	6	0
23	7	4	8	73	88	9	4
24	8	5	3	74	97	8	7
25	59	4	7	75	34	6	3
26	32	8	10	76	17	2	1
27	23	2	10	77	89	8	1
28	20	3	5	78	46	3	2
29	31	10	2	79	96	7	5
30	31	6	3	80	14	5	2
31	20	3	3	81	19	4	6
32	8	2	2	82	49	8	7
33	2	6	2	83	81	7	5
34	23	0	1	84	33	10	9
35	17	6	4	85	37	4	0
36	57	4	7	86	65	3	7
37	86	5	2	87	95	1	7
38	24	3	1	88	68	3	5
39	49	10	9	89	43	2	7
40	71	2	9	90	61	1	6
41	8	6	2	91	81	3	4
42	45	5	4	92	79	9	4
43	20	5	5	93	57	2	3
44	24	5	6	94	71	8	6
45	41	5	5	95	91	8	7
46	61	2	9	96	59	6	8
47	40	1	6	97	8	8	6
48	87	7	9	98	10	5	4
49	31	2	3	99	44	5	5
50	70	1	9	100	98	8	3

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.
☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

SANTA MONICA MOUNTAINS CONSERVANCY
SAMPLE AREA 03
THE ORANGE GROVES

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	95	1	2	51	85	10	8
2	4	3	4	52	14	6	4
3	28	0	7	53	57	15	6
4	21	15	7	54	33	13	5
5	26	5	2	55	85	10	8
6	24	12	8	56	61	13	4
7	96	4	7	57	51	13	6
8	41	5	1	58	97	3	8
9	78	5	4	59	9	2	2
10	8	12	8	60	60	14	7
11	26	2	2	61	19	14	5
12	66	3	6	62	23	2	4
13	80	2	2	63	63	2	4
14	85	6	0	64	90	4	6
15	16	3	5	65	65	1	3
16	86	11	5	66	94	1	2
17	46	11	8	67	71	6	6
18	53	3	1	68	22	12	6
19	8	14	4	69	27	4	5
20	48	7	9	70	57	2	4
21	84	2	6	71	94	10	6
22	19	9	3	72	86	10	4
23	30	7	6	73	80	9	8
24	71	6	4	74	1	15	7
25	56	6	1	75	52	7	3
26	17	12	4	76	39	5	9
27	63	5	4	77	66	4	5
28	99	8	2	78	33	4	7
29	19	11	5	79	46	9	5
30	45	4	3	80	31	8	6
31	58	1	4	81	61	8	5
32	40	3	6	82	42	11	4
33	84	12	3	83	33	7	7
34	21	7	3	84	46	4	1
35	81	3	7	85	75	4	6
36	32	9	4	86	31	7	7
37	12	3	4	87	22	12	4
38	8	1	8	88	42	1	5
39	39	5	3	89	48	6	2
40	44	4	8	90	12	6	8
41	5	5	0	91	72	3	2
42	70	5	3	92	0	12	3
43	52	2	4	93	76	4	4
44	54	7	3	94	40	8	7
45	83	11	2	95	43	13	2
46	65	12	8	96	64	11	6
47	97	4	5	97	4	13	2
48	98	12	8	98	15	8	2
49	10	2	2	99	91	1	3
50	99	3	7	100	84	6	7

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

RANDOM NUMBERS USED TO SELECT SAMPLING BLOCKS AND SAMPLING LOCATIONS WITHIN EACH BLOCK

SANTA MONICA MOUNTAINS CONSERVANCY
SAMPLE AREA 04
FORMER ROCKETDYNE EMPLOYEE SHOOTING RANGE

NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*	NUMBER	RANDOMLY SELECTED BLOCK NUMBER	X COORDINATE*	Y COORDINATE*
1	93	7	9	51	45	5	5
2	93	6	3	52	92	3	7
3	49	10	7	53	84	5	8
4	83	4	1	54	86	3	7
5	99	9	6	55	24	5	9
6	38	4	4	56	7	1	6
7	60	4	3	57	33	4	4
8	41	8	9	58	43	7	2
9	71	9	5	59	44	2	9
10	27	2	3	60	37	0	0
11	59	1	8	61	1	3	8
12	34	4	8	62	58	8	7
13	44	8	10	63	60	3	8
14	12	4	1	64	36	3	10
15	15	6	3	65	82	8	2
16	61	2	1	66	6	8	2
17	8	10	1	67	52	9	4
18	56	0	6	68	69	4	5
19	23	0	9	69	68	6	1
20	96	7	5	70	57	1	8
21	9	1	5	71	63	9	2
22	40	6	2	72	84	6	8
23	31	4	1	73	59	0	7
24	80	5	7	74	100	4	8
25	43	7	9	75	42	3	9
26	1	3	9	76	97	2	7
27	1	4	2	77	96	4	2
28	21	3	7	78	56	1	9
29	85	6	3	79	78	8	9
30	22	0	1	80	61	1	5
31	14	8	3	81	96	7	2
32	90	1	2	82	87	7	2
33	57	0	4	83	40	10	4
34	38	4	4	84	34	7	7
35	72	5	0	85	77	2	6
36	82	9	2	86	20	5	10
37	30	4	4	87	15	8	4
38	89	6	8	88	8	5	7
39	74	8	5	89	95	6	7
40	84	3	2	90	56	3	3
41	83	10	7	91	44	6	1
42	80	1	2	92	66	10	3
43	17	10	5	93	4	10	10
44	94	1	1	94	53	4	5
45	45	3	3	95	91	6	9
46	81	7	4	96	2	6	2
47	80	4	6	97	17	10	7
48	41	2	4	98	24	9	5
49	67	9	8	99	63	8	3
50	87	9	1	100	8	1	6

* - COORDINATE REPRESENTS THE DISTANCE FROM THE ORIGIN OF THE BLOCK.

▨ Randomly selected sampling blocks.

☐ Alternative randomly selected sampling blocks.

APPENDIX C

SUMMARY OF ANALYTICAL RESULTS BY ANALYSIS

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137** pCi/g (dry)	Error +/-
Rocky Peak	BG01005	Teledyne	69754	0.092	0.027
	BG01008	Teledyne	69752	< 0.04	
	BG01100	Teledyne	69750	0.18	0.04
Santa Susana Park	BG02007	Teledyne	69734	0.17	0.04
		USEPA	SSFL92.1773	0.19	0.01
	BG02074	Teledyne	69736	< 0.04	
	BG02076	Teledyne	69732	0.099	0.032
Bell Canyon	BG03001	Teledyne	70138	< 0.07	
	BG03019	Teledyne	70140	< 0.07	
	BG03059	Teledyne	70142	< 0.05	
		USEPA	SSFL92.1836	0.017	0.018
Western Site	BG04025	Teledyne	70144	0.15	0.05
		USEPA(LS-TI)	SSFL92.5413	0.11	0.01
	BG04029	Teledyne	70161	0.14	0.05
		USEPA	SSFL92.1837	0.15	0.01
	BG04090	Teledyne	70146	0.19	0.03
Happy Camp	BG05016	Teledyne	70167	0.074	0.029
	BG05026	Teledyne	70165	0.067	0.025
	BG05074	Teledyne	70163	0.10	0.03
		Teledyne(FD)	75185	0.073	0.026
Santa Monica Mountains National Recreation Area	BG06033	Teledyne	70154	0.097	0.034
	BG06089	Teledyne	70152	< 0.06	
	BG06096	Teledyne	70149	0.14	0.03

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Perimeter of the Playground	BB01001	Teledyne	70884	0.060	0.027
		Teledyne(FD)	70889	< 0.04	
		Teledyne(LD)	70903	< 0.03	
	BB01027	Teledyne	70886	< 0.03	
		BBI		< 0.3	
	BB01038	Teledyne	70888	0.085	0.033
	BB01041	Teledyne	70882	0.10	0.02
	BB01056	Teledyne	70880	< 0.04	
		USEPA	SSFL92.1956	0.035	0.012
Dormitory Area	BB02045	Teledyne	70920	< 0.05	
	BB02060	Teledyne	70922	< 0.05	
		Teledyne(FD)	70929	< 0.05	
	BB02071	Teledyne	70918	0.058	0.032
		BBI		< 0.3	
	BB02075	Teledyne	70924	0.048	0.025
	BB02078	Teledyne	70928	0.10	0.04
Campsite Area 1	BB03005	Teledyne	70818	0.20	0.04
		USEPA	SSFL92.1889	0.26	0.02
	BB03017	Teledyne	70816	0.085	0.038
		Teledyne(FD)	70819	0.057	0.028
	BB03025	Teledyne	70810	0.20	0.05
	BB03079	Teledyne	70814	< 0.04	
	BB03092	Teledyne	70812	0.38	0.06
Campsite Area 2	BB04021	Teledyne	70171	< 0.05	
		USEPA	SSFL92.1888	0.034	0.018
	BB04023	Teledyne	70173	0.099	0.040
	BB04026	Teledyne	70179	0.15	0.03
	BB04082	Teledyne	70177	< 0.03	
	BB04097	Teledyne	70175	< 0.03	
		DHS		0.03	0.01

(FD) – Field duplicate sample
(LD) – Lab duplicate sample
(LS-TI) – Laboratory split from Teledyne, Illinois
BBI – Brandeis-Bardin Institute split sample
Cs-137 – Cesium-137
DHS – Department of Health Services split sample
NA – Not analyzed
pCi/g(dry) – Picocuries per gram of dried sample
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** – Values rounded to two significant figures
< – Less than
+/- – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Picnic Area	BB05003	Teledyne	70857	0.22	0.03
	BB05006	Teledyne	70861	0.11	0.02
	BB05057	Teledyne	70863	0.052	0.030
	BB05077	Teledyne	70865	0.16	0.04
		USEPA	SSFL92.1955	0.086	0.014
	BB05089	Teledyne	70859	0.14	0.04
House of the Book	BB06007	Teledyne	70842	< 0.05	
	BB06013	Teledyne	70848	< 0.05	
	BB06017	Teledyne	70840	< 0.03	
		Teledyne(LD)	70854	< 0.04	
	BB06066	Teledyne	70846	< 0.04	
	BB06092	Teledyne	70844	< 0.04	
		USEPA	SSFL92.1887	<0.033	
Counselor-in-Training Area	BB07012	Teledyne	70952	0.044	0.021
	BB07035	Teledyne	70944	0.095	0.027
		BBI		< 0.3	
	BB07036	Teledyne	70946	0.095	0.026
	BB07038	Teledyne	70954	0.13	0.03
	BB07058	Teledyne	70950	0.099	0.036
Potential Development Site 1	BB08003	Teledyne	70910	0.16	0.04
	BB08022	Teledyne	70912	0.14	0.04
		BBI		< 0.3	
	BB08034	Teledyne	70906	0.15	0.04
	BB08035	Teledyne	70908	0.17	0.04
	BB08038	Teledyne	70914	0.094	0.035
Potential Development Site 2	BB09031	Teledyne	70935	0.062	0.034
	BB09051	Teledyne	70937	0.11	0.05
	BB09070	Teledyne	70931	0.092	0.020
	BB09092	Teledyne	70933	0.069	0.026
		BBI		< 0.3	
	BB09100	Teledyne	70939	0.066	0.020

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Potential Development Site 3	BB10023	Teledyne	70964	0.16	0.04
	BB10029	Teledyne	70966	0.068	0.028
	BB10067	Teledyne	70958	0.098	0.029
	BB10079	Teledyne	70960	0.15	0.04
		Teledyne(FD)	70967	0.13	0.04
		Teledyne(LD)	70968	0.10	0.04
	BB10081	Teledyne	70962	0.093	0.038
		BBI		< 0.3	
Vegetable Garden	BB11006	Teledyne	70899	0.11	0.03
	BB11018	Teledyne	70891	0.16	0.03
		BBI		< 0.3	
	BB11032	Teledyne	70897	0.20	0.04
	BB11057	Teledyne	70895	0.11	0.03
	BB11061	Teledyne	70893	< 0.05	
		USEPA	SSFL92.2046	0.056	0.018
Main House Orchard	BB12003	Teledyne	70878	< 0.04	
	BB12006	Teledyne	70868	0.091	0.027
	BB12019	Teledyne	70870	0.15	0.03
	BB12020	Teledyne	70874	0.15	0.03
		Teledyne(LD)	70876	0.091	0.030
		USEPA	SSFL92.1954	0.084	0.017
	BB12023	Teledyne	70872	0.12	0.03
		USEPA (LS-NJ)	SSFL92.5414	0.130	0.016
		BBI		< 0.3	
Avocado Grove	BB13010	Teledyne	70851	< 0.05	
	BB13011	Teledyne	70849	0.098	0.039
	BB13024	Teledyne	70823	< 0.05	
		USEPA	SSFL92.1890	0.030	0.011
	BB13037	Teledyne	70825	0.10	0.04
	BB13039	Teledyne	70827	0.077	0.018
		Teledyne(LD)	70829	0.059	0.033

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Old Well Campsite	BB14004	Teledyne	70189	0.20	0.04
	BB14037	Teledyne	70190	0.17	0.04
	BB14041	Teledyne	70183	0.27	0.05
	BB14079	Teledyne	75184	< 0.04	
		USEPA	SSFL92.1891	0.015	0.008
	BB14094	Teledyne	70187	< 0.04	
RD-51 Watershed	BB15001	Teledyne	74358	0.045	0.026
		DHS		0.04	0.01
	BB15002	Teledyne	74360	0.044	0.022
		Teledyne(FD)	75181	< 0.04	
	BB15003	Teledyne	74362	0.039	0.020
	BB15004	Teledyne	74364	0.043	0.025
		BBI		< 0.3	
	BB15005	Teledyne	74366	0.052	0.025
		USEPA	SSFL92.3048	0.041	0.013
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	74405	0.070	0.028
	BB16001B	Teledyne	74380	< 0.04	
		USEPA	SSFL92.3052	<0.017	
	BB16002	Teledyne	74370	<0.04	
	BB16003	Teledyne	74372	< 0.03	
		USEPA	SSFL92.3051	0.0078	0.0081
	BB16004	Teledyne	74374	0.34	0.04
		DHS		0.60	0.03
	BB16005	Teledyne	74376	< 0.04	
		BBI		< 0.3	
Building 59 Watershed	BB17001	Teledyne	74325	0.077	0.032
		USEPA	SSFL92.3270	0.086	0.016
	BB17002	Teledyne	74327	0.16	0.04
	BB17003	Teledyne	74329	0.13	0.03
		DHS		0.09	0.02
	BB17004	Teledyne	74331	0.23	0.03
		BBI		< 0.3	

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
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+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Sodium Burn Pit Watershed	BB18001	Teledyne	74321	0.086	0.039
		BBI		< 0.3	
		USEPA	SSFL92.3070	0.088	0.018
	BB18002	Teledyne	74340	0.057	0.023
	BB18003	Teledyne	74342	< 0.03	
	BB18001A	Teledyne	74336	0.11	0.03
		DHS		0.07	0.02
	BB18002A	Teledyne	74338	0.063	0.027
	BB18003A	Teledyne	74343	NA	
	BB18001B	Teledyne	74315	< 0.03	
	BB18002B	Teledyne	74317	< 0.05	
	BB18003B	Teledyne	74319	0.060	0.028
Sodium Reactor Experiment Watershed	BB19001	Teledyne	74385	0.30	0.05
	BB19002	Teledyne	74387	0.24	0.06
		DHS		0.28	0.03
	BB19003	Teledyne	74389	< 0.04	
		USEPA	SSFL92.3079	0.055	0.010
	BB19004	Teledyne	74391	0.18	0.03
		BBI		< 0.3	
The Visitor Center Parking Lot	SM01004	Teledyne	71354	0.038	0.022
		USEPA	SSFL92.2591	0.054	0.017
	SM01007	Teledyne	71356	< 0.04	
		USEPA	SSFL92.2590	0.069	0.014
	SM01008	Teledyne	71348	0.073	0.024
	SM01020	Teledyne	71359	< 0.04	
	SM01021	Teledyne	71350	0.12	0.02
The Existing Road System	SM02004	Teledyne	69566	< 0.06	
	SM02019	Teledyne	69572	0.12	0.03
		USEPA	SSFL92.1775	0.12	0.01
	SM02021	Teledyne	69570	0.052	0.026
	SM02032	Teledyne	69568	< 0.04	
	SM02044	Teledyne	69564	< 0.04	

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS*-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137**	
				pCi/g (dry)	Error +/-
Near the Former Rocketdyne Employee Shooting Range	SM03001	Teledyne	69581	0.19	0.05
		USEPA	SSFL92.1774	0.17	0.02
	SM03009	Teledyne	69579	0.13	0.04
	SM03012	Teledyne	69575	0.13	0.03
	SM03014	Teledyne	69583	0.10	0.03
		Teledyne (FD)	69584	0.083	0.026
	SM03015	Teledyne	69577	0.27	0.040
The Orange Groves	SM04003	Teledyne	69742	0.17	0.05
	SM04024	Teledyne	69748	0.42	0.06
		Teledyne(LD)		0.39	0.04
	SM04026	Teledyne	69746	< 0.05	
	SM04028	Teledyne	69744	0.12	0.04
	SM04041	Teledyne	69740	0.29	0.05

(FD) - Field duplicate sample
(LD) - Lab duplicate sample
(LS-TI) - Laboratory split from Teledyne, Illinois
BBI - Brandeis-Bardin Institute split sample
Cs-137 - Cesium-137
DHS - Department of Health Services split sample
NA - Not analyzed
pCi/g(dry) - Picocuries per gram of dried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** - Values rounded to two significant figures
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS - WATER SAMPLES*

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137 pCi/L
Rocky Peak	BG01002	Teledyne	69555	< 4
		USEPA	SSFL92.1756	<4.7
Campsite Area 1	BB03001	Teledyne	70158	< 4
		USEPA	SSFL92.1881	<4.3
Campsite Area 2	BB04001	Teledyne	70449	< 4
		USEPA	SSFL92.1882	<8.1
Radioactive Materials	BB16001A	Teledyne	74409	< 3
Disposal Facility	BB16001B	Teledyne	74405	< 2
Watershed		USEPA	SSFL92.3055	<4.7
	BB16RD30*	Teledyne	74395	< 4
		USEPA	SSFL92.3065	<4.8
Sodium Burn Pit	BB18003	Teledyne	74343	< 4
Watershed		Teledyne (FD)	74345	< 4
		DHS		<8.0
Sodium Reactor Experiment Watershed	BB19003	Teledyne	74401	< 3
Antenna Well**	SM05001	Teledyne	69558	< 5
		USEPA	SSFL92.1755	<5.5
	SM05002	Teledyne	70339	< 4
Well by the Gate**	SM07001	Teledyne	69755	< 5
		USEPA	SSFL92.1754	<4.6
	SM07002	Teledyne	70335	< 5
Spring	SM08001	Teledyne	70363	< 5
		USEPA	SSFL92.1946	<4.3

(FD) - Field duplicate sample

Cs-137 - Cesium-137

pCi/L - Picocuries per liter of water

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency Split Sample

* All other man-made, gamma-emitting radionuclides were below detection limits.

** - Groundwater samples, all other samples are surface water samples.

< - Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS - FRUIT SAMPLES*

SAMPLE LOCATION	GRID** BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137 pCi/g(wet)
Orchards Near Happy Camp	BG07001A	Teledyne	70347	< 0.006
		USEPA	SSFL92.1833	<0.021
	BG07002A	Teledyne	70348	< 0.007
	BG07003A	Teledyne	70349	< 0.006
	BG07004L	Teledyne	70350	< 0.006
		USEPA	SSFL92.1835	<0.013
	BG07005L	Teledyne	70351	< 0.007
	BG07006L	Teledyne	70352	< 0.005
Local Supermarket	BG08001O	Teledyne	70660	< 0.005
		Teledyne(FD)		< 0.005
	BG08002O	Teledyne	70658	< 0.005
	BG08003O	Teledyne	70659	< 0.005
	BG08004T	Teledyne	71343	< 0.005
		USEPA	SSFL92.2089	<0.010
	BG08005T	Teledyne	71345	< 0.007
	BG08006T	Teledyne	71344	< 0.007
	BG08007A	Teledyne	71339	< 0.007
	BG08008A	Teledyne	71340	< 0.008
	BG08009A	Teledyne	71341	< 0.007
		Teledyne (FD)	71342	< 0.007

(FD) - Field duplicate sample

(LD) - Lab duplicate sample

Cs-137 - Cesium-137

pCi/g(wet) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

* All other man-made, gamma-emitting radionuclides were below detection limits

**A - Avocado

**L - Lemon

**O - Orange

**T - Tangerine

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS – FRUIT SAMPLES*

SAMPLE LOCATION	GRID** BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs–137 pCi/g(wet)
Main House Orchard	BB12020T	Teledyne	70662	< 0.005
	BB12006L	Teledyne	70664	< 0.003
		USEPA	SSFL92.1936	<0.013
	BB12026L	Teledyne	70663	< 0.003
		Teledyne (LD)	70667	< 0.004
		Teledyne (FD)	70665	< 0.007
Avocado Grove	BB13011A	Teledyne	70657	< 0.005
	BB13024A	Teledyne	70656	< 0.004
	BB13039A	Teledyne	70655	< 0.005
The Orange Groves	SM040030O	Teledyne	69547	< 0.006
		Teledyne (FD)	69548	< 0.007
		USEPA	SSFL92.1834	<0.013
	SM040260O	Teledyne	69551	< 0.008
		Teledyne (FD)	69552	< 0.008
	SM040280O	Teledyne	69550	< 0.007
		Teledyne (FD)	69549	< 0.006

(FD) - Field duplicate sample

(LD) - Lab duplicate sample

Cs-137 - Cesium-137

pCi/g(wet) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

* All other man-made, gamma-emitting radionuclides were below detection limits

**A - Avocado

**L - Lemon

**O - Orange

**T - Tangerine

< – Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GROSS ALPHA/BETA SCAN – WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	ABORATOR ID#	Gross Alpha pCi/L	Error +/-	Gross Beta pCi/L	Error +/-
Rocky Peak	BG01002	Teledyne	69562	<2		<3	
		USEPA	SSFL92.1760	<5.2		<5.3	
Campsite Area 1	BB03001	Teledyne	70159	<3		7.8	3.3
		USEPA	SSFL92.1879	<2.4		5.2	1.5
Campsite Area 2	BB04001	Teledyne	70450	<3		<4	
		USEPA	SSFL92.1880	<1.6		4.2	1.5
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	74410	<5		20	4
	BB16001B	Teledyne	74406	<5		25	4
		USEPA	SSFL92.3057	2.5	1.6	18.5	2.1
	BB16RD30*	Teledyne	74396	<4		9.4	3.2
		USEPA	SSFL92.3066	2.3	1.5	10.9	1.6
Sodium Burn Pit Watershed	BB18003	Teledyne	74344	<2		<3	
		Teledyne (FD)	74346	<2		4.1	2
		DHS		<0.40		<2.50	
Sodium Reactor Experiment Watershed	BB19003	Teledyne	74402	<4		4.9	2.5
Antenna Well*	SM05001	Teledyne	69561	<7		7.9	3.2
		USEPA	SSFL92.1759	<3.8		5.5	3.4
	SM05002	Teledyne	70340	2.9	2.7	8.3	3.4
Well by the Gate*	SM07001	Teledyne	69756	<3		3.8	2.3
		USEPA	SSFL92.1758	<4.4		<5.0	
	SM07002	Teledyne	70336	5.5	3.1	5.7	2.8
Spring	SM08001	Teledyne	70344	3.4	2.4	<4	
		USEPA	SSFL92.1945	<4.6		<4.6	

(FD) – Field duplicate sample
DHS – Department of Health Services split sample
Gross Alpha/Beta Scan – Analysis for alpha– and beta–emitting radionuclides
pCi/L – Picocuries per liter of water
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protecton Agency split sample
* – Groundwater samples, all other samples are surface water.
< – Less than
+/– Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	IODINE-129 pCi/g(dry)	ERROR (+/-)
Rocky Peak	BG01005	Teledyne	1832	<0.2	
	BG01008	Teledyne	1825	<0.2	
	BG01100	Teledyne	1824	<0.1	
Santa Susana Park	BG02007	Teledyne	1822	<0.1	
		USEPA	S20303401A	<0.37	
	BG02074	Teledyne	1821	<0.3	
	BG02076	Teledyne	1823	<0.1	
Bell Canyon	BG03001	Teledyne	1996	<0.3	
	BG03019	Teledyne	1997	<0.3	
	BG03059	Teledyne	1998	<0.3	
		USEPA	S20303502A	<0.27	
Western Site	BG04025	Teledyne	1872	<0.3	
	BG04029	Teledyne	1874	<0.2	
		USEPA	S20303502A	<0.27	
	BG04090	Teledyne	1873	<0.3	
Happy Camp	BG05016	Teledyne	1877	<0.2	
	BG05026	Teledyne	1876	<0.2	
	BG05074	Teledyne	1875	<0.3	
Santa Monica Mountains National Recreation Area	BG06033	Teledyne	1991	<0.4	
	BG06089	Teledyne	1992	<0.3	
	BG06096	Teledyne	1993	<0.3	
		Teledyne (FD)	1994	<0.3	

(FD) - Field duplicate sample

(LD) - Lab duplicate

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	IODINE-129 pCi/g(dry)	ERROR (+/-)
Perimeter of the Playground	BB01001	Teledyne	1935	<0.3	
	BB01027	Teledyne	1936	<0.3	
	BB01038	Teledyne	1937	<0.2	
	BB00004	Teledyne (FD)	1938	<0.3	
	BB01041	Teledyne	2034	<0.3	
	BB01056	Teledyne	1934	<0.23	
		USEPA	S20304404A	<0.3	
Dormitory Area	BB02045	Teledyne	1970	<0.2	
	BB02060	Teledyne	1971	<0.2	
	BB02071	Teledyne	1969	<0.3	
	BB02075	Teledyne	1972	<0.3	
	BB02078	Teledyne	1953	<0.3	
Campsite Area 1	BB03005	Teledyne	1923	<0.2	
		USEPA	S20303705A	<0.28	
	BB03017	Teledyne	1922	<0.3	
	BB03025	Teledyne	1919	<0.2	
	BB03079	Teledyne	1921	<0.2	
	BB03092	Teledyne	1920	<0.2	
Campsite Area 2	BB04021	Teledyne	1879	<0.2	
		USEPA	S20303703A	<0.29	
	BB04023	Teledyne	1880	<0.3	
	BB04026	Teledyne	1883	<0.3	
	BB04082	Teledyne	1882	<0.3	
		Teledyne(FD)	1889	<0.3	
	BB04097	Teledyne	1881	<0.3	
Picnic Area	BB05003	Teledyne	1924	<0.2	
	BB05006	Teledyne	1926	<0.2	
	BB05057	Teledyne	1927	<0.2	
	BB05077	Teledyne	1928	<0.2	
		USEPA	S20304402A	<0.23	
	BB05089	Teledyne	1925	<0.2	
House of the Book	BB06007	Teledyne	1915	<0.3	
	BB06013	Teledyne	1918	<0.2	
	BB06017	Teledyne	1914	<0.2	
	BB06066	Teledyne	1917	<0.2	
	BB06092	Teledyne	1916	<0.2	
		USEPA	S20303707A	<0.28	

(FD) - Field duplicate sample

(LD) - Lab duplicate

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	IODINE-129 pCi/g(dry)	ERROR (+/-)
Counselor-in-Training Area	BB07012	Teledyne	1945	<0.3	
	BB07035	Teledyne	1961	<0.3	
	BB07036	Teledyne	1962	<0.4	
	BB07038	Teledyne	1946	<0.2	
	BB07058	Teledyne	1944	<0.2	
Potential Development Site 1	BB08003	Teledyne	1965	<0.3	
	BB08022	Teledyne	1966	<0.3	
	BB08034	Teledyne	1963	<0.3	
	BB08035	Teledyne	1964	<0.3	
	BB08038	Teledyne	1967	<0.3	
Potential Development Site 2	BB09031	Teledyne	1956	<0.3	
	BB09051	Teledyne	1957	<0.3	
	BB09070	Teledyne	1954	<0.2	
	BB09092	Teledyne	1955	<0.3	
	BB09100	Teledyne	1958	<0.3	
		Teledyne(FD)	1959	<0.3	
Potential Development Site 3	BB10023	Teledyne	1951	<0.3	
	BB10029	Teledyne	1952	<0.3	
	BB10067	Teledyne	1948	<0.3	
	BB10079	Teledyne	1949	<0.3	
	BB10081	Teledyne	1950	<0.3	
Vegetable Garden	BB11006	Teledyne	1943	<0.3	
	BB11018	Teledyne	1939	<0.3	
	BB11032	Teledyne	1942	<0.3	
	BB11057	Teledyne	1941	<0.2	
	BB11061	Teledyne	1940	<0.3	
		USEPA	S20305001A	<0.16	
Main House Orchard	BB12003	Teledyne	1933	<0.2	
	BB12006	Teledyne	1929	<0.2	
	BB12019	Teledyne	1930	<0.2	
	BB12020	Teledyne	1932	<0.2	
		USEPA	S20304403A	<0.23	
	BB12023	Teledyne	1931	<0.3	
Avocado Grove	BB13010	Teledyne	1913	<0.2	
	BB13011	Teledyne	1912	<0.2	
	BB13024	Teledyne	1909	<0.2	
		USEPA	S20303706A	<0.29	
	BB13037	Teledyne	1910	<0.2	
	BB13039	Teledyne	1911	<0.2	

(FD) - Field duplicate sample

(LD) - Lab duplicate

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	IODINE-129 pCi/g(dry)	ERROR (+/-)
Old Well Campsite	BB14004	Teledyne	1888	<0.3	
		Teledyne (FD)	1898	<0.2	
	BB14037	Teledyne	1884	<0.2	
	BB14041	Teledyne	1885	<0.2	
	BB14079	Teledyne	1886	<0.3	
		USEPA	S20303704A	<0.28	
	BB14094	Teledyne	1887	<0.2	
RD-51 Watershed	BB15001	Teledyne	2171	<0.3	
		Teledyne (FD)	2159	<0.3	
	BB15002	Teledyne	2172	<0.3	
	BB15003	Teledyne	2173	<0.3	
	BB15004	Teledyne	2174	<0.2	
	BB15005	Teledyne	2158	<0.2	
		USEPA	S20405405A	<0.17	
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	2166	<0.3	
	BB16001B	Teledyne	2160	<0.3	
		USEPA	S20406101A	<0.17	
	BB16002	Teledyne	2161	<0.3	
		Teledyne(FD)	2165	<0.2	
	BB16003	Teledyne	2162	<0.3	
	BB16004	Teledyne	2163	<0.3	
	BB16005	Teledyne	2164	<0.3	
Building 59 Watershed	BB17001	Teledyne	2167	<0.3	
		USEPA	S20404605A	<0.17	
	BB17002	Teledyne	2168	<0.3	
	BB17003	Teledyne	2169	<0.2	
	BB17004	Teledyne	2170	<0.2	
		Teledyne	2170D	<0.2	
Sodium Burn Pit Watershed	BB18001	Teledyne	2179	<0.3	
		USEPA	S20404601A	<0.17	
	BB18002	Teledyne	2177	<0.3	
	BB18003	Teledyne	2178	<0.2	
	BB18001A	Teledyne	2175	<0.3	
	BB18002A	Teledyne	2176	<0.3	
	BB18003A	Teledyne	2180	<0.2	
	BB18001B	Teledyne	2183	<0.3	
	BB18002B	Teledyne	2182	<0.3	
	BB18003B	Teledyne	2181	<0.3	

(FD) - Field duplicate sample

(LD) - Lab duplicate

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	IODINE-129 pCi/g(dry)	ERROR (+/-)
Sodium Reactor	BB19001	Teledyne	2184	<0.3	
Experiment Watershed	BB19002	Teledyne	2185	<0.3	
	BB19003	Teledyne	2186	<0.3	
		USEPA	S20406102A	<0.17	
	BB19004	Teledyne	2187	<0.3	
The Visitor Center	SM01004	Teledyne	2003	<0.3	
Parking Lot		USEPA	S20305601A	<0.16	
	SM01007	Teledyne	2004	<0.3	
		USEPA	S20305602A	<0.16	
	SM01008	Teledyne	2000	<0.3	
	SM01020	Teledyne	2002	<0.3	
	SM01021	Teledyne	2001	<0.3	
The Existing Road	SM02004	Teledyne	1834	<0.1	
System	SM02019	Teledyne	1837	<0.2	
		USEPA	S20303403A	<0.27	
	SM02021	Teledyne	1836	<0.2	
	SM02032	Teledyne	1835	<0.2	
	SM02044	Teledyne	1833	<0.1	
Near the Former	SM03001	Teledyne	1841	<0.2	
Rocketdyne Employee		USEPA	S20303402A	<0.27	
Shooting Range	SM03009	Teledyne	1840	<0.2	
	SM03012	Teledyne	1838	<0.1	
	SM03014	Teledyne	1842	<0.1	
	SM03015	Teledyne	1839	<0.1	
The Orange Groves	SM04003	Teledyne	1827	<0.1	
	SM04024	Teledyne	1830	<0.2	
	SM04026	Teledyne	1829	<0.3	
	SM04028	Teledyne	1828	<0.2	
	SM04041	Teledyne	1826	<0.3	
		Teledyne (FD)	1831	<0.1	

(FD) - Field duplicate sample

(LD) - Lab duplicate

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE-129 RESULTS - WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	IODINE-129 pCi/L	ERROR (+/-)
Rocky Peak	BG01002	Teledyne	1853	<0.7	
		USEPA	S20303404A	<3.3	
Campsite Area 1	BB03001	Teledyne	1895	<0.7	
		USEPA	S20303702A	<3.3	
Campsite Area 2	BB04001	Teledyne	1900	<0.8	
		USEPA	S20303701A	<3.3	
Radioactive Materials Disposal Facility Watershed	BB16001B	Teledyne	2145	<1.8	
		USEPA	S20405401A	<2.5	
Sodium Burn Pit Watershed	BB18003	Teledyne	2150	<1.6	
		Teledyne (FD)	2149	<1.7	
Sodium Reactor Experiment Watershed	BB19003	Teledyne	2140	<1.8	
Antenna Well*	SM05001	Teledyne	1855	<0.7	
		USEPA	S20303407A	<3.3	
	SM05002	Teledyne	1977	<1.1	
Well by the Gate*	SM07001	Teledyne	1850	<0.9	
		USEPA	S20303406A	<3.3	
	SM07002	Teledyne	1978	<1.1	
Spring	SM08001	Teledyne	1976	<1.1	
		USEPA	S20304401A	<3.3	

(FD) - Field duplicate sample
pCi/L - Picocuries per liter of water
Teledyne - Teledyne Isotopes (Illinois)
USEPA - United States Environmental Protection Agency Split Sample
* - Groundwater samples, all others are surface water.
< - Less than
+/- - Plus or minus
Sample location BB16001A was not analyzed for Iodine-129.

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE 129 RESULTS – FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK*	LABORATORY	LABORATORY ID #	IODINE–129 pCi/g(wet)	ERROR (+/–)
Orchards Near Happy Camp	BG07001A	Teledyne	70347	<0.033	
		USEPA	20407103	<0.17	
	BG07002A	Teledyne	70348	<0.02	
	BG07003A	Teledyne	70349	<0.01	
	BG07004L	Teledyne	70350	<0.02	
		USEPA	20407102	<0.040	
	BG07005L	Teledyne	70351	<0.03	
	BG07006L	Teledyne	70352	<0.02	
Local Supermarket	BG08001O	Teledyne	70660	<0.02	
		Teledyne(FD)		<0.03	
	BG08002O	Teledyne	70658	<0.03	
	BG08003O	Teledyne	70659	<0.03	
	BG08004T	Teledyne	71343	<0.03	
		USEPA	20407107	<0.078	
	BG08005T	Teledyne	71344	<0.04	
	BG08006T	Teledyne	71345	<0.03	
	BG08007A	Teledyne	71339	<0.03	
	BG08008A	Teledyne	71340	<0.03	
	BG08009A	Teledyne	71341	<0.03	
		Teledyne (FD)	71342	<0.02	

(FD) – Field duplicate Sample
(LD) – Lab duplicate
pCi/g(wet) – Picocuries per gram of undried sample
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency split sample (Values rounded to two significant figures)
*A – Avocados
*L – Lemons
*O – Oranges
*T – Tangerines
< – Less than
+/- – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
IODINE 129 RESULTS - FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK*	LABORATORY	LABORATORY ID #	IODINE-129 pCi/g(wet)	ERROR (+/-)
Orchards Near Happy Camp	BG07001A	Teledyne	70347	<0.033	
		USEPA	20407103	<0.17	
	BG07002A	Teledyne	70348	<0.02	
	BG07003A	Teledyne	70349	<0.01	
	BG07004L	Teledyne	70350	<0.02	
		USEPA	20407102	<0.040	
	BG07005L	Teledyne	70351	<0.03	
	BG07006L	Teledyne	70352	<0.02	
Local Supermarket	BG08001O	Teledyne	70660	<0.02	
		Teledyne(FD)		<0.03	
	BG08002O	Teledyne	70658	<0.03	
	BG08003O	Teledyne	70659	<0.03	
	BG08004T	Teledyne	71343	<0.03	
		USEPA	20407107	<0.078	
	BG08005T	Teledyne	71344	<0.04	
	BG08006T	Teledyne	71345	<0.03	
	BG08007A	Teledyne	71339	<0.03	
	BG08008A	Teledyne	71340	<0.03	
	BG08009A	Teledyne	71341	<0.03	
		Teledyne (FD)	71342	<0.02	

(FD) - Field duplicate Sample
(LD) - Lab duplicate
pCi/g(wet) - Picocuries per gram of undried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample (Values rounded to two significant figures)
*A - Avocados
*L - Lemons
*O - Oranges
*T - Tangerines
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
Rocky Peak	BG01005	Teledyne	69753	< 0.07		< 0.01	
	BG01008	Teledyne	69751	< 0.04		< 0.01	
	BG01100	Teledyne	69749	< 0.02		< 0.01	
Santa Susana Park	BG02007	Teledyne	69733	< 0.02		< 0.01	
		USEPA	SSFL92.1779	0.05	0.05	0.064	0.06
	BG02074	Teledyne	69731	< 0.01		< 0.007	
	BG02076	Teledyne	69735	< 0.02		< 0.01	
Bell Canyon	BG03001	Teledyne	70157	< 0.03		< 0.006	
	BG03019	Teledyne	70139	0.066	0.055	< 0.02	
	BG03059	Teledyne	70141	0.10	0.07	< 0.02	
		USEPA	SSFL92.1839	< 0.02	0.03	< 0.018	
Western Site	BG04025	Teledyne	70143	< 0.009		< 0.006	
	BG04029	Teledyne	70147	< 0.008		< 0.005	
		USEPA	SSFL92.1840	< 0.04		< 0.023	
	BG04090	Teledyne	70145	< 0.01		< 0.007	
Happy Camp	BG05016	Teledyne	70166	< 0.02		< 0.005	
	BG05026	Teledyne	70164	< 0.03		< 0.006	
	BG05074	Teledyne	70162	< 0.02		< 0.005	
Santa Monica Mountains National Recreation Area	BG06033	Teledyne	70153	< 0.08		< 0.03	
	BG06089	Teledyne	70151	< 0.07		< 0.02	
	BG06096	Teledyne	70149	0.13	0.03	< 0.01	
		Teledyne (LD)		< 0.02			
		Teledyne (DC)		0.11	0.04		
		Teledyne (FD)	70150	0.012	0.002	< 0.0002	
		Teledyne (LD)		< 0.01			
		Teledyne (DC)		< 0.04			

(DC) - Duplicate count of original isotopic plutonium sample

(FD) - Field duplicate sample

(LD) - Lap duplicate using original sample

pCi/g(dry) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

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+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
Perimeter of the Playground	BB01001	Teledyne	70883	< 0.1		< 0.07	
	BB01027	Teledyne	70885	< 0.03		< 0.008	
	BB01038	Teledyne	70887	< 0.02		<0.007	
	BB01041	Teledyne	70881	< 0.06		< 0.02	
	BB01056	Teledyne	70879	< 0.1		< 0.04	
		USEPA	SSFL92.1950	< 0.02		< 0.015	
Dormitory Area	BB02045	Teledyne	70919	< 0.01		< 0.004	
	BB02060	Teledyne	70921	< 0.02		< 0.006	
	BB02071	Teledyne	70917	< 0.01		< 0.003	
	BB02075	Teledyne	70923	< 0.03		< 0.007	
	BB02078	Teledyne	70927	< 0.05		< 0.02	
Campsite Area 1	BB03005	Teledyne	70817	< 0.08		< 0.02	
		USEPA	SSFL92.1898	0.04	0.05	< 0.023	
	BB03017	Teledyne	70815	< 0.007		< 0.007	
	BB03025	Teledyne	70809	< 0.2		< 0.05	
	BB03079	Teledyne	70813	< 0.01		< 0.01	
	BB03092	Teledyne	70811	< 0.1		< 0.04	
Campsite Area 2	BB04021	Teledyne	70170	< 0.02		< 0.007	
		USEPA	SSFL92.1900	.025	0.020	< 0.016	
	BB04023	Teledyne	70172	< 0.01		< 0.006	
	BB04026	Teledyne	70178	< 0.009		< 0.006	
	BB04082	Teledyne	70176	< 0.02		< 0.007	
	BB04097	Teledyne	70174	< 0.02		< 0.005	
Picnic Area	BB05003	Teledyne	70856	< 0.01		< 0.005	
		Teledyne (FD)	70866	< 0.02		< 0.02	
	BB05006	Teledyne	70860	< 0.03		< 0.008	
	BB05057	Teledyne	70862	< 0.006		< 0.006	
	BB05077	Teledyne	70864	< 0.008		< 0.01	
		USEPA	SSFL92.1948	0.03	0.03	0.015	0.02
	BB05089	Teledyne	70858	< 0.03		< 0.02	
House of the Book	BB06007	Teledyne	70841	< 0.02		< 0.004	
	BB06013	Teledyne	70847	< 0.02		< 0.01	
	BB06017	Teledyne	70839	< 0.01		< 0.004	
	BB06066	Teledyne	70845	< 0.01		< 0.009	
	BB06092	Teledyne	70843	< 0.006		< 0.006	
		USEPA	SSFL92.1897	.031	.05	< 0.022	

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
Counselor-in-Training Area	BB07012	Teledyne	70951	< 0.06		< 0.02	
	BB07035	Teledyne	70943	< 0.06		< 0.02	
	BB07036	Teledyne	70945	< 0.08		< 0.04	
	BB07038	Teledyne	70953	< 0.2		< 0.04	
	BB07058	Teledyne	70949	< 0.06		< 0.01	
Potential Development Site 1	BB08003	Teledyne	70909	< 0.1		< 0.03	
	BB08022	Teledyne	70911	< 0.1		< 0.08	
	BB08034	Teledyne	70905	< 0.06		< 0.02	
		Teledyne(LD)	70925	<0.2		<0.1	
	BB08035	Teledyne	70907	< 0.1		< 0.03	
	BB08038	Teledyne	70913	< 0.05		< 0.02	
Potential Development Site 2	BB09031	Teledyne	70934	< 0.07		< 0.02	
	BB09051	Teledyne	70936	< 0.05		< 0.02	
	BB09070	Teledyne	70930	< 0.09		< 0.02	
		Teledyne (FD)	70940	< 0.02		< 0.02	
	BB09092	Teledyne	70932	< 0.1		< 0.04	
	BB09100	Teledyne	70938	< 0.1		< 0.05	
Potential Development Site 3	BB10023	Teledyne	70963	< 0.04		< 0.02	
	BB10029	Teledyne	70965	< 0.04		< 0.01	
	BB10067	Teledyne	70957	< 0.03		< 0.008	
	BB10079	Teledyne	70959	< 0.02		< 0.005	
	BB10081	Teledyne	70961	< 0.03		< 0.01	
Vegetable Garden	BB11006	Teledyne	70898	< 0.03		< 0.01	
	BB11018	Teledyne	70890	< 0.07		< 0.05	
	BB11032	Teledyne	70896	< 0.07		< 0.02	
	BB11057	Teledyne	70894	< 0.06		< 0.02	
	BB11061	Teledyne	70892	< 0.05		< 0.01	
		USEPA	SSFL92.2047	0.02	0.03	<0.008	
Main House Orchard	BB12003	Teledyne	70875	< 0.08		< 0.03	
	BB12006	Teledyne	70867	< 0.07		< 0.02	
	BB12019	Teledyne	70869	< 0.1		< 0.09	
	BB12020	Teledyne	70873	< 0.1		< 0.04	
		USEPA	SSFL92.1949	0.03	0.04	< 0.019	
	BB12023	Teledyne	70871	< 0.07		< 0.02	

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Teledyne - Teledyne Isotopes (New Jersey)

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< - Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
Avocado Grove	BB13010	Teledyne	70850	< 0.05		< 0.01	
	BB13011	Teledyne	70828	< 0.05		< 0.02	
	BB13024	Teledyne	70822	< 0.09		< 0.02	
		USEPA	SSFL92.1896	< 0.03		< 0.021	
		Teledyne (FD)	70851	< 0.05		< 0.01	
	BB13037	Teledyne	70824	< 0.03		< 0.01	
	BB13039	Teledyne	70826	< 0.1		< 0.04	
Old Well Campsite	BB14004	Teledyne	70188	< 0.07		< 0.02	
	BB14037	Teledyne	70180	< 0.01		< 0.009	
	BB14041	Teledyne	70182	< 0.06		< 0.08	
	BB14079	Teledyne	75183	0.12	0.03	< 0.006	
		Teledyne (LD)		< 0.08			
		Teledyne (DC)		0.10	0.03		
		USEPA	SSFL92.1899	< 0.02		< 0.011	
	BB14094	Teledyne	70186	< 0.05		< 0.01	
RD-51 Watershed	BB15001	Teledyne	74357	0.22	0.07	< 0.01	
	BB15002	Teledyne	74359	0.067	0.025	< 0.005	
	BB15003	Teledyne	74361	< 0.05		< 0.01	
	BB15004	Teledyne	74363	< 0.05		< 0.01	
	BB15005	Teledyne	74365	0.055	0.042	< 0.01	
		USEPA	SSFL92.3049	< 0.02		< 0.011	
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	74379	< 0.04		< 0.008	
	BB16001B	Teledyne	74367	< 0.03		< 0.01	
		USEPA	SSFL92.3053	< 0.02		< 0.019	
	BB16002	Teledyne	74369	0.066	0.061	< 0.02	
		Teledyne (LD)	89859	< 0.04			
	BB16003	Teledyne	74371	< 0.02		< 0.009	
	BB16004	Teledyne	74373	< 0.07		< 0.03	
	BB16005	Teledyne	74375	< 0.02		< 0.005	
Building 59 Watershed	BB17001	Teledyne	74324	0.19	0.06	< 0.02	
		Teledyne (LD)		< 0.009			
		Teledyne (DC)		0.15	0.05		
		USEPA	SSFL92.3071	0.027	0.030	< 0.008	
	BB17002	Teledyne	74326	0.055	0.024	< 0.005	
	BB17003	Teledyne	74328	0.055	0.031	< 0.007	
	BB17004	Teledyne	74330	< 0.04		< 0.007	
		Teledyne (FD)	74332	0.33	0.08	< 0.01	
		Teledyne (LD)		< 0.06			
		Teledyne (DC)		0.27	0.07		

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pCi/g(dry) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
Sodium Burn Pit Watershed	BB18001	Teledyne	74320	0.017	0.013	< 0.004	
		USEPA	SSFL92.3074	< 0.02		< 0.015	
	BB18002	Teledyne	74339	< 0.02		< 0.01	
	BB18003	Teledyne	74341	< 0.1		< 0.03	
	BB18001A	Teledyne	90152	0.043	0.040	< 0.02	
	BB18002A	Teledyne	74337	< 0.03		< 0.01	
	BB18003A	Teledyne	74322	< 0.02		< 0.02	
	BB18001B	Teledyne	74314	< 0.02		< 0.01	
	BB18002B	Teledyne	74316	< 0.02		< 0.007	
	BB18003B	Teledyne	74318	< 0.02		< 0.009	
Sodium Reactor Experiment Watershed	BB19001	Teledyne	74384	< 0.05		< 0.03	
	BB19002	Teledyne	74386	< 0.06		< 0.01	
	BB19003	Teledyne	74388	< 0.07		< 0.01	
		USEPA	SSFL92.3080	0.03	0.05	< 0.020	
	BB19004	Teledyne	74390	< 0.04		< 0.01	
		Teledyne (FD)	75180	0.03	0.02	< 0.005	
The Visitor Center Parking Lot	SM01004	Teledyne	71353	0.082	0.036	< 0.01	
		USEPA	SSFL92.2592	0.02	0.03	0.010	0.02
	SM01007	Teledyne	71355	< 0.05		< 0.02	
	SM01008	Teledyne	71347	< 0.06		< 0.04	
	SM01020	Teledyne	71351	< 0.02		< 0.008	
	SM01021	Teledyne	71349	< 0.04		< 0.03	
he Existing Road System	SM02004	Teledyne	69565	< 0.04		< 0.007	
	SM02019	Teledyne	69571	< 0.01		< 0.009	
		USEPA	SSFL92.1780	< 0.43		< 0.032	
	SM02021	Teledyne	69569	< 0.01		< 0.008	
	SM02032	Teledyne	69567	< 0.02		< 0.005	
		Teledyne (FD)	69573	< 0.01		< 0.004	
	SM02044	Teledyne	69563	< 0.02		< 0.007	
Near the Former Rocketdyne Employee Shooting Range	SM03001	Teledyne	69580	< 0.02		< 0.02	
		USEPA	SSFL92.1781	< 0.03		< 0.027	
	SM03009	Teledyne	69578	< 0.02		< 0.005	
	SM03012	Teledyne	69574	< 0.02		< 0.004	
	SM03014	Teledyne	69572	< 0.02		< 0.005	
	SM03015	Teledyne	69541	< 0.04		< 0.01	

(DC) - Duplicate count of original isotopic plutonium sample

(FD) - Field duplicate sample

(LD) - Lap duplicate using original sample

pCi/g(dry) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	Plutonium-238 pCi/g(dry)	Error (+/-)	Plutonium-239 pCi/g(dry)	Error (+/-)
The Orange Groves	SM04003	Teledyne	69576	< 0.02		< 0.01	
	SM04024	Teledyne	69747	< 0.03		< 0.007	
	SM04026	Teledyne	69745	< 0.02		< 0.005	
	SM04028	Teledyne	69743	< 0.02		< 0.005	
	SM04041	Teledyne	69739	< 0.06		< 0.01	

(DC) - Duplicate count of original isotopic plutonium sample

(FD) - Field duplicate sample

(LD) - Lap duplicate using original sample

pCi/g(dry) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

< - Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS – WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK*	LABORATORY (Remarks)	LABORATORY ID#	Plutonium-238 pCi/L	Plutonium-239 pCi/L
Rocky Peak	BG01002	Teledyne	69557	<0.2	<0.09
		USEPA	SSFL92.1772	<0.04	<0.03
Campsite Area 1	BB03001	Teledyne	70160	<0.2	<0.07
		USEPA	SSFL92.2219	<0.02	<0.04
Campsite Area 2	BB04001	Teledyne	70447/8	<0.2	<0.2
		USEPA	SSFL92.2218	<0.03	<0.02
Radioactive Materials	BB16001A	Teledyne	74412	<0.8	<0.6
Watershed Disposal Facility	BB16001B	Teledyne	74408	<0.2	<0.06
		USEPA	SSFL92.3059	<0.04	<0.03
	BB16RD30*	Teledyne	74398	<0.3	<0.3
		USEPA	SSFL92.3069	<0.05	<0.04
Sodium Burn Pit	BB18003	Teledyne	74349	<0.2	<0.08
Watershed		Teledyne (FD)	74350	<0.2	<0.09
Sodium Reactor Experiment Watershed	BB19003	Teledyne	74404	<0.4	<0.3
Antenna Well*	SM05001	Teledyne	69560	<0.2	<0.09
		USEPA	SSFL92.1771	<0.06	<0.05
	SM05002	Teledyne	70342	<0.1	<0.09
Well by the Gate*	SM07001	Teledyne	69757	<0.2	<0.09
		USEPA	SSFL92.1770	<0.04	<0.03
	SM07002	Teledyne	70388	<0.2	<0.04
Spring	SM08001	Teledyne	70346	<0.2	<0.1
		USEPA	SSFL92.1943	<0.08	<0.02

(FD) – Field duplicate sample
pCi/L – Picocuries per liter of water
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency split sample (Values rounded to two significant figures)
* – Groundwater samples, all other samples are surface water.
< – Less than
+/- – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS – FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK*	LABORATORY (Remarks)	LABORATORY ID#	Plutonium-238 pCi/g(wet)	Plutonium-239 pCi/g(wet)
Orchards Near Happy Camp	BG07001A	Teledyne	70347	<0.002	<0.0005
	BG07001	USEPA	SSFL92.2045	<.000618	<.000584
	BG07002A	Teledyne	70348	<0.002	<0.0003
	BG07003A	Teledyne	70349	<0.0007	<0.0009
	BG07004L	Teledyne	70350	<0.0001	<0.00003
		USEPA	SSFL92.4032	<0.00009	<0.00008
	BG07005L	Teledyne	70351	<0.00009	<0.00003
	BG07006L	Teledyne	70352	<0.0002	<0.00005
Local Supermarket	BG08001O	Teledyne	70660	<0.0002	<0.0002
		Teledyne(FD)		<0.002	
	BG08002O	Teledyne	70658	<0.0003	<0.0001
	BG08003O	Teledyne	70659	<0.0002	<0.0001
	BG08004T	Teledyne	71343	<0.0007	<0.0003
		USEPA	SSFL92.4041	<0.0001	<0.00009
	BG08005T	Teledyne	71345	<0.0005	<0.0002
	BG08006T	Teledyne	71344	<0.0007	<0.0004
	BG08007A	Teledyne	71339	<0.0007	<0.0002
	BG08008A	Teledyne	71340	<0.0007	<0.0002
	BG08009A	Teledyne	71341	<0.0005	<0.0001
		Teledyne (FD)	71342	<0.001	<0.0004

(FD) - Field duplicate sample

pCi/g(wet) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

* A - Avocado

* L - Lemon

* O - Orange

* T - Tangerine

< - Less than

+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
ISOTOPIC PLUTONIUM RESULTS – FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK*	LABORATORY (Remarks)	LABORATORY ID#	Plutonium–238 pCi/g(wet)	Plutonium–239 pCi/g(wet)
Main House Orchard	BB12020T	Teledyne	70662	<0.0003	<0.00009
	BB12006L	Teledyne	70664	<0.0005	<0.0002
		USEPA	SSFL92.1939	<0.00009	<0.0007
	BB12026L	Teledyne	70663	<0.0005	<0.0002
		Teledyne (FD)	70665	<0.0003	<0.0001
Avocado Grove	BB13011A	Teledyne	70657	<0.001	<0.0005
	BB13024A	Teledyne	70656	<0.0004	<0.0002
	BB13039A	Teledyne	70655	<0.0005	<0.0002
The Orange Groves	SM04003O	Teledyne	69547	<0.0004	<0.0001
		Teledyne (FD)	69548	<0.0003	<0.0001
		USEPA	SSFL92.4044	<0.0001	<0.0001
	SM04026O	Teledyne	69551	<0.0002	<0.0001
		Teledyne (FD)	69552	<0.0009	<0.0006
	SM04028O	Teledyne	69550	<0.0002	<0.0001
		Teledyne (FD)	69549	<0.0003	<0.00008

(FD) - Field duplicate sample

pCi/g(wet) - Picocuries per gram of undried sample

Teledyne - Teledyne Isotopes (New Jersey)

USEPA - United States Environmental Protection Agency split sample

* A - Avocado

* L - Lemon

* O - Orange

* T - Tangerine

< - Less than

+/- - Plus or minus

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Rocky Peak	BG01005	M/H	<1.00	2.1	0.66	<0.50	21	11	<0.25	16	18	<2.50	<0.25	<0.50	48
	BG01008	M/H	<1.00	2.2	0.61	<0.50	21	11	<0.25	16	9.5	<2.50	<0.25	<0.50	45
	BG01100	M/H	<1.00	1.7	0.71	<0.50	22	12	<0.25	16	26	<2.50	<0.25	<0.50	51
Santa Susana Park	BG02007	M/H	<1.00	3.6	0.53	<0.50	14	10	<0.25	9.1	34	<2.50	<0.25	<0.50	48
		USEPA	0.5	3.6	0.3	<0.5	9	8	<0.1	6	22.8		<0.2		37.6
	BG02074	M/H	<1.00	1.7	0.46	<0.50	16	17	<0.25	14	6.5	<2.50	<0.25	<0.50	55
	BG02076	M/H	<1.00	2.9	0.54	<0.50	14	11	<0.25	10	12	<2.50	<0.25	<0.50	49
Bell Canyon	BG03001	M/H	<1.00	3.1	1.00	6.4	96	65	<0.25	82	15	<2.50	0.69	<0.50	120
	BG03019	M/H	1.30	14.0	0.68	4.1	87	72	<0.25	77	9.2	<2.50	1.1	<0.50	120
	BG03059	M/H	<1.00	5.1	0.48	7.3	40	40	<0.25	64	5.5	<2.50	0.82	<0.50	72
		USEPA	1.60	4.8	0.6	5.0	62	40	<0.1	70	5.3		0.6		85.5
Western Location	BG04025	M/H	<1.00	3.3	0.65	<0.50	23	20	<0.25	16	18	<2.50	<0.25	<0.50	69
		M/H (FD)	<1.00	3.0	0.67	<0.50	23.00	17.00	<0.25	16.00	18.00	<2.50	<0.25	<0.50	68
	BG04029	M/H	<1.00	3.0	0.73	<0.50	23	14	<0.25	15	15	<2.50	<0.25	<0.50	67
		USEPA	0.80	4.7	1.0	<0.5	30.00	14.00	<0.1	17.00	10.50		<0.2		75
	BG04090	M/H	<1.00	3.0	0.65	<0.50	24	14	<0.25	14	20	<2.50	<0.25	<0.50	70

Blank - Not Analyzed

(FD) - Field duplicate sample

mg/kg - milligrams per kilogram

M/H - McLaren/Hart Analytical Laboratory

USEPA - United States Environmental Protection Agency split sample

Metals:

As - Arsenic
Ag - Silver
Be - Beryllium
Cd - Cadmium
<- Less than

Cr - Chromium
Cu - Copper
Hg - Mercury

Ni - Nickel
Pb - Lead
Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Happy Camp	BG05016	M/H	<1.00	2.3	0.48	1.2	16	17	<0.25	17	8.7	<2.50	<0.25	<0.50	42
	BG05026	M/H	<1.00	4.4	0.45	1.5	15	16	<0.25	17	7.5	<2.50	<0.25	<0.50	40
	BG05074	M/H	<1.00	2.2	0.41	2.2	22	19	<0.25	23	6.6	<2.50	0.40	<0.50	51
Santa Monica Mountains National Recreation Area	BG06033	M/H	<1.00	3.0	0.56	2.7	24	24	<0.25	35	8.3	<2.50	0.53	<0.50	58
	BG06089	M/H	<1.00	3.1	0.62	3.6	33	34	<0.25	45	8.3	<2.50	0.70	<0.50	66
	BG06096	M/H	<1.00	3.0	0.66	3.9	35	30	<0.25	46	12	<2.50	0.52	<0.50	68

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mg/kg - milligrams per kilogram

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USEPA - United States Environmental Protection Agency split sample

Metals:

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Ag - Silver
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Cd - Cadmium
<- Less than
Cr - Chromium
Cu - Copper
Hg - Mercury
Ni - Nickel
Pb - Lead
Sb - Antimony
Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Perimeter of the Playground	BB01001	M/H	<1.00	7.1	0.78	<0.50	19	18	<0.25	17	16	<2.50	0.8	<0.50	64
	BB01027	M/H	<1.00	2.2	0.39	<0.50	10	9.6	<0.25	5.9	26	<2.50	1.6	<0.50	52
	BB01038	M/H	<1.00	3.6	0.56	<0.50	11	14	<0.25	7.9	12	<2.50	1.9	<0.50	42
	BB01041	M/H	<1.00	4.0	0.56	<0.50	12	19	<0.25	9.5	14	<2.50	4.9	<0.50	52
	BB01056	M/H	<1.00	13.0	0.89	<0.50	24	28	<0.25	18	18	<2.50	<0.25	<0.50	74
		USEPA	<0.5	6.7	0.7	<0.5	22	20	<0.1	17	15.8		<0.2		71.1
Dormitory Area	BB02045	M/H	<1.00	4.8	0.27	<0.50	6.7	7.2	<0.25	4.2	5.1	<2.50	1.8	<0.50	27
	BB02060	M/H	<1.00	4.8	0.42	<0.50	8.2	9.1	<0.25	4.9	8.1	<2.50	2.0	<0.50	34
	BB02071	M/H	<1.00	3.7	0.28	<0.50	6.7	11	<0.25	5	6.4	<2.50	1.1	<0.50	30
	BB02075	M/H	<1.00	6.6	0.44	<0.50	10	8.5	<0.25	6.6	11	<2.50	2.6	<0.50	39
	BB02078	M/H	<1.00	<0.5	0.44	<0.50	10	13	<0.25	6.8	11	<2.50	<0.25	<0.50	48
Campsite Area 1	BB03005	M/H	<1.00	1.9	0.60	<0.50	13	11	<0.25	11	14	<2.50	<0.25	<0.50	46
		USEPA	<0.5	2.8	0.4	<0.5	11	8	<0.1	11	13.8		<0.2		39.7
	BB03017	M/H	<1.00	1.5	0.50	<0.50	10	10	<0.25	8.5	8.8	<2.50	<0.25	<0.50	37
	BB03025	M/H	<1.00	1.0	0.52	<0.50	12	10	<0.25	10	12	<2.50	<0.25	<0.50	44
	BB03079	M/H	<1.00	2.6	0.65	<0.50	13	10	<0.25	9.1	9.8	<2.50	<0.25	<0.50	47
	BB03092	M/H	<1.00	2.9	0.67	<0.50	17	9.6	<0.25	14	12	<2.50	<0.25	<0.50	46

Blank - Not Analyzed

(FD) - Field duplicate sample

mg/kg - milligrams per kilogram

M/H - McLaren/Hart Analytical Laboratory

USEPA - United States Environmental Protection Agency split sample

Metals:

As - Arsenic
Ag - Silver
Be - Beryllium
Cd - Cadmium
< - Less than

Cr - Chromium
Cu - Copper
Hg - Mercury

Ni - Nickel
Pb - Lead
Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Campsite Area 2	BB04021	M/H	<1.00	2.4	0.59	<0.50	9	9.1	<0.25	5.1	6.6	<2.50	<0.25	<0.50	45
		USEPA	<0.5	3.7	0.3	<0.5	7	6	<0.1	5	5.3		<0.2		36.6
	BB04023	M/H	<1.00	2.3	0.36	<0.50	9.7	10	<0.25	6	7.4	<2.50	<0.25	<0.50	41
	BB04026	M/H	<1.00	3.0	0.46	<0.50	9.7	8.2	<0.25	5.4	7.6	<2.50	<0.25	<0.50	45
	BB04082	M/H	<1.00	1.9	0.39	<0.50	8.6	7	<0.25	4.8	5	<2.50	<0.25	<0.50	39
	BB04097	M/H	<1.00	2.3	0.38	<0.50	7.8	5.9	<0.25	4.4	8.8	<2.50	<0.25	<0.50	40
Picnic Area	BB05003	M/H	<1.00	3.5	0.52	<0.50	13	16	<0.25	10	18	<2.50	2.0	<0.50	52
	BB05006	M/H	<1.00	4.6	0.39	<0.50	11	13	<0.25	8.4	10	<2.50	7.6	<0.50	36
	BB05057	M/H	<1.00	1.5	0.53	<0.50	12	17	<0.25	10	10	<2.50	1.1	<0.50	46
	BB05077	M/H	<1.00	2.8	0.55	<0.50	12	15	<0.25	10	12	<2.50	2.1	<0.50	44
		USEPA	<0.5	2.9	0.4	<0.5	11	13	<0.1	10	14		<0.2		44.1
	BB05089	M/H	<1.00	1.3	0.54	<0.50	11	14	<0.25	9.2	12	<2.50	1.3	<0.50	36
House of the Book	BB06007	M/H	<1.00	5.5	0.88	<0.50	20	20	<0.25	15	17	<2.50	<0.25	<0.50	80
	BB06013	M/H	<1.00	4.6	0.77	<0.50	23	22	<0.25	23	13	<2.50	<0.25	<0.50	72
	BB06017	M/H	<1.00	3.4	0.80	<0.50	19	20	<0.25	16	16	<2.50	<0.25	<0.50	73
	BB06066	M/H	<1.00	1.4	0.83	<0.50	15	18	<0.25	10	15	<2.50	<0.25	<0.50	53
	BB06092	M/H	<1.00	3.2	0.72	<0.50	14	19	<0.25	9.6	15	<2.50	<0.25	<0.50	54
		USEPA	<0.5	6.1	0.7	1.1	12	18	<0.1	10	12.6		<0.2		52.4

Blank - Not Analyzed
(FD) - Field duplicate sample
mg/kg - milligrams per kilogram
M/H - McLaren/Hart Analytical Laboratory
USEPA - United States Environmental Protection Agency split sample
Metals:

As - Arsenic	Cr - Chromium	Ni - Nickel	Se - Selenium
Ag - Silver	Cu - Copper	Pb - Lead	Tl - Thallium
Be - Beryllium	Hg - Mercury	Sb - Antimony	Zn - Zinc
Cd - Cadmium			
< - Less than			

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Counselor-in-Training Area	BB07012	M/H	<1.00	3.2	0.52	<0.50	9.4	10	<0.25	6.6	11	<2.50	<0.25	<0.50	46
	BB07035	M/H	<1.00	2.0	0.48	<0.50	13	13	<0.25	8.7	12	<2.50	6.4	<0.50	48
	BB07036	M/H	<1.00	2.9	0.44	<0.50	9.8	11	<0.25	7.1	9.7	<2.50	8.1	<0.50	42
	BB07038	M/H	<1.00	2.5	0.50	<0.50	10	9.3	<0.25	7.4	12	<2.50	0.35	<0.50	45
	BB07058	M/H	<1.00	2.4	0.47	<0.50	8.1	11	<0.25	6.7	15	<2.50	7.2	<0.50	41
Potential Development Site 1	BB08003	M/H	<1.00	<0.50	0.56	<0.50	21	24	<0.25	15	16	<2.50	2.0	<0.50	58
	BB08022	M/H	<1.00	<0.50	0.62	<0.50	21	25	<0.25	16	16	<2.50	2.1	<0.50	59
	BB08034	M/H	<1.00	11.0	0.61	<0.50	22	25	<0.25	16	16	<2.50	4.5	<0.50	61
	BB08035	M/H	<1.00	0.50	0.55	<0.50	20	25	<0.25	16	17	<2.50	<0.25	<0.50	60
	BB08038	M/H	<1.00	13.0	0.62	<0.50	20	26	<0.25	16	16	<2.50	5.8	<0.50	60
Potential Development Site 2	BB09031	M/H	<1.00	<0.50	0.76	<0.50	22	28	<0.25	19	18	<2.50	2.4	<0.50	63
		M/H (FD)	<1.00	4.3	0.78	<0.50	25	27	<0.25	18	19	<2.50	2.7	<0.50	61
	BB09051	M/H	<1.00	16.0	0.73	<0.50	21	29	<0.25	18	17	<2.50	7.8	<0.50	60
	BB09070	M/H	<1.00	<0.50	0.73	<0.50	27	28	<0.25	20	19	<2.50	<0.25	<0.50	65
	BB09092	M/H	<1.00	<0.50	0.74	<0.50	24	27	<0.25	19	19	<2.50	2.0	<0.50	62
	BB09100	M/H	<1.00	4.4	0.71	<0.50	24	27	<0.25	18	16	<2.50	1.3	<0.50	60

Blank - Not Analyzed

(FD) - Field duplicate sample

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USEPA - United States Environmental Protection Agency split sample

Metals:

As - Arsenic
Ag - Silver
Be - Beryllium
Cd - Cadmium
<- Less than

Cr - Chromium
Cu - Copper
Hg - Mercury

Ni - Nickel
Pb - Lead
Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Potential Development Site 3	BB10023	M/H	<1.00	4.6	0.65	<0.50	19	17	<0.25	15	17	<2.50	1.4	<0.50	61
	BB10029	M/H	<1.00	<0.50	0.87	<0.50	24	24	<0.25	20	18	<2.50	1.9	<0.50	80
	BB10067	M/H	<1.00	3.4	0.88	<0.50	25	22	<0.25	19	17	<2.50	2.0	<0.50	80
		M/H (FD)	<1.00	6.6	0.88	<0.50	24	21	<0.25	19	16	<2.50	0.54	<0.50	75
	BB10079	M/H	<1.00	3.1	0.64	<0.50	17	16	<0.25	13	13	<2.50	0.35	<0.50	60
	BB10081	M/H	<1.00	4.7	0.64	<0.50	18	15	<0.25	13	13	<2.50	<0.25	<0.50	54
Vegetable Garden	BB11006	M/H	<1.00	4.4	0.57	<0.50	14	16	<0.25	11	19	<2.50	1.3	<0.50	69
	BB11018	M/H	<1.00	4.0	0.56	<0.50	14	15	<0.25	10	19	<2.50	0.59	<0.50	65
	BB11032	M/H	<1.00	4.1	0.60	<0.50	16	15	<0.25	11	22	<2.50	0.72	<0.50	69
	BB11057	M/H	<1.00	3.8	0.50	<0.50	13	15	<0.25	8.9	22	<2.50	0.79	<0.50	64
	BB11061	M/H	<1.00	4.5	0.69	<0.50	15	23	<0.25	11	18	<2.50	0.68	<0.50	70
		USEPA	<0.5	2.4	0.5	<0.5	15	23	<0.1	12	11.4		<0.2		67

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Pb - Lead
Sb - Antimony
Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Main House Orchard	BB12003	M/H	<1.00	2.8	0.46	<0.50	12	16	<0.25	8.5	17		2.0	<0.50	72
	BB12006	M/H	<1.00	2.4	0.44	<0.50	12	16	<0.25	8.6	53	<2.50	1.7	<0.50	78
	BB12019	M/H	<1.00	2.8	0.52	<0.50	15	21	<0.25	9.9	20	<2.50	2.0	<0.50	74
	BB12020	M/H	<1.00	3.5	0.49	<0.50	13	21	<0.25	9.7	18	<2.50	1.9	<0.50	70
		M/H (FD)	<1.00	2.7	0.55	<0.50	16	22	<0.25	11	18	<2.50	2.2	<0.50	76
		USEPA	<0.5	1.8	0.5	<0.5	15	18	<0.1	11	19		<0.2		72.4
	BB12023	M/H	<1.00	2.5	0.46	<0.50	13	21	<0.25	10	25	<2.50	0.75	<0.50	76
Avocado Grove	BB13010	M/H	<1.00	11.0	0.85	<0.50	22	21	<0.25	19	17	<2.50	2.5	<0.50	74
	BB13011	M/H	<1.00	5.5	0.69	<0.50	20	17	<0.25	16	15	<2.50	<0.25	<0.50	63
	BB13024	M/H	<1.00	2.3	0.99	<0.50	25	20	<0.25	18	16	<2.50	2.9	<0.50	68
		USEPA	<0.5	4.9	0.8	<0.5	19	15	<0.1	15	10		<0.2		62.8
	BB13037	M/H	<1.00	4.5	0.68	<0.50	20	19	<0.25	16	16	<2.50	3.0	<0.50	67
	BB13039	M/H	<1.00	7.6	0.70	<0.50	21	19	<0.25	16	17	<2.50	<0.25	<0.50	67

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Cd - Cadmium
< - Less than

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Hg - Mercury

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Pb - Lead
Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Old Well Campsite	BB14004	M/H	<1.00	1.2	0.43	<0.50	11	8.9	<0.25	6.2	11	<2.50	<0.25	<0.50	41
	BB14037	M/H	<1.00	2.2	0.43	<0.50	15	11	<0.25	7.9	9	<2.50	<0.25	<0.50	42
	BB14041	M/H	<1.00	2.4	0.40	<0.50	8.7	6	<0.25	5.2	10	<2.50	<0.25	<0.50	37
		M/H (FD)	<1.00	2.7	0.53	<0.50	15	14	<0.25	8.3	9	<2.50	<0.25	<0.50	44
	BB14079	M/H	<1.00	1.0	0.51	<0.50	14	9.2	<0.25	8.5	7.4	<2.50	<0.25	<0.50	40
		USEPA	<0.5	2.8	0.5	<0.5	13	22	<0.1	9	5.5		<0.2		45
	BB14094	M/H	<1.00	2.6	0.46	<0.50	12	9.4	<0.25	6.8	9.4	<2.50	<0.25	<0.50	43
RD-51 Watershed	BB15001	M/H	<1.00	2.0	<0.25	<0.50	7.6	5.2	<0.25	4.2	7.6	<2.50	<0.25	<0.50	45
	BB15002	M/H	<1.00	2.4	<0.25	<0.50	8.8	5.3	<0.25	5	8.6	<2.50	<0.25	<0.50	49
	BB15003	M/H	<1.00	1.9	<0.25	<0.50	7.4	5.3	<0.25	4.5	9.8	<2.50	<0.25	<0.50	51
	BB15004	M/H	<1.00	2.7	0.30	<0.50	12	6.2	<0.25	5.5	21	<2.50	<0.25	<0.50	54
	BB15005	M/H	<1.00	2.8	0.28	<0.50	9.8	5.9	<0.25	6	12	<2.50	<0.25	<0.50	51
		USEPA	<0.5	1.6	0.2	<0.5	17	5	<0.1	6	9.3		<0.2		68.9

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< - Less than

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Hg - Mercury

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Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE - SANTA SUSANA FIELD LABORATORY

METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Radioactive Materials	BB16001A	M/H	<1.00	2.7	0.42	<0.50	14	7.5	<0.25	8.1	8	<2.50	<0.25	<0.50	44
Disposal Facility	BB16001B	M/H	<1.00	2.4	<0.25	<0.50	5.8	3	<0.25	2.8	3.3	<2.50	<0.25	<0.50	19
Watershed		USEPA	<0.5	1.2	0.2	<0.5	5	6	<0.1	3	2		<0.2		21.1
	BB16002	M/H	<1.00	2.6	0.32	<0.50	10	6.3	<0.25	6.5	5	<2.50	<0.25	<0.50	36
	BB16003	M/H	<1.00	1.1	<0.25	<0.50	4.9	2.7	<0.25	2.9	2.4	<2.50	<0.25	<0.50	18
	BB16004	M/H	<1.00	2.5	0.39	<0.50	9.9	6.5	<0.25	5.7	14	<2.50	<0.25	<0.50	120
	BB16005	M/H	<1.00	1.6	<0.25	<0.50	5	2.5	<0.25	2.8	2.6	<2.50	<0.25	<0.50	18
Building 59 Watershed	BB17001	M/H	<1.00	2.4	0.39	<0.50	12	6.7	<0.25	6.6	9.7	<2.50	<0.25	<0.50	42
		USEPA	<0.5	2.5	0.4	<0.5	13	6	<0.1	9	4.5		<0.2		54.4
	BB17002	M/H	<1.00	3.0	0.32	<0.50	16	8.6	<0.25	8.4	11	<2.50	<0.25	<0.50	46
	BB17003	M/H	<1.00	2.6	0.44	<0.50	12	8.3	<0.25	8.6	14	<2.50	<0.25	<0.50	40
	BB17004	M/H	<1.00	1.9	0.46	<0.50	14	8.3	<0.25	8.3	14	<2.50	<0.25	<0.50	43

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ROCKETDYNE - SANTA SUSANA FIELD LABORATORY

METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Sodium Burn Pit	BB18001	M/H	<1.00	8.8	0.31	<0.50	9.3	6.1	0.35	6.2	26	<2.50	<0.25	<0.50	32
Watershed		USEPA	<0.5	13.8	0.2	<0.50	7	4	0.4	5	6.5		<0.2		22.4
	BB18002	M/H	<1.00	1.9	<0.25	<0.50	5.9	3.8	<0.25	2.9	4.1	<2.50	<0.25	<0.50	22
	BB18003	M/H	<1.00	5.1	<0.25	<0.50	4.8	2.9	<0.25	2.7	4	<2.50	<0.25	<0.50	19
	BB18001A	M/H	<1.00	4.2	<0.25	<0.50	6.5	3.9	<0.25	4.1	9.8	<2.50	<0.25	<0.50	25
	BB18002A	M/H	<1.00	2.5	0.39	<0.50	11	6.9	<0.25	7.3	10	<2.50	<0.25	<0.50	41
	BB18003A	M/H	<1.00	24.0	0.30	<0.50	8.1	4.6	<0.25	4.3	7.8	<2.50	<0.25	<0.50	34
	BB18001B	M/H	<1.00	4.4	0.39	<0.50	6.5	4.1	<0.25	4.2	5.3	<2.50	<0.25	<0.50	36
	BB18002B	M/H	<1.00	2.2	0.33	<0.50	10	5.7	<0.25	5.6	6	<2.50	<0.25	<0.50	36
	BB18003B	M/H	<1.00	2.5	<0.25	<0.50	4.9	3.4	<0.25	2.9	5	<2.50	<0.25	<0.50	19
Sodium Reactor	BB19001	M/H	<1.00	2.6	0.41	<0.50	11	8.1	<0.25	6.2	17	<2.50	<0.25	<0.50	110
Experiment Watershed	BB19002	M/H	<1.00	2.7	0.44	<0.50	13	8.8	<0.25	6.9	16	<2.50	<0.25	<0.50	52
		M/H (FD)	<1.00	1.8	0.39	<0.50	11	6.2	<0.25	5.9	13	<2.50	<0.25	<0.50	39
	BB19003	M/H	<1.00	1.9	0.27	<0.50	7.4	4.5	<0.25	3.9	4.5	<2.50	<0.25	<0.50	58
		USEPA	<0.5	1.9	0.2	<0.5	6	6	<0.1	5	3.5		<0.2		56
	BB19004	M/H	<1.00	3.0	0.32	<0.50	5.5	3.4	<0.25	2.6	5.9	<2.50	<0.25	<0.50	44

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ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
The Visitor Center	SM01004	M/H	<1.00	6.4	0.74	<0.50	20	21	<0.25	15	16	<2.50	<0.25	<0.50	62
Parkin Lot		USEPA	<0.5	5.4	0.92	<0.5	21	22	<0.1	15	14		<0.2		67.1
	SM01007	M/H	<1.00	5.2	0.80	<0.50	21	23	<0.25	16	19	<2.50	<0.25	<0.50	64
	SM01008	M/H	<1.00	6.2	1.00	<0.50	24	24	<0.25	20	26	<2.50	<0.25	<0.50	76
	SM01020	M/H	<1.00	8.2	1.20	<0.50	24	34	<0.25	18	17	<2.50	<0.25	<0.50	70
	SM01021	M/H	<1.00	5.4	0.57	<0.50	12	12	<0.25	8.3	11	<2.50	<0.25	<0.50	34
The Existing Road	SM02004	M/H	<1.00	2.0	0.58	<0.50	14	9.7	<0.25	10	13	<2.50	<0.25	<0.50	44
System	SM02019	M/H	<1.00	1.9	0.63	0.52	14	11	<0.25	11	13	<2.50	0.20	<0.50	47
		USEPA	<0.5	4.0	0.5	<0.5	12	10	<0.1	10	10.8		<0.2		40.3
	SM02021	M/H	<1.00	2.0	0.71	<0.50	16	13	<0.25	12	11	<2.50	<0.25	<0.50	49
	SM02032	M/H	<1.00	2.0	0.61	<0.50	16	11	<0.25	12	11	<2.50	<0.25	<0.50	46
	SM02044	M/H	<1.00	2.1	0.52	<0.50	13	8.3	<0.25	9.2	7.6	<2.50	<0.25	<0.50	38
Near the Former	SM03001	M/H	<1.00	4.8	0.31	<0.50	9.4	7.4	<0.25	5.7	170	<2.50	<0.25	<0.50	34
Rocketdyne Employee		USEPA	<0.5	5.7	0.30	<0.5	8	7	<0.1	6	225		<0.2		28.8
Shooting Range	SM03009	M/H	<1.00	7.1	0.37	<0.50	11	8.3	<0.25	7.2	59	<2.50	<0.25	<0.50	37
	SM03012	M/H	<1.00	3.0	0.61	<0.50	12	12	<0.25	8.1	82	<2.50	<0.25	<0.50	41
	SM03014	M/H	<1.00	4.5	0.34	<0.50	10	8.6	<0.25	6.8	84	<2.50	<0.25	<0.50	39
	SM03015	M/H	<1.00	7.0	0.38	<0.50	11	8.9	<0.25	7.6	280	<2.50	<0.25	<0.50	43

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ROCKETDYNE - SANTA SUSANA FIELD LABORATORY
METALS RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	METALS (mg/kg)												
			Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
The Orange Groves	SM04003	M/H	<1.00	2.9	0.74	0.55	14	17	<0.25	10	16	<2.50	<0.25	<0.50	50
	SM04024	M/H	<1.00	2.3	0.74	<0.50	16	21	<0.25	12	26	<2.50	<0.25	<0.50	58
		M/H (FD)	<1.00	2.5	0.74	<0.50	16	20	<0.25	11	26	<2.50	<0.25	<0.50	60
	SM04026	M/H	<1.00	2.1	0.77	<0.50	16	17	<0.25	12	13	<2.50	<0.25	<0.50	53
	SM04028	M/H	<1.00	1.9	0.67	0.52	14	16	<0.25	10	13	<2.50	<0.25	<0.50	55
	SM04041	M/H	<1.00	2.9	0.66	<0.50	14	13	<0.25	11	21	<2.50	<0.25	<0.50	48

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Hg - Mercury

Ni - Nickel
Pb - Lead
Sb - Antimony

Se - Selenium
Tl - Thallium
Zn - Zinc

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
METALS RESULTS - WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	METAL	PPB (ug/L)
Rocky Peak	BG01002	M/H	Zn	29
		USEPA	Zn	20
Campsite Area 1	BB03001	M/H	Zn	21
		USEPA	Zn	16
Campsite Area 2	BB04001	M/H	Zn	< 20
		USEPA	Zn	10
Radioactive Materials Disposal Facility Watershed	BB16001B	M/H	Zn	< 20
		USEPA	Zn	14
Sodium Burn Pit Watershed	BB18003	M/H	--	--
		M/H (FD)	--	--
Sodium Reactor Experiment Watershed	BB19003	M/H	--	--
Spring	SM08001	M/H	Zn	< 20
		USEPA	Zn	23

-- Below reporting limit
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - Parts per billion
USEPA - United States Environmental Protection Agency Split Sample
ug/L - Micrgrams per liter of water
Zn - Zinc
<- Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
Rocky Peak	BG01005	Teledyne	1832	0.03	0.01
	BG01008	Teledyne	1825	0.01	0.01
	BG01100	Teledyne	1824	0.05	0.01
Santa Susana Park	BG02007	Teledyne	1822	0.02	0.01
		USEPA	SSFL92.1777	< 0.68	
	BG02074	Teledyne	1821	< 0.01	
	BG02076	Teledyne	1823	0.03	0.01
Bell Canyon	BG03001	Teledyne	1996	< 0.01	
	BG03019	Teledyne	1997	0.02	0.01
	BG03059	Teledyne	1998	0.01	0.01
		USEPA	SSFL92.1839	<0.72	
Western Site	BG04025	Teledyne	1872	0.02	0.01
	BG04029	Teledyne	1874	0.02	0.01
		USEPA	SSFL92.1838	< 0.67	
	BG04090	Teledyne	1873	0.05	0.01
Happy Camp	BG05016	Teledyne	1877	0.05	0.01
	BG05026	Teledyne	1876	0.08	0.02
	BG05074	Teledyne	1875	0.05	0.01
Santa Monica Mountains National Recreation Area	BG06033	Teledyne	1991	0.03	0.01
	BG06089	Teledyne	1992	0.03	0.01
	BG06096	Teledyne	1993	0.02	0.01
		Teledyne (FD)	1994	0.04	0.01

(FD) - Field duplicate sample

(LD) - Lab duplicate

BBI - Brandeis-Bardin Institute split sample

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

< - Less than

+/- Plus or minus

* - Withdrawn by Brandeis-Bardin Consultant (Cehn, 1993)

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
Perimeter of the	BB01001	Teledyne	1935	< 0.01	
Playground	BB01027	Teledyne	1936	< 0.01	
		BBI		< 0.7	
	BB01038	Teledyne	1937	0.02	0.01
		Teledyne (FD)	1938	0.01	0.01
	BB01041	Teledyne	2034	0.02	0.01
	BB01056	Teledyne	1934	0.04	0.01
		USEPA	SSFL92.1952	< 0.69	
Dormitory Area	BB02045	Teledyne	1970	<0.01	
	BB02060	Teledyne	1971	0.01	0.01
	BB02071	Teledyne	1969	0.01	0.01
		BBI		< 1.2	
	BB02075	Teledyne	1972	0.01	0.01
	BB02078	Teledyne	1953	0.02	0.01
Campsite Area 1	BB03005	Teledyne	1923	0.06	0.01
		USEPA	SSFL92.1893	< 0.66	
	BB03017	Teledyne	1922	0.05	0.01
	BB03025	Teledyne	1919	0.09	0.01
	BB03079	Teledyne	1921	0.03	0.01
	BB03092	Teledyne	1920	0.04	0.01
Campsite Area 2	BB04021	Teledyne	1879	0.03	0.01
		USEPA	SSFL92.1901	< 0.71	
	BB04023	Teledyne	1880	0.02	0.01
	BB04026	Teledyne	1883	0.03	0.01
	BB04082	Teledyne	1882	0.01	0.01
		Teledyne(FD)	1889	0.04	0.01
	BB04097	Teledyne	1881	0.01	0.01
Picnic Area	BB05003	Teledyne	1924	0.02	0.01
	BB05006	Teledyne	1926	0.02	0.01
	BB05057	Teledyne	1927	0.03	0.01
	BB05077	Teledyne	1928	0.06	0.01
		USEPA	SSFL92.1951	< 0.71	
	BB05089	Teledyne	1925	0.02	0.01

(FD) - Field duplicate sample

(LD) - Lab duplicate

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pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

< - Less than

+/- Plus or minus

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
House of the Book	BB06007	Teledyne	1915	< 0.01	
	BB06013	Teledyne	1918	0.01	0.01
	BB06017	Teledyne	1914	0.01	0.01
	BB06066	Teledyne	1917	< 0.01	
	BB06092	Teledyne	1916	< 0.01	
		USEPA	SSFL92.1892	< 0.70	
Counselor-in-Training Area	BB07012	Teledyne	1945	0.01	0.01
	BB07035	Teledyne	1961	0.02	0.01
		BBI		< 1.2	
	BB07036	Teledyne	1962	0.02	0.01
	BB07038	Teledyne	1946	0.02	0.01
	BB07058	Teledyne	1944	0.01	0.01
Potential Development Site 1	BB08003	Teledyne	1965	0.02	0.01
	BB08022	Teledyne	1966	0.01	0.01
		BBI		< 1.3	
	BB08034	Teledyne	1963	< 0.01	
	BB08035	Teledyne	1964	< 0.01	
	BB08038	Teledyne	1967	0.02	0.01
Potential Development Site 2	BB09031	Teledyne	1956	0.02	0.01
	BB09051	Teledyne	1957	0.02	0.01
	BB09070	Teledyne	1954	0.01	0.01
	BB09092	Teledyne	1955	0.02	0.01
		BBI		< 1.4	
	BB09100	Teledyne	1958	0.02	0.01
		Teledyne(FD)	1959	0.02	0.01
Potential Development Site 3	BB10023	Teledyne	1951	0.02	0.01
	BB10029	Teledyne	1952	0.02	0.01
	BB10067	Teledyne	1948	0.06	0.01
	BB10079	Teledyne	1949	0.05	0.01
	BB10081	Teledyne	1950	0.02	0.01
		BBI		< 0.6	

(FD) - Field duplicate sample

(LD) - Lab duplicate

BBI - Brandeis-Bardin Institute split sample

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

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+/- Plus or minus

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
Vegetable Garden	BB11006	Teledyne	1943	0.02	0.01
	BB11018	Teledyne	1939	0.02	0.01
		BBI		< 1.0	
	BB11032	Teledyne	1942	0.02	0.01
	BB11057	Teledyne	1941	0.02	0.01
	BB11061	Teledyne	1940	< 0.01	
		USEPA	SSFL92.2048	< 0.68	
Main House Orchard	BB12003	Teledyne	1933	0.01	0.01
	BB12006	Teledyne	1929	0.03	0.01
	BB12019	Teledyne	1930	0.04	0.01
		BBI		< 1.1	
	BB12020	Teledyne	1932	0.03	0.01
		USEPA	SSFL92.1953	< 0.74	
	BB12023	Teledyne	1931	0.02	0.01
Avocado Grove	BB13010	Teledyne	1913	< 0.01	
	BB13011	Teledyne	1912	0.01	0.01
	BB13024	Teledyne	1909	0.01	0.01
		USEPA	SSFL92.1894	< 0.65	
	BB13037	Teledyne	1910	0.01	0.01
	BB13039	Teledyne	1911	0.01	0.01
Old Well Campsite	BB14004	Teledyne	1888	0.05	0.01
		Teledyne (FD)	1898	0.06	0.01
	BB14037	Teledyne	1884	0.02	0.01
	BB14041	Teledyne	1885	0.06	0.01
	BB14079	Teledyne	1886	0.03	0.01
		USEPA	SSFL92.1895	< 0.71	
	BB14094	Teledyne	1887	0.02	0.01
RD-51 Watershed	BB15001	Teledyne	2171	0.01	0.01
		Teledyne (FD)	2159	0.02	0.02
	BB15002	Teledyne	2172	<0.01	
	BB15003	Teledyne	2173	0.01	0.01
	BB15004	Teledyne	2174	<0.01	
		BBI		< 0.6	
	BB15005	Teledyne	2158	<0.01	
		USEPA	SSFL92.3050	< 0.73	

(FD) - Field duplicate sample

(LD) - Lab duplicate

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pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
Radioactive Materials	BB16001A	Teledyne	2166	0.08	0.01
Disposal Facility	BB16001B	Teledyne	2160	0.03	0.01
Watershed		USEPA	SSFL92.3054	< 0.63	
	BB16002	Teledyne	2161	0.09	0.01
		Teledyne(FD)	2165	0.12	0.02
	BB16003	Teledyne	2162	0.02	0.01
	BB16004	Teledyne	2163	0.15	0.02
	BB16005	Teledyne	2164	0.04	0.01
		BBI		<0.6	
Building 59 Watershed	BB17001	Teledyne	2167	0.01	0.01
		USEPA	SSFL92.3072	< 0.66	
	BB17002	Teledyne	2168	0.02	0.01
	BB17003	Teledyne	2169	0.01	0.01
	BB17004	Teledyne	2170	0.03	0.01
		Teledyne(LD)	2170D	0.02	0.01
		BBI		*	
Sodium Burn Pit	BB18001	Teledyne	2179	0.02	0.01
Watershed		USEPA	SSFL92.3075	<0.62	
	BB18002	Teledyne	2177	<0.01	
	BB18003	Teledyne	2178	0.01	0.01
	BB18001A	Teledyne	2175	0.02	0.01
	BB18002A	Teledyne	2176	0.02	0.01
	BB18003A	Teledyne	2180	<0.01	
	BB18001B	Teledyne	2183	0.01	0.01
		BBI		<0.6	
	BB18002B	Teledyne	2182	0.02	0.01
	BB18003B	Teledyne	2181	<0.01	
Sodium Reactor	BB19001	Teledyne	2184	0.08	0.02
Experiment Watershed	BB19002	Teledyne	2185	0.09	0.02
	BB19003	Teledyne	2186	0.02	0.01
		USEPA	SSFL92.3081	< 0.74	
	BB19004	Teledyne	2187	0.03	0.01
		BBI		< 0.6	

(FD) - Field duplicate sample

(LD) - Lab duplicate

BBI - Brandeis-Bardin Institute split sample

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

< - Less than

+/- Plus or minus

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(dry)	ERROR (+/-)
The Visitor Center	SM01004	Teledyne	2003	0.02	0.01
Parking Lot		USEPA	SSFL92.2589	< 0.71	
	SM01007	Teledyne	2004	0.02	0.01
	SM01008	Teledyne	2000	0.04	0.01
	SM01020	Teledyne	2002	0.01	0.01
	SM01021	Teledyne	2001	0.02	0.01
The Existing Road	SM02004	Teledyne	1834	0.03	0.01
System	SM02019	Teledyne	1837	0.05	0.01
		USEPA	SSFL92.1776	< 0.75	
	SM02021	Teledyne	1836	0.03	0.01
	SM02032	Teledyne	1835	0.02	0.01
	SM02044	Teledyne	1833	0.02	0.01
Near the Former	SM03001	Teledyne	1841	0.07	0.01
Rocketdyne Employee		USEPA	SSFL92.1778	< 0.69	
Shooting Range	SM03009	Teledyne	1840	0.03	0.01
	SM03012	Teledyne	1838	0.02	0.01
	SM03014	Teledyne	1842	0.02	0.01
	SM03015	Teledyne	1839	0.05	0.01
The Orange Groves	SM04003	Teledyne	1827	0.04	0.01
	SM04024	Teledyne	1830	0.1	0.01
	SM04026	Teledyne	1829	0.03	0.01
	SM04028	Teledyne	1828	0.03	0.01
	SM04041	Teledyne	1826	0.14	0.02
		Teledyne (FD)	1831	0.15	0.02

(FD) - Field duplicate sample

(LD) - Lab duplicate

BBI - Brandeis-Bardin Institute split sample

pCi/g(dry) - Picocuries per gram of dried sample

Teledyne - Teledyne Isotopes (Illinois)

USEPA - United State Environmental Protection Agency split sample (Values rounded to two significant figures)

< - Less than

+/- Plus or minus

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS – WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM pCi/L	ERROR (+/-)
Rocky Peak	BG01002	Teledyne	1852	< 0.4	
		USEPA	SSFL92.1763	< 0.87	
Campsite Area 1	BB03001	Teledyne	1894	< 0.5	
		USEPA	SSFL92.1883	< 0.78	
Campsite Area 2	BB04001	Teledyne	1899	< 0.4	
		USEPA	SSFL92.1884	< 0.99	
Radioactive Materials	BB16001A	Teledyne	2142	1.1	0.3
Disposal Facility	BB16001B	Teledyne	2141	1.8	0.5
Watershed		USEPA	SSFL92.3058	7.79	+/-0.5
	BB16RD30*	Teledyne	2139	< 0.3	
		USEPA	SSFL92.3068	< 0.53	
Sodium Burn Pit	BB18003	Teledyne	2150	< 0.3	
Watershed		Teledyne (FD)	2149	1.0	0.4
Sodium Reactor Experiment Watershed	BB19003	Teledyne	2140	< 0.4	
Antenna Well*	SM05001	Teledyne	1854	< 0.4	
		USEPA	SSFL92.1762	< 0.74	
	SM05002	Teledyne	1980	< 0.4	
Well by the Gate*	SM07001	Teledyne	1851	< 0.4	
		USEPA	SSFL92.1761	< 0.86	
	SM07002	Teledyne	1981	< 0.3	
Spring	SM08001	Teledyne	1979	< 0.4	
		USEPA	SSFL92.1944	< 0.80	

(FD) – Field duplicate sample

pCi/L – Picocuries per liter of water

Teledyne – Teledyne Isotopes (Illinois)

USEPA – United States Environmental Protection Agency split sample (Values rounded to two significant figures)

* – Groundwater samples, all other samples are surface water.

< – Less than

+/- – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS - FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(wet)	ERROR (+/-)
Orchards Near Happy Camp	BG07001A	Teledyne	70347	< 0.003	
		USEPA	SSFL92.2044	< 0.023	
	BG07002A	Teledyne	70348	< 0.003	
	BG07003A	Teledyne	70349	0.0053	0.0038
	BG07004L	Teledyne	70350	0.0021	0.0012
		USEPA	SSFL92.4031	< 0.003	
	BG07005L	Teledyne	70351	0.0041	0.0017
	BG07006L	Teledyne	70352	0.0016	0.0011
Local Supermarket	BG08001O	Teledyne	70660	0.0076	0.0021
		Teledyne(FD)		0.0034	0.001
	BG08002O	Teledyne	70658	< 0.002	
	BG08003O	Teledyne	70659	0.0032	0.0018
	BG08004T	Teledyne	71343	0.021	0.005
		USEPA	SSFL92.4040	< 0.004	
	BG08005T	Teledyne	71344	< 0.004	
	BG08006T	Teledyne	71345	0.014	0.005
	BG08007A	Teledyne	71339	0.016	0.005
	BG08008A	Teledyne	71340	0.0068	0.0034
	BG08009A	Teledyne	71341	0.0072	0.0027
		Teledyne (FD)	71342	< 0.1	

(FD) - Field duplicate Sample
pCi/g(wet) - Picocuries per gram of undried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
STRONTIUM-90 RESULTS - FRUIT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY	LABORATORY ID #	STRONTIUM-90 pCi/g(wet)	ERROR (+/-)
Main House Orchard	BB12020T	Teledyne	70662	< 0.004	
	BB12006L	Teledyne	70664	< 0.003	
		USEPA	SSFL92.1938	< 0.006	
	BB12026L	Teledyne	70663	< 0.002	
		Teledyne (FD)	70665	0.0032	0.0022
		Teledyne (LD)	70667	< 0.003	
Avocado Grove	BB13011A	Teledyne	70657	< 0.002	
	BB13024A	Teledyne	70656	< 0.002	
	BB13039A	Teledyne	70655	< 0.002	
The Orange Groves	SM040030	Teledyne	69547	< 0.005	
		Teledyne(FD)	69548	< 0.003	
		USEPA	SSFL92.4043	< 0.005	
	SM040260	Teledyne	69551	< 0.005	
		Teledyne (FD)	69552	< 0.008	
	SM040280	Teledyne	69550	< 0.005	
		Teledyne (FD)	69549	< 0.006	

(FD) - Field duplicate Sample
pCi/g(wet) - Picocuries per gram of undried sample
Teledyne - Teledyne Isotopes (New Jersey)
USEPA - United States Environmental Protection Agency split sample
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+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/kg)
Rocky Peak	BG01005	M/H		--
	BG01008	M/H		--
	BG01100	M/H		--
Santa Susana Park	BG02007	M/H		--
		USEPA		--
	BG02074	M/H		--
	BG02076	M/H		--
Bell Canyon	BG03001	M/H		--
	BG03019	M/H		--
	BG03059	M/H		--
		USEPA		--
Western Site	BG04025	M/H		--
	BG04029	M/H		--
		USEPA		--
	BG04090	M/H		--
Happy Camp	BG05016	M/H		--
	BG05026	M/H		--
	BG05074	M/H		--
Santa Monica Mountains National Recreation Area	BG06033	M/H		--
	BG06089	M/H		--
		M/H (FD)		--
	BG06096	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
SVOC analysis includes 65 chemicals
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
< - Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/kg)
Perimeter of the Playground	BB01001	M/H		--
	BB01027	M/H		--
	BB01038	M/H		--
	BB01041	M/H		--
	BB01056	M/H		--
		USEPA		--
Dormitory Area	BB02045	M/H		--
	BB02060	M/H	4-Methylphenol	670
	BB02071	M/H		--
	BB02075	M/H		--
	BB02078	M/H		--
Campsite Area 1	BB03005	M/H		--
		USEPA		--
	BB03017	M/H		--
	BB03025	M/H		--
	BB03079	M/H		--
	BB03092	M/H		--
Campsite Area 2	BB04021	M/H		--
		USEPA		--
	BB04023	M/H		--
	BB04026	M/H		--
	BB04082	M/H		--
	BB04097	M/H		--
Picnic Area	BB05003	M/H		--
	BB05006	M/H		--
	BB05057	M/H		--
	BB05077	M/H		--
		USEPA		--
	BB05089	M/H		--
House of the Book	BB06007	M/H		--
	BB06013	M/H		--
	BB06017	M/H		--
	BB06066	M/H		--
	BB06092	M/H		--
		USEPA		--
Counselor-in-Training Area	BB07012	M/H	Bis(2-ethylhexyl)phthalate	370
	BB07035	M/H	Bis(2-ethylhexyl)phthalate	3100
	BB07036	M/H	Bis(2-ethylhexyl)phthalate	5800
	BB07038	M/H	Bis(2-ethylhexyl)phthalate	8100
	BB07058	M/H	Bis(2-ethylhexyl)phthalate	8500

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
SVOC analysis includes 65 chemicals
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
< - Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/kg)
Potential Development Site 1	BB08003	M/H		--
	BB08022	M/H		--
	BB08034	M/H		--
	BB08035	M/H		--
	BB08038	M/H		--
Potential Development Site 2	BB09031	M/H		--
	BB09051	M/H		--
	BB09070	M/H		--
	BB09092	M/H		--
	BB09100	M/H		--
Potential Development Site 3	BB10023	M/H		--
	BB10029	M/H		--
	BB10067	M/H		--
		M/H (FD)		--
	BB10079	M/H		--
	BB10081	M/H		--
Vegetable Garden	BB11006	M/H		--
		USEPA		--
	BB11018	M/H		--
	BB11032	M/H	4,4'-DDE	340
	BB11057	M/H	4,4'-DDE	< 330
		M/H (FD)	4,4'-DDE	360
	BB11061	M/H		--
Main House Orchard	BB12003	M/H		--
	BB12006	M/H		--
	BB12019	M/H		--
	BB12020	M/H		--
		USEPA		--
	BB12023	M/H		--
Avocado Grove	BB13010	M/H		--
	BB13011	M/H		--
	BB13024	M/H		--
		USEPA		--
	BB13037	M/H		--
		M/H (FD)		--
	BB13039	M/H		--
		M/H (FD)		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
SVOC analysis includes 65 chemicals
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
< - Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/kg)
Old Well Campsite	BB14004	M/H		--
	BB14037	M/H		--
	BB14041	M/H		--
	BB14079	M/H		--
		USEPA		--
	BB14094	M/H		--
RD-51 Watershed	BB15001	M/H		--
	BB15002	M/H		--
		M/H (FD)		--
	BB15003	M/H		--
	BB15004	M/H		--
	BB15005	M/H		--
		USEPA		--
Radioactive Materials Disposal Facility Watershed	BB16001A	M/H		--
	BB16001B	M/H		--
		USEPA		--
	BB16002	M/H		--
	BB16003	M/H		--
	BB16004	M/H		--
	BB16005	M/H		--
Building 59 Watershed	BB17001	M/H		--
		USEPA		--
	BB17002	M/H		--
	BB17003	M/H		--
	BB17004	M/H		--
Sodium Burn Pit Watershed	BB18001	M/H		--
		USEPA		--
	BB18002	M/H		--
	BB18003	M/H		--
	BB18001A	M/H		--
	BB18002A	M/H		--
	BB18003A	M/H		--
	BB18001B	M/H		--
	BB18002B	M/H		--
	BB18003B	M/H		--

-- Below reporting limits

(FD) - Field duplicate sample

M/H - McLaren/Hart Analytical Laboratory

PPB - parts per billion

SVOC analysis includes 65 chemicals

ug/kg - microgram per kilogram

USEPA - United States Environmental Protection Agency split sample

< - Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/kg)
Sodium Reactor Experiment Watershed	BB19001	M/H		--
	BB19002	M/H		--
	BB19003	M/H		--
		USEPA		--
	BB19004	M/H		--
The Visitor Center Parking Lot	SM01004	M/H		--
		USEPA		--
	SM01007	M/H		--
		USEPA		--
	SM01008	M/H		--
	SM01020	M/H		--
	SM01021	M/H		--
The Existing Road System	SM02004	M/H		--
	SM02019	M/H		--
		USEPA		--
	SM02021	M/H		--
	SM02032	M/H		--
	SM02044	M/H		--
Near the Former Rocketdyne Employee Shooting Range	SM03001	M/H		--
		USEPA		--
	SM03009	M/H		--
	SM03012	M/H		--
	SM03014	M/H		--
	SM00002	M/H		--
	SM03015	M/H		--
The Orange Groves	SM04003	M/H		--
		M/H (FD)		--
	SM04024	M/H		--
	SM04026	M/H		--
	SM04028	M/H		--
	SM04041	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
SVOC analysis includes 65 chemicals
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
< - Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
SEMI-VOLATILE ORGANIC COMPOUND (SVOC) RESULTS – WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	SVOC	PPB (ug/L)
Rocky Peak	BG01002	M/H	--	--
		USEPA	--	--
Campsite Area 1	BB03001	M/H	--	--
		USEPA	--	--
Campsite Area 2	BB04001	M/H	--	--
		USEPA	--	--
Radioactive Materials Disposal Facility	BB16001B	M/H	Fluoranthene	< 10
		USEPA	Fluoranthene	0.33
Sodium Burn Pit Watershed	BB18003	M/H	--	--
		M/H (FD)	--	--
Sodium Reactor Experiment Watershed	BB19003	M/H	--	--
Antenna Well*	SM05001	M/H	--	--
		USEPA	--	--
	SM05002	M/H	--	--
Well by the Gate*	SM07001	M/H	--	--
		USEPA	--	--
	SM07002	M/H	--	--
Spring	SM08001	M/H	--	--
		USEPA	--	--

(FD) – Field duplicate sample
-- Below reporting limits
M/H – McLaren/Hart Analytical Laboratory
PPB – parts per billion
ug/L – Microgram per liter of water
USEPA – United States Environmental Protection Agency split sample
* – Groundwater samples, all other samples are surface water.
< – Less than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Rocky Peak	BG01005	TELEDYNE	69754	220	80	13
	BG01008	TELEDYNE	69752	< 100		11
	BG01100	TELEDYNE	69750	380	100	18
Santa Susana Park	BG02007	TELEDYNE	69734	360	90	15
		USEPA	SSFL92.1773	< 200		21
		TELEDYNE (LS-TI)	89787	170	90	17.1
	BG02074	TELEDYNE	69736	W	120	9
	BG02076	TELEDYNE	69732	420	90	20
Bell Canyon	BG03001	TELEDYNE	70138	D		
	BG03019	TELEDYNE	70140	< 200		57
	BG03059	TELEDYNE	70142	< 200		58
		USEPA	SSFL92.1836	< 210		45
Western Site	BG04025	TELEDYNE	70144	220	80	38
		TELEDYNE (LS-TI)	89785	160	70	17.5
	BG04029	TELEDYNE	70161	750	200	25
		TELEDYNE (LS-TI)	89793	240	70	20.5
		USEPA	SSFL92.1837	< 209		21.5
	BG04090	TELEDYNE	70146	120	70	44
Happy Camp	BG05016	TELEDYNE	70167	260	160	19
	BG05026	TELEDYNE	70165	380	160	20
		TELEDYNE (LS-TI)	89786	200	70	12.6
	BG05074	TELEDYNE	70163	490	180	22
		TELEDYNE (FD)	75185	140	80	20
Santa Monica Mountains National Recreation Area	BG06033	TELEDYNE	70154	330	80	27
	BG06089	TELEDYNE	70152	440	90	25
	BG06096	TELEDYNE	70149	D		

(DC) - Duplicate count using original aliquot.

(FD) - Field duplicate sample.

(LS-TI) - Laboratory split from Teledyne, IL.

(LS-TN) - Laboratory split from Teledyne, New Jersey.

BBI - Brandeis Bardin Institute split sample.

DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.

USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.

D - Sample accidently dried, making analysis impossible.

gm - grams.

ml - milliliters

pCi/L - Picocuries per liter of water in soil/sediment.

Teledyne - Teledyne Isotopes (New Jersey) water extracted from samples using a vacuum cryogenic (freeze-dry) technique. Samples analyzed using liquid scintillation.

W - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and subsequently was withdrawn by the laboratory.

* - A second analysis was conducted by DHS 3 months later with the result of 392 +/- 153 pCi/L. (DHS, 1993)

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< - Less Than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS – SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Perimeter of the Playground	BB01001	TELEDYNE	70884	< 100		33
		TELEDYNE (FD)	70889	< 100		34
		TELEDYNE (DC)	70903	< 100		34
	BB01027	TELEDYNE	70886	< 200		12
	BB01038	TELEDYNE	70888	< 100		18
	BB01041	TELEDYNE	70882	< 200		23
	BB01056	TELEDYNE	70880	190	70	26
		USEPA	SSFL92.1956	< 200		27
Dormitory Area	BB02045	TELEDYNE	70920	W		8
	BB02060	TELEDYNE	70922	< 200		18
		TELEDYNE (FD)	70929	< 200		15
	BB02071	TELEDYNE	70918	W		6
	BB02075	TELEDYNE	70924	< 200		13
	BB02078	TELEDYNE	70928	< 200		22
Campsite Area 1 (BB03)	BB03005	TELEDYNE (LS-TI)	89791	< 200**		13.2
		USEPA	SSFL92.1889	< 209		20
	BB03017	TELEDYNE (LS-TI)	87180	<300**		7
		TELEDYNE (FD)	70819	< 400		16
	BB03025	TELEDYNE	70810	340	120	15
		TELEDYNE (LS-TI)	89798	200	120	18.4
	BB03079	TELEDYNE (LS-TI)	87181	< 200**		12
	BB03092	TELEDYNE (LS-TI)	87189	< 200**		13
Campsite Area 2	BB04021	TELEDYNE	70171	390	200	15
		USEPA	SSFL92.1888	< 200		11
	BB04023	TELEDYNE	70173	310	160	13
		TELEDYNE (LS-TI)	89803	230	90	11.6
	BB04026	TELEDYNE	70179	660	210	15
	BB04082	TELEDYNE	70177	510	180	13
	BB04097	TELEDYNE (LS-TI)	70175	< 200		19
		DHS		2470*	197	115
		USEPA (LS-TI)	SSFL92.4305	< 192		20

(DC) - Duplicate count using original aliquot.

(FD) - Field duplicate sample.

(LS-TI) - Laboratory split from Teledyne, IL.

(LS-TN) - Laboratory split from Teledyne, New Jersey.

BBI - Brandeis Bardin Institute split sample.

DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.

USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.

D - Sample accidently dried, making analysis impossible.

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+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Picnic Area	BB05003	TELEDYNE	70857	280	130	18
	BB05006	TELEDYNE	70861	200	110	15
	BB05057	TELEDYNE	70863	< 200		16
	BB05077	TELEDYNE	70865	< 200		19
		USEPA	SSFL92.1955	< 200		20
	BB05089	TELEDYNE (LS-TI)	87182	< 200**		10.5
House of the Book	BB06007	TELEDYNE (LS-TI)	89784	380**	140	8.5
	BB06013	TELEDYNE	70848	< 300		19
	BB06017	TELEDYNE	70840	D		
	BB06066	TELEDYNE (LS-TI)	87183	< 300**		8.5
	BB06092	TELEDYNE	70844	190	100	13
		USEPA	SSFL92.1887	< 210		20
Counselor-in-Training Area	BB07012	TELEDYNE	70952	210	70	15
	BB07035	TELEDYNE	70944	< 200		22
	BB07036	TELEDYNE	70946	< 200		19
	BB07038	TELEDYNE	70954	< 100		17
	BB07058	TELEDYNE	70950	190	80	16
Potential Development Site 1	BB08003	TELEDYNE	70910	280	100	16
	BB08022	TELEDYNE	70912	210	90	19
	BB08034	TELEDYNE	70906	< 100		23
	BB08035	TELEDYNE	70908	200	90	16
	BB08038	TELEDYNE	70914	420	100	17
Potential Development Site 2	BB09031	TELEDYNE	70935	180	100	22
	BB09051	TELEDYNE	70937	< 200		24
	BB09070	TELEDYNE	70931	< 200		28
	BB09092	TELEDYNE	70933	220	110	21
	BB09100	TELEDYNE	70939	< 200		30

(DC) - Duplicate count using original aliquot.

(FD) - Field duplicate sample.

(LS-TI) - Laboratory split from Teledyne, IL.

(LS-TN) - Laboratory split from Teledyne, New Jersey.

BBI - Brandeis Bardin Institute split sample.

DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.

USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.

D - Sample accidently dried, making analysis impossible.

gm - grams.

ml - milliliters

pCi/L - Picocuries per liter of water in soil/sediment.

Teledyne - Teledyne Isotopes (New Jersey) water extracted from samples using a vacuum cryogenic (freeze-dry) technique. Samples analyzed using liquid scintillation.

W - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and subsequently was withdrawn by the laboratory.

* - A second analysis was conducted by DHS 3 months later with the result of 392 +/- 153 pCi/L. (DHS, 1993)

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< - Less Than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Potential Development Site 3	BB10023	TELEDYNE	70964	< 100		28
	BB10029	TELEDYNE	70966	< 100		23
	BB10067	TELEDYNE	70958	< 100		25
	BB10079	TELEDYNE	70960	< 100		17
		TELEDYNE (FD)	70967	170	80	25
		TELEDYNE (DC)	70968	170	80	25
	BB10081	TELEDYNE (DC)	70962	< 100		24
Vegetable Garden	BB11006	TELEDYNE	70899	< 100		27
		TELEDYNE (LS-TI)	89795	160	80	16.1
	BB11018	TELEDYNE	70891	< 100		26
	BB11032	TELEDYNE	70897	< 100		26
	BB11057	TELEDYNE	70895	< 100		22
	BB11061	TELEDYNE	70893	< 100		26
		USEPA	SSFL92.2046	< 200		20
Main House Orchard	BB12003	TELEDYNE	70878	< 200		13
	BB12006	TELEDYNE	70868	< 100		17
	BB12019	TELEDYNE	70870	< 200		19
	BB12020	TELEDYNE (LS-TI)	89790	< 200**		8.6
		USEPA	SSFL92.1954	< 200		20
	BB12023	TELEDYNE	70872	< 200		23
Avocado Grove	BB13010	TELEDYNE (LS-TI)	89784	< 200**		8.7
	BB13011	TELEDYNE	70849	520	110	16
	BB13024	TELEDYNE	70823	760	200	14
		TELEDYNE (LS-TI)	89782	120	70	11.2
		USEPA	SSFL92.1890	< 206		20
	BB13037	TELEDYNE	70825	400	130	36
	BB13039	TELEDYNE	70829	< 200		30
		TELEDYNE (DC)	70827	< 200		30
		TELEDYNE (LS-TI)	89801	170	80	15.2

(DC) - Duplicate count using original aliquot.

(FD) - Field duplicate sample.

(LS-TI) - Laboratory split from Teledyne, IL.

(LS-TN) - Laboratory split from Teledyne, New Jersey.

BBI - Brandeis Bardin Institute split sample.

DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.

USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.

D - Sample accidently dried, making analysis impossible.

gm - grams.

ml - milliliters

pCi/L - Picocuries per liter of water in soil/sediment.

Teledyne - Teledyne Isotopes (New Jersey) water extracted from samples using a vacuum cryogenic (freeze-dry) technique. Samples analyzed using liquid scintillation.

W - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and subsequently was withdrawn by the laboratory.

* - A second analysis was conducted by DHS 3 months later with the result of 392 +/- 153 pCi/L. (DHS, 1993)

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< - Less Than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS – SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Old Well Campsite	BB14004	TELEDYNE	70189	< 200		16
	BB14037	TELEDYNE	70190	D		
	BB14041	TELEDYNE	70183	D		
	BB14079	TELEDYNE	75184	140	80	23
		USEPA	SSFL92.1891	< 200		20
	BB14094	TELEDYNE	70187	W	80	8
RD-51 Watershed	BB15001	TELEDYNE	74358	W		6
		DHS		316	152	58
	BB15002	TELEDYNE	74360	< 200		13
		TELEDYNE (FD)	75181	< 100		23
	BB15003	TELEDYNE	74362	< 200		9
		TELEDYNE (LS-TI)	89784	380	140	8.5
	BB15004	TELEDYNE	74364	W		5
	BB15005	TELEDYNE	74366	D		
		USEPA	SSFL92.3048	< 171		2.5

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(FD) - Field duplicate sample.

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+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Radioactive Materials Disposal Facility Watershed	BB16001A	TELEDYNE	74380	990	150	18
		TELEDYNE (LS-TI)	89792	955	100	13.4
	BB16001B	TELEDYNE	74368	< 200		40
		TELEDYNE (LS-TI)	89799	220	120	25.3
		USEPA	SSFL92.3052	< 190		24
	BB16002	TELEDYNE	74370	1100	100	15
		TELEDYNE (LS-TI)	87185	710	120	15.5
		USEPA (LS-TN)	SSFL92.6230	873	176	34
		USEPA(LS-TI)	SSFL92.6940	1679	913	15
	BB16003	TELEDYNE	74372	1300	300	42
		TELEDYNE (LS-TI)	87186	1500	200	12.5
		USEPA(LS-TI)	SSFL92.6941	1845	525	11
	BB16004	TELEDYNE	74374	1300	200	44
		TELEDYNE (LS-TI)	87187	1600	200	13.5
		DHS		1900	190	228
		USEPA(LS-TI)	SSFL92.6942	1764	173	40
		USEPA(LS-TN)	SSFL92.6229	1422	177	38
	BB16005	TELEDYNE	74376	1500	200	34
		TELEDYNE (LS-TI)	87188	1700	200	9.5
Building 59 Watershed	BB17001	TELEDYNE	74325	130	80	31
		USEPA	SSFL92.3070	< 190		30
	BB17002	TELEDYNE	74327	< 100		22
		TELEDYNE (LS-TI)	79836	< 100		22
		USEPA (LS-TI)	SSFL92.5111	< 200		22
	BB17003	TELEDYNE	74329	10800	300	42
		TELEDYNE (DC)		11000	1000	42
		USEPA (LS-TN)	SSFL92.5415	12380	371	30
		DHS		10700	300	305
	BB17004	TELEDYNE	74331	9810	330	33
		USEPA (LS-TN)	SSFL92.5712	9855	325	31
		BBI		12,720	4300	29

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ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Sodium Burn Pit Watershed	BB18001	TELEDYNE	74321	< 100		27
		USEPA	SSFL92.3073	< 200		20
	BB18002	TELEDYNE	74340	< 100		33
	BB18003	TELEDYNE	74342	< 100		
	BB18001A	TELEDYNE	74336	120	80	20
		DHS		260		289
	BB18002A	TELEDYNE	74338	< 100		34
	BB18003A	TELEDYNE	74343	D		
	BB18001B	TELEDYNE	74315	260	80	39
	BB18002B	TELEDYNE	74317	440	80	30
	BB18003B	TELEDYNE	74319	200	70	27
Sodium Reactor Experiment Watershed	BB19001	TELEDYNE	74385	D		
	BB19002	TELEDYNE	74387	< 100		35
		DHS		444	153	290
	BB19003	TELEDYNE	74389	200	100	35
		USEPA	SSFL92.3079	< 200		32
	BB19004	TELEDYNE	74391	< 100		38
		BBI		< 4500		25
The Visitor Center Parking Lot	SM01004	TELEDYNE	71354	< 100		22
		USEPA		< 224		21
	SM01007	TELEDYNE	71356	< 100		22
	SM01008	TELEDYNE	71348	< 100		24
	SM01020	TELEDYNE	71352	< 200		19
	SM01021	TELEDYNE	71350	< 100		26
The Existing Road System	SM02004	TELEDYNE	69566	< 100		33
	SM02019	TELEDYNE	69572	< 100		38
		USEPA	SSFL92.1775	< 200		21
	SM02021	TELEDYNE	69570	< 100		32
	SM02032	TELEDYNE	69568	< 100		35
	SM02044	TELEDYNE	69564	< 100		32

(DC) - Duplicate count using original aliquot.

(FD) - Field duplicate sample.

(LS-TI) - Laboratory split from Teledyne, IL.

(LS-TN) - Laboratory split from Teledyne, New Jersey.

BBI - Brandeis Bardin Institute split sample.

DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.

USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.

D - Sample accidently dried, making analysis impossible.

gm - grams.

ml - milliliters

pCi/L - Picocuries per liter of water in soil/sediment.

Teledyne - Teledyne Isotopes (New Jersey) water extracted from samples using a vacuum cryogenic (freeze-dry) technique. Samples analyzed using liquid scintillation.

W - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and subsequently was withdrawn by the laboratory.

* - A second analysis was conducted by DHS 3 months later with the result of 392 +/- 153 pCi/L. (DHS, 1993)

** - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and was subsequently withdrawn by the laboratory. Values shown were analyzed using a liquid scintillation method.

< - Less Than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID #	TRITIUM pCi/L	ERROR (+/-)	YIELD ml (water)
Near the Former Rocketdyne	SM03001	TELEDYNE	69581	< 100		64
Employee Shooting Range		USEPA	SSFL92.1774	< 200		23
	SM03009	TELEDYNE	69579	< 100		36
	SM03012	TELEDYNE	69575	< 100		40
	SM03014	TELEDYNE	69583	< 100		45
		TELEDYNE (FD)	69584	< 100		46
	SM03015	TELEDYNE(LS-TI)	89797	< 200**		9.8
		USEPA(LS-TN)	SSFL92.8937	<869		
The Orange Groves	SM04003	TELEDYNE	69742	380	120	17
	SM04024	TELEDYNE	69748	460	110	23
	SM04026	TELEDYNE	69746	280	80	24
	SM04028	TELEDYNE	69744	460	100	21
	SM04041	TELEDYNE	69740	230	100	25

(DC) - Duplicate count using original aliquot.
(FD) - Field duplicate sample.
(LS-TI) - Laboratory split from Teledyne, IL.
(LS-TN) - Laboratory split from Teledyne, New Jersey.
BBI - Brandeis Bardin Institute split sample.
DHS - Department of Health Services split sample. Water extracted from entire sample using a vacuum-cryogenic technique followed by distillation. Samples analyzed using liquid scintillation.
USEPA - United States Environmental Protection Agency split sample. Water extracted from samples using a double distillation technique. Samples analyzed using liquid scintillation.
D - Sample accidently dried, making analysis impossible.
gm - grams.
ml - milliliters
pCi/L - Picocuries per liter of water in soil/sediment.
Teledyne - Teledyne Isotopes (New Jersey) water extracted from samples using a vacuum cryogenic (freeze-dry) technique. Samples analyzed using liquid scintillation.
W - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and subsequently was withdrawn by the laboratory.
* - A second analysis was conducted by DHS 3 months later with the result of 392 +/- 153 pCi/L. (DHS, 1993)
** - Original data, analyzed using a gas counting method, could not be validated by the laboratory using the QA/QC protocol and was subsequently withdrawn by the laboratory. Values shown were analyzed using a liquid scintillation method.
< - Less Than
+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS - WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	TRITIUM pCi/L	ERROR (+/-)
Rocky Peak	BG01002	Teledyne	< 100	
		USEPA	< 200	
Campsite Area 1	BB03001	Teledyne	< 100	
		USEPA	< 200	
Campsite Area 2	BB04001	Teledyne	< 100	
		USEPA	< 200	
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	1500	100
		Teledyne (DC)	1500	100
	BB16001B	Teledyne	< 100	
		Teledyne (DC)	130	70
		USEPA	< 191	
	BB16RD30*	Teledyne	< 100	
		USEPA	< 191	
Sodium Burn Pit Watershed	BB18003	Teledyne	< 100	
		Teledyne(FD)	< 100	
		DHS	< 170	
Sodium Reactor Experiment Watershed	BB19003	Teledyne	< 100	
Antenna Well*	SM05001	Teledyne	< 100	
		USEPA	< 200	
	SM05002	Teledyne	< 200	
Well by the Gate*	SM07001	Teledyne	< 100	
		USEPA	< 200	
	SM07002	Teledyne	< 100	
Spring	SM08001	Teledyne	300	180
		USEPA	< 200	

(FD) - Field duplicate sample
(DC) - Duplicate count using original aliquot.
DHS - Department of Health Services split sample
Teledyne - Teledyne Isotopes (New Jersey)
pCi/L - Picocuries per liter of water
USEPA - United States Environmental Protection Agency split sample
* - Groundwater samples, all other samples are surface water.
< - Less than
+/- - Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS – FRUIT SAMPLES

SAMPLE LOCATION	GRID* BLOCK	LABORATORY (Remarks)	TRITIUM pCi/L	ERROR (+/–)
Orchards Near Happy Camp	BG07001A	Teledyne	< 200	
		USEPA	< 206	
	BG07002A	Teledyne	< 200	
	BG07003A	Teledyne	< 200	
	BG07004L	Teledyne	< 200	
		USEPA	400	200
	BG07005L	Teledyne	< 200	
	BG07006L	Teledyne	< 200	
Local Supermarket	BG08001O	Teledyne	< 200	
		Teledyne(FD)	< 100	
	BG08002O	Teledyne	< 200	
	BG08003O	Teledyne	< 200	
	BG08004T	Teledyne	< 100	
		USEPA	400	200
	BG08005T	Teledyne	< 100	
	BG08006T	Teledyne	< 100	
	BG08007A	Teledyne	< 100	
	BG08008A	Teledyne	160	100
	BG08009A	Teledyne	< 100	
		Teledyne(FD)	< 100	

(FD) – Field duplicate sample
(LD) – Laboratory duplicate
pCi/L – Picocuries per liter of water in fruit
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency split sample
*A – Avocado
*L – Lemon
*O – Orange
*T – Tangerine
< – Less than
+/– – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
TRITIUM RESULTS – FRUIT SAMPLES

SAMPLE LOCATION	GRID* BLOCK	LABORATORY (Remarks)	TRITIUM pCi/L	ERROR (+/–)
Main House Orchard	BB12020T	Teledyne	< 100	
	BB12006L	Teledyne	< 100	
		USEPA	< 190	
	BB12026L	Teledyne	< 100	
		Teledyne(FD)	< 100	
		Teledyne(LD)	130	70
Avocado Grove	BB13011A	Teledyne	< 200	
	BB13024A	Teledyne	< 200	
	BB13039A	Teledyne	< 200	
The Orange Groves	SM04003O	Teledyne	< 100	
		Teledyne(FD)	< 100	
		USEPA	350	200
	SM04026O	Teledyne	< 100	
		Teledyne(FD)	< 100	
	SM04028O	Teledyne	< 100	
		Teledyne(FD)	180	90

(FD) – Field duplicate sample
(LD) – Laboratory duplicate
pCi/L – Picocuries per liter of water in fruit
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency split sample
*A – Avocado
*L – Lemon
*O – Orange
*T – Tangerine
< – Less than
+/– – Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
Rocky Peak	BG01005	M/H		--
	BG01008	M/H		--
	BG01100	M/H		--
		M/H (FD)		--
Santa Susana Park	BG02007	M/H	Acetone	< 25
		USEPA	Acetone	12
	BG02074	M/H		--
	BG02076	M/H		--
Bell Canyon	BG03001	M/H		--
	BG03019	M/H		--
	BG03059	M/H		--
		USEPA		--
Western Site	BG04025	M/H		--
	BG04029	M/H		--
		USEPA		--
	BG04090	M/H		--
Happy Camp	BG05016	M/H		--
	BG05026	M/H		--
	BG05074	M/H		--
Santa Monica Mountains National Recreation Area	BG06033	M/H		--
	BG06089	M/H		--
	BG06096	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* - Methylene Chloride was also detected in trip blank sent with shipment
< - Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
Perimeter of the Playground	BB01001	M/H		--
	BB01027	M/H		--
	BB01038	M/H		--
	BB01041	M/H		--
	BB01056	M/H		--
		USEPA		--
Dormitory Area	BB02045	M/H		--
	BB02060	M/H		--
	BB02071	M/H		--
	BB02075	M/H		--
	BB02078	M/H		--
Campsite Area 1	BB03005	M/H	Acetone	< 25
		USEPA	Acetone	27
	BB03017	M/H		--
	BB03025	M/H		--
	BB03079	M/H		--
	BB03092	M/H		--
Campsite Area 2	BB04021	M/H		--
		USEPA		--
	BB04023	M/H		--
	BB04026	M/H		--
	BB04082	M/H		--
	BB04097	M/H		--
Picnic Area	BB05003	M/H		--
	BB05006	M/H		--
	BB05057	M/H		--
	BB05077	M/H		--
		USEPA		--
	BB05089	M/H		--
House of the Book	BB06007	M/H		--
	BB06013	M/H		--
	BB06017	M/H		--
	BB06066	M/H		--
	BB06092	M/H		--
		USEPA		--

-- Below reporting limits
(FD) – Field duplicate sample
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ug/kg – microgram per kilogram
USEPA – United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* – Methylene Chloride was also detected in trip blank sent with shipment
< – Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
Counselor-in-Training Area	BB07012	M/H		--
	BB07035	M/H		--
	BB07036	M/H		--
	BB07038	M/H		--
	BB07058	M/H		--
Potential Development Site 1	BB08003	M/H		--
	BB08022	M/H		--
	BB08034	M/H		--
		M/H (FD)		--
	BB08035	M/H		--
	BB08038	M/H		--
Potential Development Site 2	BB09031	M/H		--
	BB09051	M/H		--
	BB09070	M/H		--
	BB09092	M/H		--
	BB09100	M/H		--
Potential Development Site 3	BB10023	M/H		--
	BB10029	M/H		--
	BB10067	M/H		--
	BB10079	M/H		--
	BB10081	M/H		--
Vegetable Garden	BB11006	M/H		--
	BB11018	M/H		--
	BB11032	M/H		--
	BB11057	M/H		--
	BB11061	M/H		--
		USEPA		--
Main House Orchard	BB12003	M/H		--
	BB12006	M/H		--
		M/H (FD)		--
	BB12019	M/H		--
	BB12020	M/H		--
		USEPA		--
	BB12023	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* - Methylene Chloride was also detected in trip blank sent with shipment
< - Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
Avocado Grove	BB13010	M/H		--
	BB13011	M/H		--
	BB13024	M/H		--
		USEPA		--
	BB13037	M/H		--
	BB13039	M/H		--
Old Well Campsite	BB14004	M/H		--
	BB14037	M/H		--
	BB14041	M/H		--
	BB14079	M/H		--
		M/H (FD)		--
		USEPA		--
	BB14094	M/H		--
RD-51 Watershed	BB15001	M/H		--
	BB15002	M/H		--
	BB15003	M/H		--
	BB15004	M/H		--
	BB15005	M/H	Methylene Chloride	< 5
		M/H	Acetone	< 25
		USEPA	Methylene Chloride	17
			Acetone	19
Radioactive Materials Disposal Facility Watershed	BB16001A	M/H		--
	BB16001B	M/H	Methylene Chloride	< 5
		USEPA	Methylene Chloride	7
	BB16002	M/H		--
	BB16003	M/H		--
		M/H (FD)		--
	BB16004	M/H		--
	BB16005	M/H		--
Building 59 Watershed	BB17001	M/H		--
		USEPA		--
	BB17002	M/H		--
	BB17003	M/H		--
	BB17004	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* - Methylene Chloride was also detected in trip blank sent with shipment
< - Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
Sodium Burn Pit Watershed	BB18001	M/H		--
		USEPA		--
	BB18002	M/H		--
	BB18003	M/H		--
		M/H (FD)		--
	BB18001A	M/H		--
	BB18002A	M/H		--
	BB18003A	M/H		--
	BB18001B	M/H		--
	BB18002B	M/H		--
	BB18003B	M/H		--
Sodium Reactor Experiment Watershed	BB19001	M/H		--
	BB19002	M/H		--
	BB19003	M/H	Acetone	<25
		USEPA	Acetone	30
	BB19004	M/H		--
The Visitor Center Parking Lot	SM01004	M/H	Toluene	9
		USEPA	Methylene Chloride	6
	SM01007	M/H	Toluene	7
		USEPA	Methylene Chloride	7
	SM01008	M/H		--
	SM01020	M/H		--
	SM01021	M/H		--
The Existing Road System	SM02004	M/H		--
	SM02019	M/H		--
		USEPA		--
	SM02021	M/H		--
	SM02032	M/H		--
	SM02044	M/H		--
Near the Former Rocketdyne Employee Shooting Range	SM03001	M/H	Acetone	<25
		USEPA	Acetone	23
	SM03009	M/H		--
	SM03012	M/H		--
	SM03014	M/H		--
		M/H (FD)		--
	SM03015	M/H		--

-- Below reporting limits
(FD) – Field duplicate sample
M/H – McLaren/Hart Analytical Laboratory
PPB – parts per billion
ug/kg – microgram per kilogram
USEPA – United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* – Methylene Chloride was also detected in trip blank sent with shipment
< – Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS-SOIL/SEDIMENT SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/kg)
The Orange Groves	SM04003	M/H		--
	SM04024	M/H		--
	SM04026	M/H		--
	SM04028	M/H		--
	SM04041	M/H		--

-- Below reporting limits
(FD) - Field duplicate sample
M/H - McLaren/Hart Analytical Laboratory
PPB - parts per billion
ug/kg - microgram per kilogram
USEPA - United States Environmental Protection Agency split sample
VOC analysis includes 37 chemicals
* - Methylene Chloride was also detected in trip blank sent with shipment
< - Less Than

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
VOLATILE ORGANIC COMPOUND (VOC) RESULTS - WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	VOC	PPB (ug/L)
Rocky Peak	BG01002	M/H	--	--
		USEPA	--	--
Campsite Area 1	BB03001	M/H	--	--
		USEPA	--	--
Campsite Area 2	BB04001	M/H	--	--
		USEPA	--	--
Radioactive Materials	BB16001B	M/H	--	--
Disposal Facility		USEPA	--	--
Watershed	BB16RD30**	M/H	Trichloroethene	38
			cis-1,2-Dichloroethene	13
Sodium Burn Pit	BB18003	M/H	Methylene Chloride	< 5
Watershed		M/H (FD)	Methylene Chloride*	16
Sodium Reactor Experiment Watershed	BB19003	M/H	--	--
Antenna Well**	SM05001	M/H	--	--
		M/H(FD)	--	--
		USEPA	--	--
		USEPA(FD)	--	--
	SM05002	M/H	Methylene Chloride	7
	SM05003	M/H	--	--
		M/H(F)	--	--
Well by the Gate**	SM07001	M/H	Trichloroethene	10
		USEPA	Trichloroethene	13
	SM07002	M/H	Trichloroethene	9
Spring	SM08001	M/H	--	--
		USEPA	--	--

(FD) - Field duplicate sample
* - Likely laboratory contaminant
-- Below reporting limits
M/H - McLaren/Hart Analytical Laboratory
PPB - Parts per billion
ug/L - Microgram per liter of water
USEPA - United States Environmental Protection Agency split sample
** - Groundwater samples, all other samples are surface water.
< - Less than

APPENDIX D

COMMENTS TO FINAL DRAFT REPORT
DATED JANUARTY 27, 1993

COMMENTS FROM
ARNOLD J. ROBBINS
CHAIR SANATA SUSANA FIELD LABORATORY WORKGROUP
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
SAN FRANCISCO, CA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

FEB 23 1993

MAR 1993
RECEIVED

Arlene Giliberto, Ph.D.
Environmental Toxicologist/Epidemiologist
Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue
P.O. Box 7922, Mail Code T486
Canoga Park, CA 91309-7922

Dear Doctor Giliberto,

I am requesting that the following paragraph on page 12-1 of the "Conclusions" section of the Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy be deleted:

> "All data were subjected to a rigorous quality assurance/quality control (QA/QC) protocol. The QA/QC samples included: (1) split duplicates with the United States Environmental Protection Agency (USEPA), the California Department of Health Services (DHS), and a consultant for the Brandeis-Bardin Institute; (2) blind field duplicates; (3) interlaboratory split duplicates; (4) trip blanks; (5) field blanks; (6) field equipment rinsates; and (7) matrix spike/matrix spike duplicates (MS/MSD)."

I am requesting that you delete this paragraph from the "Conclusions" portion of the report because it may lead the public to interpret your conclusions as having been approved by the EPA, DHS and Brandeis-Bardin. This would be an inappropriate interpretation. I believe that the information you are trying to convey in the paragraph located on page 12-1 of the "Conclusions" portion of the report has already been more appropriately presented on page ES-2 of the "Executive Summary" section of the report.

Your attention to this matter is appreciated.

Sincerely,

Arnold J. Robbins

Arnold J. Robbins, Chair
Santa Susana Field Laboratory
Workgroup

02021RC

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COMMENTS FROM
GREGG D. DEMPSEY
CHIEF FIELD STUDIES BRANCH
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR QUALITY
LAS VEGAS FACILITY, NV

EPA
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR - LAS VEGAS FACILITY
P.O. BOX 98517
LAS VEGAS, NEVADA 89193-8517
(702) 798-2476

MAR 1993
RECEIVED

FEB 26 1993

Dr. Arlene Giliberto
Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue
P.O. Box 7922
Canoga Park, CA 91309-7922

Dear Dr. Giliberto:

We have reviewed the draft "Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy" and have several comments:

a. Please explain the change regarding the number of soil/sediment samples. In the previous draft, I believe there were 136 soil/sediment samples and in this draft, there are 118 (page ES-4).

b. How was it determined that the 7 metals on page 2-6 were associated with the activities at Rocketdyne? Why was zirconium not on this list?

c. The paragraph discussing the cesium and strontium spill at the RMDF which was in the previous draft should be added back into this report. The historical data on the RMDF on page 11-4 should be expanded upon. Also, please state which "regulatory agencies" are being referred to at the bottom of that page, so that there is no confusion with the study participants.

d. Regarding the statistical variance, my feeling is that just because the data does not meet the 95% confidence limit it does not mean that the data should be discarded. Therefore, I do not think the reasoning concerning statistical variance on page ES-5 should be included.

e. It is noted that paragraph 6.2.2.1 on strontium-90 (page 6-24) from the 12/14 draft report has been removed from the latest draft. It is my opinion that this paragraph be added back into the report.

f. Number 2 on page 11-13 was not listed as a cause in either the summary or the comments on 6-24 of the 12/14 draft.

02055RC

g. Why were the results of the As, Be, Se, and Ag left out of both drafts? (note the post-it note on page C-26 of our comments on the 12/14 draft).

h. Note the typographic error "long term storage" on page C-51 of the most recent draft.

i. On page C-51, I would like to see the comments added to the footnote "**": the gas counting data was left out because it did not meet internal laboratory QA scrutiny. If this is not included here, please include the information elsewhere in the report.

If you have any questions about these comments, please call me at (702) 798-2461.

Sincerely,

Gregg D. Dempsey, Chief
Field Studies Branch

cc: Jed Harrison, LVF
Arnold Robbins (H-4-1)

COMMENTS FROM
PENNY MCCLAY
CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL MANAGEMENT BRANCH
SACRAMENTO, CA

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL MANAGEMENT BRANCH
601 NORTH 7TH STREET
P. O. BOX 942732
SACRAMENTO, CALIFORNIA 94234-7320

DATE: 2/23/93

TO: Arlene Giliberto

FAX NO: (818) 586 - 5889

FROM: Penny McLay
FAX NO: (916) 323-9869 PHONE NO: (916) 445-0498

MESSAGE:

Corrections to the Multi-media Report attached. The LLD for Cesium 137 was previously erroneously reported as <0.09 pCi/L. Please correct as indicated to <8.0 pCi/L.

Thanks, Penny

COVER SHEET PLUS ____ PAGES

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GROSS ALPHA/BETA SCAN – WATER SAMPLES

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	ABORATOR ID#	Gross Alpha pCi/L	Error +/-	Gross Beta pCi/L	Error +/-
Rocky Peak	BG01002	Teledyne	69562	<2		<3	
		USEPA	SSFL92.1760	<5.2		<5.3	
Campsite Area 1	BB03001	Teledyne	70159	<3		7.8	3.3
		USEPA	SSFL92.1879	<2.4		5.2	1.5
Campsite Area 2	BB04001	Teledyne	70450	<3		<4	
		USEPA	SSFL92.1880	<1.6		4.2	1.5
Radioactive Materials Disposal Facility Watershed	BB16001A	Teledyne	74410	<5		20	4
	BB16001B	Teledyne	74406	<5		25	4
		USEPA	SSFL92.3057	2.5	1.6	18.5	2.1
	BB16RD30*	Teledyne	74396	<4		9.4	3.2
		USEPA	SSFL92.3066	2.3	1.5	10.9	1.6
Sodium Burn Pit Watershed	BB18003	Teledyne	74344	<2		<3	
		Teledyne (FD)	74346	<2		4.1	2
		DHS		~~0.38~~	~~0.63~~	~~0.71~~	~~2.65~~
Sodium Reactor Experiment Watershed	BB19003	Teledyne	74402	<4		4.9	2.5
Antenna Well*	SM05001	Teledyne	69561	<7		7.9	3.2
		USEPA	SSFL92.1759	<3.8		5.5	*3.4
	SM05002	Teledyne	70340	2.9	2.7	8.3	3.4
Well by the Gate*	SM07001	Teledyne	69756	<3		3.8	2.3
		USEPA	SSFL92.1758	<4.4		<5.0	
	SM07002	Teledyne	70336	5.5	3.1	5.7	2.8
Spring	SM08001	Teledyne	70344	3.4	2.4	<4	
		USEPA	SSFL92.1945	<4.6		<4.6	

(FD) – Field duplicate sample

DHS – Department of Health Services split sample

Gross Alpha/Beta Scan – Analysis for alpha- and beta-emitting radionuclides

<0.40 <2.50

pCi/L – Picocuries per liter of water

Teledyne = Teledyne Isotopes (New Jersey)

USEPA – United States Environmental Protecton Agency split sample

* – Groundwaater samples, all other samples are surface water.

< – Less than

+/- Plus or minus

ROCKETDYNE SANTA SUSANA FIELD LABORATORY
GAMMA SCAN RESULTS – WATER SAMPLES*

SAMPLE LOCATION	GRID BLOCK	LABORATORY (Remarks)	LABORATORY ID#	Cs-137 pCi/L
Rocky Peak	BG01002	Teledyne	69555	< 4
		USEPA	SSFL92.1756	<4.7
Campsite Area 1	BB03001	Teledyne	70158	< 4
		USEPA	SSFL92.1881	<4.3
Campsite Area 2	BB04001	Teledyne	70449	< 4
		USEPA	SSFL92.1882	<8.1
Radioactive Materials	BB16001A	Teledyne	74409	< 3
Disposal Facility	BB16001B	Teledyne	74405	< 2
Watershed		USEPA	SSFL92.3055	<4.7
	BB16RD30*	Teledyne	74395	< 4
		USEPA	SSFL92.3065	<4.8
Sodium Burn Pit	BB18003	Teledyne	74343	< 4
Watershed		Teledyne (FD)	74345	< 4
Sodium Reactor Experiment Watershed	BB19003	Teledyne	74401	< 3
Antenna Well**	SM05001	Teledyne	69558	< 5
		USEPA	SSFL92.1755	<5.5
	SM05002	Teledyne	70339	< 4
Well by the Gate**	SM07001	Teledyne	69755	< 5
		USEPA	SSFL92.1754	<4.6
	SM07002	Teledyne	70335	< 5
Spring	SM08001	Teledyne	70363	< 5
		USEPA	SSFL92.1946	<4.3

DHS

<8.0

(FD) – Field duplicate sample
Cs-137 – Cesium-137
pCi/L – Picocuries per liter of water
Teledyne – Teledyne Isotopes (New Jersey)
USEPA – United States Environmental Protection Agency Split Sample
* All other man-made, gamma-emitting radionuclides were below detection limits.
** – Groundwater samples, all other samples are surface water samples.
< – Less than
+/– Plus or minus

TABLE 9-46

Radionuclide Results for Surface Water Samples at the Sodium Burn Pit Watershed (BB-18)

	Cesium-137 (pCi/L)	Plutonium-238 (pCi/L)	Plutonium-239 (pCi/L)	Strontium-90 (pCi/L)	Iodine-129 (pCi/L)	Tritium (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)
BB-18-003								
Sample	< 4	< 0.2	< 0.08	< 0.3	< 1.6	D	< 2	< 3
Field Duplicate	< 4	< 0.2	< 0.09	1.0 +/- 0.4	< 1.7	< 100		
DHS	~~< 0.09~~ <8.0					< 260	0.38 +/- 0.63	0.71 +/- 2.65

pCi/L -- Picocuries per liter of water
< -- Less than
+/- -- Plus or minus

* -- Below detection limits
Blank -- Not analyzed

BBI -- Brandeis-Bardin Institute split sample
DHS -- Department of Health Services split sample
USEPA -- United States Environmental Protection Agency split or interlaboratory duplicate sample

Field Duplicate -- A duplicate sample is collected in the field and submitted under an anonymous sample identifier.

Cesium-137 was the only man-made radionuclide detected in the gamma scan analysis.

COMMENTS FROM
JOEL I. CEHN
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ROCKETDYN CNPK

Rockwell
International

ENVIRONMENTAL PROTECTION
D/543, 055

REPORT OF TELEPHONE CONVERSATION

DATE: February 18, 1993 TIME: 11:40 a.m.

BY: Arlene A. Giliberto, Ph.D. I CALLED ___ HE/~~SHE~~ CALLED X

PERSON: Joel I. Cehn TITLE: CHP

ORGANIZATION:

ADDRESS: 1036 Hubert Road CITY Oakland STATE CA ZIP 94610

TELEPHONE (510) 268-1571

SUBJECT:

Comments to the Final Draft of the Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy, Volume I, January 27, 1993.

ACTION TO BE TAKEN:

Collections to two tables in the text only: 1.) Page 9-73, Table 9-38, change BB16005, BBI Strontium - 90 from <1 to <0.6 (2.) Page 9-80, Table 9-42, change BB17004, BBI, Strontium - 90 from <0 to a blank (not analyzed).

COPIES TO:

Ann Holbrow and Dennis Dineen - McLaren/Hart Engineering, Irvine, CA

0363H-7/16/91
(Dept 543 Rev)

COMMENTS FROM
DANIEL HIRSCH
PRESIDENT
COMMITTEE TO BRIDGE THE GAP
LOS ANGELES, CA

COMMITTEE TO BRIDGE THE GAP
1637 BUTLER AVENUE, SUITE 203
LOS ANGELES, CALIFORNIA 90025
(310) 478-0829

22 February 1993

Arlene Giliberto
Rockwell-Rocketdyne
Mail Stop 543,T486
6633 Canoga Avenue
PO Box 7922
Canoga Park, CA 91309-7922

by FAX

Dear Ms. Giliberto:

What follows are comments by the Committee to Bridge the Gap regarding the draft "Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy," dted January 27, 1993.

Executive Summary

1. p. ES-1 states that six "background" locations "that were within 12.5 miles of the SSFL" were sampled. This is misleading; only one sample was at that distance, the rest much closer. Three were within two miles, the other two at about four miles. All but the single 12.5 mile site are inappropriate to consider as background, as all but perhaps the distant site are likely to have been affected by SSFL activities, such as accidental airborne releases.

CBG had objected to the use of close-in sites for "background." The study did add, as we requested, the 12.5 mile site, but then averaged the one true background with the five sites that are close enough to be potentially affected by SSFL activities. The report then set a 95% confidence band around the six data points; measurements from the study area had to be above the top band in order to qualify as "above background." Given only six "background" locations, those error bands must be substantial; and only one of those "background" measurements is appropriately a true background measurement.

In short, one is comparing areas which could have been affected by SSFL activities against other areas which could have been affected by those same activities; only if a reading is substantially above the range surrounding these false "background" levels is the reading considered above background.

This methodology is fatally flawed.

2. p. ES-1 indicates that only one surface water sample was collected from a background area. It is impossible to determine background readings from a single sample--there is no statistical validity to such a conclusion, and thus no statistical validity to any conlusion whether the seven surface water samples (also too low a number) from the study areas are at or above background.

3. ES-2 claims a high level of data agreement, rigorous quality assurance and quality control, and a conclusion that the data were valid. However, there was wide disagreement with some tritium measurements--rather than include those, which included some high readings--this report eliminates many of those high tritium findings. I understand that the contractor that performed the measurements, upon reviewing the high readings, decided that the measuring technique did not meet its standards and withdrew the high readings. This is inappropriate, and raises serious questions in addition whether other readings, ones that were low, also failed to meet standards. If it is appropriate to withdraw some of the tritium findings (admittedly, some high tritium findings remain) because the contractor screwed up and missed the problem, it raises serious questions whether there were other screw-ups that haven't been detected. And I remain concerned that the study authors tend to suspect high readings, and try to find ways of eliminating them, but do not provide the same skepticism about low readings and willingness to withdraw them if questionable. The assumption always is, if there are two readings one high, one low, the high reading is the questionable one. This suggests a bias.

The study should have included the high tritium findings and should have been much more explicit about having eliminated them. The fact that some samples were months later reanalyzed using another technique is not dispositive; tritium loss over time in the sample, and other problems associated with proper storage and so on, do not make this an approprite way of dealing with the problem. It is our recommendation that additional monitoring is necessary where the high readings had been found.

4. ES-5, after indicating that strontium-90, cesium-137, and plutonium-238 were found in soil/sediment samples above the ninety fifth percent confidence limit--and yet study authors go on to so it is not clear whether the finding were due to off-site migration from SSFL or rather "anomalies or statistical variability."

This is astonishing. First the authors set up a detailed method of determining that a reading is above the level they themselves had statistically determined to represent 95% confidence that a reading was real and not due to anomalies or statistical variability--that is what a two-signma, 95% confidence level is all about. And then, when the readings go over their own level, the authors say it is not clear whether it is due to statistical variability. You can't set a standard that tells you something is not due to statistical variability, then when the reading is above that level, say it may be due to that very variability you had already corrected for.

Thus, the conclusion is terribly flawed. Leaving out the plutonium, strontium, and cesium found is unacceptable, and looks political, rather than scientific.

Furthermore, the recommendations are exceedingly weak, given the unquestioned finding of tritium offsite, and the strontium, cesium, and plutonium findings above the 95% confidence level.

1.0 Introduction

5. I-1 It is in appropriate to claim that the Workplan was reviewed and approved by Bridge the Gap and the other entities. We were merely informed such a study was to be performed and suggestions would be entertained. We were neither asked to approve the Plan, nor did we do so. This effort to wrap the study in the mantle of approval by entities other than Rockwell is inappropriate.

2.0 Analysis

P. 2-4 and 2-7 indicate that USEPA methods provide data on 13 priority pollutant metals; however "since only seven of these metals have ever been associated with Rocketdyne activities, only these seven will be discussed and evaluated in this report." This is disturbing, as information about the activities, and disclosures thereon, has been spotty at best, and reliance on Rockwell's claims of what they could have released has proven inappropriate in the past. For example, Rockwell never monitored for tritium, saying it never had any on site; yet we now know tritium from SSFL has migrated offsite and indeed that Rockwell had a dozen or so sources of tritium over the years.

In particular, it is of concern that Beryllium, listed on the EPA table (Table 2-3) as a priority pollutant metal, is not included in the report for discussion and evaluation. However, beryllium is a standard material used in nuclear reactors--for neutron reflectors, for example, and neutron generators. ~~There may~~ also be uses in rocket and laser testing and design. Beryllium should have been included.

Additionally, it is unclear why zirconium is not included for analysis and evaluation. Zirconium ~~is~~ frequently used as a cladding material for nuclear fuels; irradiated fuels were declad in the Hot Lab; and fires involving zirconium occurred there.

The Committee to Bridge the Gap is seriously disappointed by the failure to monitor iodine-129 at sufficiently low levels as a surrogate for I-131 releases that may have occurred in the past. I-131, of course, has an 8-day half-life and is released in copious quantities in reactor accidents; behaving as a gas, it can travel long distances. I-131 concentrates in the thyroid gland and causes thyroid cancer. Since whatever I-131 that may have been released in the past would long since have decayed, sensitive measurements of a companion iodine isotope, I-129, might have yielded important information about potential releases of I-131. I-129 is produced in small quantities compared to I-131, but has a long half life. If I-129 levels near the facility were substantially larger than those far away (e.g., the 12.5 mile background site), even though the I-129 levels were below health levels, they would be indicative of potential very high I-131 levels in the past.

Unfortunately, the technique employed for the I-129 measurements in this study had a detection limit that prevented such an analysis from occurring. This is most disappointing. It is hard to believe that techniques are not available that could measure I-129 at the levels in question. The purpose of the measurements was not to ascertain hazardous levels of I-129, but to determine if there was a qualitative decrease of I-129 with distance from the site, indicative of past releases of I-131 at levels that could have been of concern.

We note that our urging of plutonium isotopic measurements was productive, as Pu-238 was found. We believe this shows the importance of not basing measurement decisions on Rockwell's assertions of what was likely to have been released. After all, Rockwell did have a plutonium fuel fabrication facility, and it is not clear that Pu-238 for radioisotope thermal generators or space "handwarmers" was not employed there as well; after all, Rockwell engaged in substantial space nuclear work involving SNAP devices.

P. 3-13; I am not entirely comfortable with the decision to reduce the surface water sampling to a single round. As indicated above, a single "background" measurement is statistically meaningless; and even if it weren't, seven samples at other locations is a very small "n" from which to get any statistically meaningful findings.

6.0 QA/QC Results

As indicated earlier, we remain troubled by what appears a substantial overstatement of the quality of the data. The methodological error involved in averaging in-close samples that could be affected by SSFL with one or so true background samples calls into question most of the results. Furthermore, the elimination of many high tritium findings is questionable. Finally, if there were errors that produced high tritium findings, that raises serious questions about the quality assurance and quality control for the whole project, undercutting confidence in low levels asserted as well.

8.0 Background

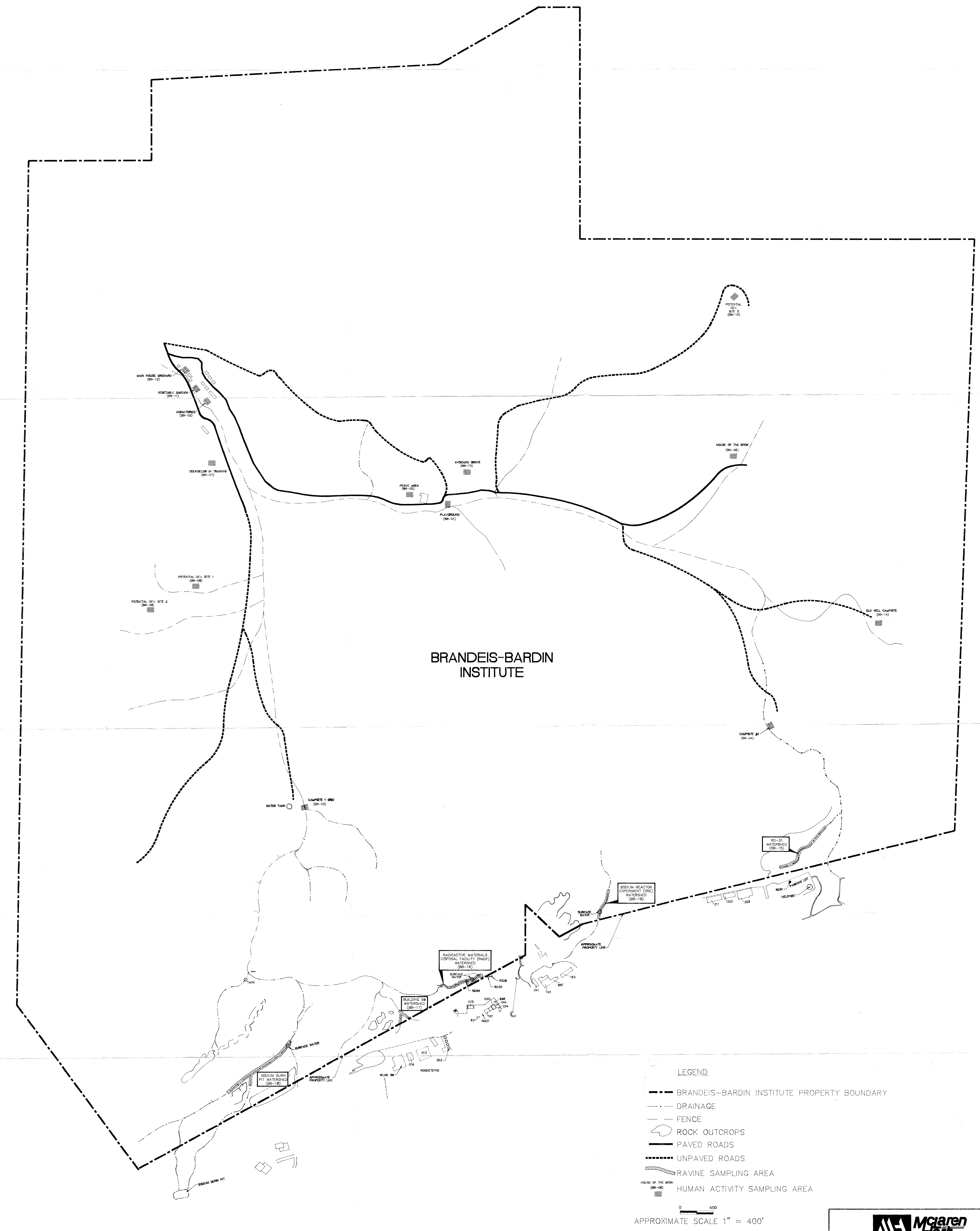
We have discussed the problem with this misuse of close-in samples earlier. We note that inclusion of Bell Canyon and the Santa Susana Knolls sites was because of community concern they could be contaminated--not because of assurance they were "clean" and could be used as background.

11.0 Discussion

This section is biased in tone and content. The strontium, plutonium, and cesium findings, rather than simply being reported as above the 95% confidence level set in the study, are followed by lengthy attempts to explain them away. The findings should be included in the conclusion.

Much discussion by the Work Group is needed to determine follow-up steps.

Daniel Hirsch



NOTE: BUILDINGS SHOWN ON FIGURE ARE USED AS REFERENCE POINTS ONLY AND ARE NOT INTENDED TO IDENTIFY POTENTIAL SOURCES.

McLaren Hart

FIGURE 3-2
SAMPLING LOCATIONS
AT THE
BRANDEIS BARDIN INSTITUTE

DRAWN BY G.N.	DATE 10/28/92	LIMITS ON DIMENSIONS	FRAC.
CHECKED BY	DATE	UNLESS OTHERWISE	DEC.
APPROVED BY	DATE	SPECIFIED	ANG.
SCALE	REFER	ISSUE	DRAWING NUMBER BRANDEIS