Energy Technology Engineering Center

Operated for the U.S. Department of Energy
Rocketdyne Division, Rockwell International

Written by:
P. Olson/R. Shepard/K. Adler

Approved by:

Analysis Report

No. GEN-ZR-0002

Page 1 of 128

Orig. Date May 29, 1987

Rev. Date

DRR No. 22125 SC

Title: CERCLA Program Phase II — Site Characterization

Rev. Ltr.	Revision	Approval / Date

ABSTRACT

This site characterization report is in response to requirements of DOE Order 5480.14, "Comprehensive Environmental Response, Compensation, and Liability Act Program." As required by the Order, the Phase I Installation Assessment was conducted previously to determine the existence of any potential inactive waste disposal sites on DOE-optioned land at the Santa Susana Field Laboratory (SSFL) which would fall under the purview of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A former temporary drum storage area — termed the "Landfill Area" — was identified in the Phase I report. In Phase II, Site Characterization, through a procedure of soil and water analyses, was conducted to confirm the presence or absence of hazardous waste on the site. Results of these efforts are presented herein.

Although this one site was identified as possibly suspect, hazardous waste sites on DOE-optioned land were not expected by those interviewed during the Phase I assessment since activities involving hazardous waste handling were performed at a location — termed the "Burn Pit" — some 300 yards from the option boundary on Rockwell land, as described in the Phase I report. As requested by DOE, site characterization of the "Burn Pit Area" has also been carried out, and results are reported herein.

Form 735-A-6 Rev. 4-86

NOTICE

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Although this one site was identified as possibly suspect, hazardous waste sites on DOE-optioned land were not expected by those interviewed during the Phase I assessment since activities involving hazardous waste handling were performed at a location — termed the "Burn Pit" — some 300 yards from the option boundary on Rockwell land, as described in the Phase I report. As requested by DOE, site characterization of the "Burn Pit Area" has also been carried out, and results are reported herein.

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1. EXECUTIVE SUMMARY

This site characterization report complies with the requirements of DOE Order 5480.14. A prior survey[1] had been conducted to determine if there were any potential disposal sites on the DOE-optioned land at the Santa Susana Field Laboratory (SSFL) of RCRA-type hazardous waste which would fall under the purview of the Comprehensive Environmental Responses, Compensation and Liability Act (CERCLA) requirements. The "Landfill Area" which had been used as a temporary drum storage facility was identified as a candidate for further investigation. A prudent course of action did require sampling and analysis in the area. A second area, the "Burn Pit," was discussed as part of the prior survey, and although it is outside the DOE-option area by about 300 yards, it was used exclusively for cleaning of components for the OMRE, Hallam, SRE, and SNAP programs conducted by the Atomics International Division of Rockwell for the Atomic Energy Commission or ERDA, which were DOE predecessor agencies. This Burn Pit Area is also characterized as part of this CERCLA — Phase II Site Characterization report.[2]

Landfill Area —

Two sampling procedures were applied in this area. A monitoring well, RD-7, was drilled to 300 ft in the area where the drums had been stored. Analyses of the water extracted from RD-7 over a period of 15 months showed the presence of trichloroethylene at 16 to 130 ppb, which is above the action level of 5 ppb. No other constituents were found in concentrations above action levels.

The second effort in this area included collection of soil samples at nine locations over the 10,000-ft^2 landfill and adjacent ravine. Visually, the soil appeared clean (undisturbed). A Miran 1B Portable Air Analyzer (single-beam, infrared spectrophotometer) did not detect any of a selected group of nine compounds that might be present in the trenches or on the surface. This included the results of air samples in 9-ft-deep trenches. Four soil samples were analyzed for volatile organic constituents, heavy metals, and a number of miscellaneous compounds. The sample analysis results did not show any contaminants that warrant any further sampling or cleanup effort in this Landfill Area. It is clear that the soil in this area is clean and that at most a little oil and grease stains could be related to damaged drums previously stored in the area.

The level of TCE in RD-7 is of concern because it is above action levels, although the water below the Landfill Area is believed to be in a pocket

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[1]Rockwell International Document N001TI000262, "CERCLA Program Phase I Installation Assessment for DOE Facilities at SSFL, April 25, 1986.

[2]Requested by DOE-SAN in a meeting with Rockwell and ETEC representatives on February 5, 1987.

resulting from fractures in the Chatsworth bedding formation. Sampling by Rockwell at adjacent offsite locations (OS-2, OS-3, OS-4, and OS-5) did not show detectable levels of organic constituents; this is considered confirmation that the water dynamics in the area present no potential or real threat to any surrounding areas.

Remedial action will be taken to remove the trichloroethylene from the water pocket at the RD-7 well. This effort has been identified in budget submittals to DOE. No further work at the DOE-optioned area of the Santa Susana Field Laboratory is required for compliance with DOE Order 5480.14.

Burn Pit —

The Burn Pit is not an ETEC facility and is not on the DOE-optioned land, and thus is not covered by the provisions of DOE Order 5480.14. It is briefly discussed in this report at the express request of DOE-SAN in a meeting with Rocketdyne on February 5, 1987.

This area (about 50,000 ft^2) was used extensively during the 1960-1970 period for disposal of combustible materials such as sodium, NaK, and kerosene from the SRE, SNAP, and other nuclear program operations. The area comprises a large concrete pad, adjacent to a concrete water pool and upper and lower pond areas, both downslope from the pool. An area adjacent to and west of the upper pond area was also used for storage (and burial) of materials.

Sampling and analysis in this area consisted of soil sampling in and around the ponds and storage area by trenching. Significant air levels of selected target chemicals were found (Miran 1B detector) in only one trench of the 23 locations sampled. (See Appendix A5 for identification of target chemicals.) This was in an area designated as the lower pond of the Burn Pit. Here the levels for carbon tetrachloride, ethanolamine, ammonia, tetrahydrofuran, and hydrazine were sufficiently high to be of concern. Eight soil samples were analyzed. Based upon the levels of contamination found, it is considered appropriate to proceed with an engineering assessment to develop a remedial action plan for this Burn Pit Area.

The natural drainage from this area is north to the Simi Valley. The contaminated soil and materials are not considered to be highly mobile since sampling of water down the drainage path has not shown contamination. Surface water flow to the north is via a dirt road east of the area and a gully on the west. The pond areas are incompletely bermed, and there is a potential threat of water runoff to adjacent areas.

2. SAMPLING AND ANALYTICAL MEASUREMENT PLAN

a. Rationale

Landfill Area —

During the CERLCA Program Phase I, one site was identified as possibly having been used in the past for the disposal of hazardous wastes. The site, approximately 10,000 ft^2 in area, is located on DOE-optioned land (see Figure 1) about 300 ft west of Building 059 at the Rockwell International Santa Susana Field Laboratory in Ventura County, California. The area was designated for "loose fill" of earth from the excavation of a future SNAP facility building (056) and was used for dirt fill from excavation associated with SCTI construction (see Figure 2). The site was used for a period of time as a temporary storage location for hazardous and nonhazardous waste materials. During 1980 and 1981, 89 barrels which had been stored in this location were removed and sent to hazardous waste disposal sites. The ETEC Chemistry Laboratory determined that the wastes in these barrels included such materials as oils, alcohols, sodium and sodium reaction products, grease, phosphoric acid, and asbestos.

In keeping with the recommendations of the CERCLA Program Phase I Installation Assessment report, a site characterization plan was developed which included the obtaining of samples in the area and their analysis for hazardous substances. Well RD-7 was drilled, and soil samples were obtained under the guidance of an independent firm of consulting hydrogeologists and were analyzed by accepted EPA procedures in the SSFL Analytical Chemistry Laboratory.

Burn Pit —

An area at SSFL that was considered to be more seriously contaminated than the landfill is the so-called Burn Pit Area or Sodium Disposal Facility north of Building 886. This area was briefly mentioned in the Phase I report but not listed as a site for follow-on work, since the Burn Pit Area (see Figure 3) is not an ETEC facility and not on DOE-controlled land and is thus outside the scope of DOE Order 5480.14 which defined the bounds for the report. However, since any hazardous, radioactive, or mixed wastes that may be buried in the Burn Pit Area resulted from DOE programs or from activities of DOE's predecessor agencies, investigative and remedial action required to meet CERCLA require - ments for this site should be considered by DOE. For this reason, sampling and analysis of soil from the Burn Pit were conducted at the same time as the investigation of the Landfill, and the data from the Burn Pit are also summarized in this Phase II report.

Figure 1. DOE tioned Area

Figure 2. Landfill Area

Figure 3. Burn Pit Area Showing Excavations Made for Sampling

A characterization study of the Burn Pit Area (T-886), the former Sodium Disposal Facility, was performed. The purpose of the effort was determination of any hazardous materials that might be present.

History

The Burn Pit, Sodium Disposal Facility, was created for the disposal of sodium and NaK by the exothermic reaction with water. After draining a system, small quantities of sodium or NaK were typically trapped in such areas as pipe elbows, valves, vessels, or insulation material. To remove the remaining reactive metal, the component was either tossed into the water pool or placed in the open field pit and hosed down initially with a light spray of water and then a heavier spray as the reaction subsided. After the hose-down was complete and the reaction stopped, the items were inspected for residual material. Clean items were scrapped, and those with residual material were returned to the reaction pool. Occasionally, firearms were used on vessels to "safely" open containers to the atmosphere. Those items, after cleaning, were removed to a dumpster, usually for a scrap dealer. The facility was also made available for the open burning of any combustible material. This policy logically shifted to include just about anything that seemed undesirable for the regular trash, that would be rendered safe by burning. Terphenyl coplant for the organic-cooled reactor program, was one of these.

For the most part, residual debris was cleared and disposed of as scrap metal. Some large components and vessels were buried in place. A large batch of barrels and scrap was buried west of the area between two rock ridges. A small amount of material was dispersed onto surrounding terrain by explosions.

In the late 1970's, a concerted effort to clean up the Sodium Disposal Facility was launched. The gate was locked, and only documented items and materials (charge number and radiation survey) were admitted. However, occasionally material of unknown origin was deposited at the site gate.

With the construction of the new Sodium Disposal Facility, T-133 (a fully RCRA-permitted facility, shown in Figure 4), and its continued operation, the accumu - lation of material at the Burn Pit subsided. Ali visible tanks were removed to the new facility for further disposition. The west burial site was excavated, hazard - ous materials removed, and trash hauled off. The pool was drained by a hazardous waste disposal company. The walls were found to be slightly contaminated with radioactive material and were scabbled clean. The ponds were surveyed, and the lower pond was found radioactively contaminated, and an effort to decontaminate some of the radiological "hot spots" was made. Later that year (1980), the dry lower north pond was gridded, and a radiation survey was conducted. Cesium-137 was identified as the principal gamma-emitting constituent. The only other isotopes discovered at that time were primordial radionuclides.

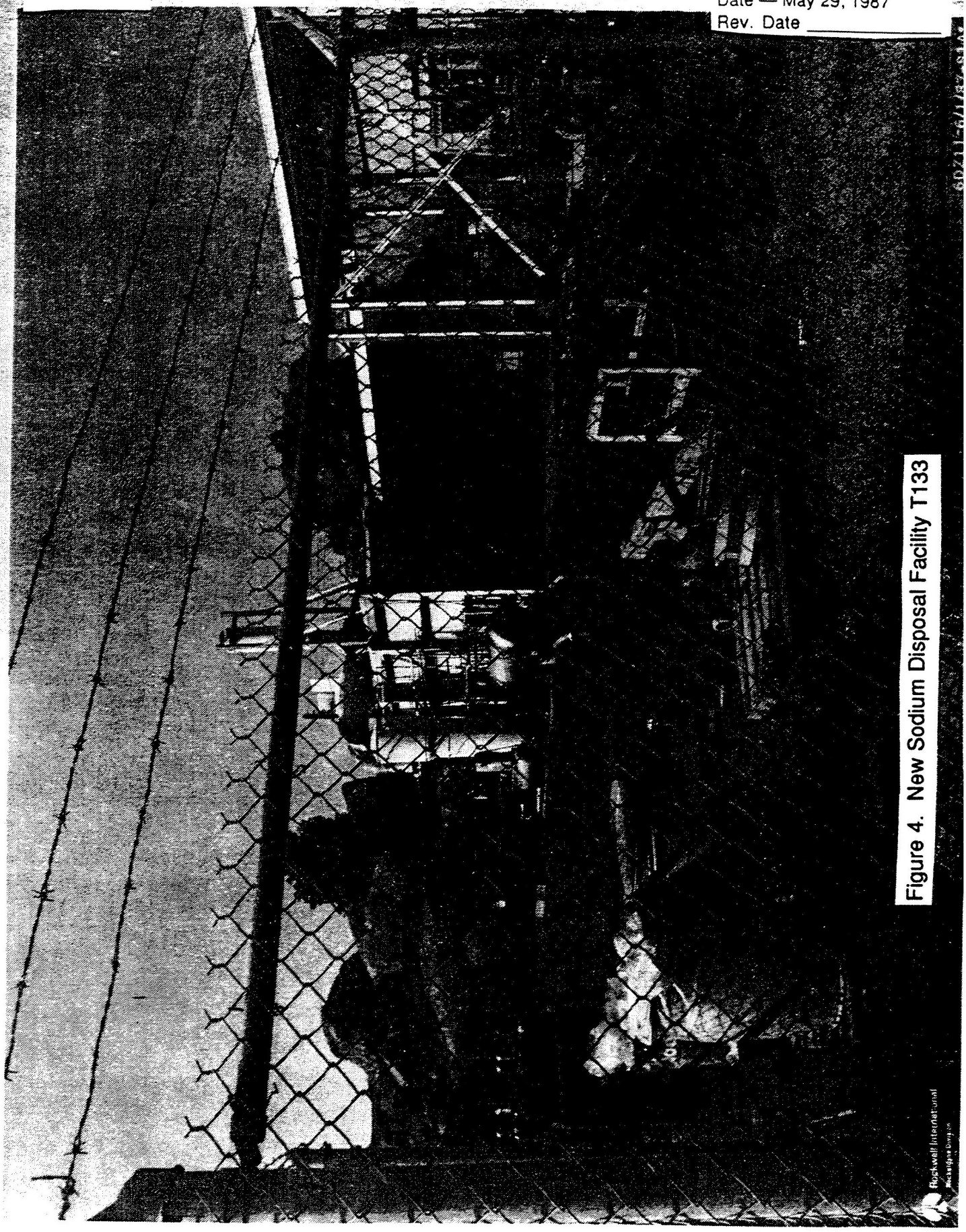


Figure 4. New Sodium Disposal Facility T133

Water samples were taken each rainy period, and only natural activity was detected. No further significant activity occurred until the March 31, 1987, characterization study, except for periodic removal of "junk" that appeared.

Sampling Program

The soil sampling procedure, techniques, and records were provided by Groundwater Resources Consultants, Inc. Skilled labor support was provided by Rocketdyne Department 635, by personnel trained and experienced in sodium handling and disposal techniques. Health, Safety and Environment provided a safety overview and procedure review with some on-site analysis. Radiation and Nuclear Safety provided full-time support during the Burn Pit Area sampling. The 137 samples taken consisted of 1-gallon plastic bags, 1000-ml glass jars, 16-oz glass jars, 4-oz glass jars, 2-oz salve cans, and the standard brass Volatile Organics Analysis (VOA) core samples. The 12 VOA samples were surveyed for radioactivity, and adjacent samples were analyzed for concentration of manmade radioactivity before they were released to the Chemical Analysis Laboratory at SSFL. All of the remaining samples were surveyed for radioactivity and stored for future analysis or disposition at Building T-100.

Summary of Radiological Data and Findings

The results of the tests indicate no spread of radiological contamination outside of the lower and upper pond areas of the Burn Pits. In these pits, it appears that cesium-137 is the major contaminant and can be found readily at the 1-ft level and randomly at other depths. The levels of activity indicated during this survey were up to 80 μR/hr in a background of 15 μR/hr, with samples ranging from background to 2×10^{-4} μCi/g of Cs-137. The indications are consistent with previous surveys showing general low level contamination with cesium-137, including some "hot spots." During the sampling program, radiologically "hot" areas were avoided to assure in getting samples that could be handled in the Chemistry Laboratory.

Some zirconium hydride sacrificial slugs, contaminated on the ends with 93% enriched uranium from the SNAP program, were found in one area (BPL-3).

b. Methods and Techniques

1. Sampling

Since it was desired to confirm and quantify, by preliminary and comprehensive environmental survey of the area, the presence or absence of hazardous substances that might pose a risk to health, safety, or the environment, a plan was developed to obtain soil samples and to provide for their characterization.

Highlights of the sampling plan were as follows:

(1) Appropriate personal protective equipment on hand to provide for adequate protection of personnel during sampling operations

(2) Required the presence of representatives of Rocketdyne Health, Safety and Environment and Radiation and Nuclear Safety groups to provide immediate assessment of any potential hazard which may have been uncovered

(3) Sample locations selected by a represenative from Rocketdyne's Environmental Control group and by representatives from an independent consulting firm, Groundwater Resources Consultants, Inc., Consulting Hydrogeologists, 1020 South Euclid Avenue, Tucson, Arizona 85719

(4) Required that no soil borings be made so as not to disturb potentially underlying objects such as partially filled drums

Appendix A contains the sampling plan, a diagram showing sampling locations in both the Landfill and Burn Pit, and photographs of the sampling process.

Samples were taken by the consulting hydrogeologists at representative locations and at varying depths within the Landfill Area as well as in the ravine located just north of the Landfill. Samples were taken of the freshly exposed soil and were immediately sealed in closed sample containers. In areas of high soil compaction, a slide hammer sampler was used to obtain 6-in. x 2-in. core samples in brass cylinders. These were sealed with caps and taped shut. After being surveyed to confirm the absence of significant radioactivity, all samples were iced down prior to their transport to the SSFL Analytical Chemistry Laboratory for analysis to minimize loss of volatile constituents.

2. Analysis Methods and Techniques

Samples taken in the Landfill Area and Burn Pit were analyzed for the presence of hazardous substances by the SSFL Analytical Chemistry Laboratory. The SSFL laboratory utilizes recognized methodology in the analysis of all samples which require traceability and validation of results. The following resources were employed in the characterization of the samples which were submitted.

(1) SW-846, "Test Methods for Evaluating Solid Waste — Physical/ Chemical Methods," 2nd Edition, Revised, U.S. Environmental Protection Agency, 1985.

(2) EPA-600/4-79-020, "EPA Handbook for the Analysis of Water and Waste Water," U.S. Environmental Protection Agency Environmental Support Laboratory, Cincinnati, Ohio, 1979.

(3) "Waste Extraction Test," Section 66700 of the California Administrative Code, Title 22 Social Security — Division 4, Environmental Health.

(4) "Guidelines for Addressing Fuel Leaks," California Regional Water Quality Control Board, San Francisco Bay Region, September 1985.

(5) "Standard Methods for the Examination of Water and Wastewater," 16th Edition, 1985, American Public Health Association, American Water Works Association, and Water Pollution Control Federation, publishers.

The following analyses were requested to be performed on the samples submitted.

Parameters Measured	Methods Used
Volatile organics	(1) SW-846, Method 8240 (GC/MS)
pH	(1) SW-846, Method 9040 carried out on a 1:1 water extract
Polychlorinated biphenyls	(1) SW-846, Method 8080
Diesel fuel, biphenyl, and terphenyls	(4) Guidelines for Addressing Fuel Leaks (gas chromatography)
Oils and greases	(5) Standard Methods, Method 503.B
Total chromium	(1) SW 846, Method 7190
Total nickel	(1) SW-846, Method 7520
Total mercury	(1) SW-846, Method 7470
Total lead	(1) SW-846, Method 7420
Total cadmium	(1) SW-846, Method 7130
Total copper	(2) EPA-600/4-79-020, Method 220.1
Extractable chromium nickel mercury lead cadmium copper	(3) Waste Extraction Test

Parameters Measured		Methods Used
Extractable	cadmium copper	(3) Waste Extraction Test
Volatile organics in well water		(1) SW-846, Method 8240 (GC/MS)

c. Quality Assurance

Since the heart and substance of the site characterization lies in the validity of the analytical measurements that are made, it is pertinent to address the qualifications and quality assurance practices of the measuring laboratory.

The SSFL Analytical Chemistry Laboratory, M. D. Robertson, Manager, is approved by the State of California Department of Public Health — Laboratory Services Sanitation and Radiation Laboratory as a noncommercial water laboratory for the performance of complete chemical examinations. This approval was first issued in May 1976, and current approval expires December 31, 1987.

The SSFL Analytical Chemistry Laboratory is also certified by the State of California Department of Health Services as a Hazardous Waste Testing Laboratory to conduct analysis of hazardous waste in the test categories of:

1. Partial organic chemical analysis
2. Partial inorganic chemical analysis
3. Physical property testing, and
4. California waste extraction testing.

Certificate No. 120 was first granted to the SSFL Analytical Chemistry Laboratory on April 4, 1986, in accordance with the provisions of Article 8.5, Chapter 6.5, Division 20, of the Health and Safety Code, State of California. Current certification expires April 3, 1988.

Copies of certifications are included in Appendix B.

The SSFL Analytical Chemistry Laboratory adheres to the practices of EPA-600/4-79-019, March 1979, "EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories," issued by the U.S. EPA Environmental and Support Laboratory, Cincinnati, Ohio 45718, which requires calibration runs to be made before and after sample runs, cross checks on standards, check for recovery upon the addition of known amounts of constituents to the samples analyzed, and duplicate runs on each batch or set of ten like samples.

3. SUMMARY OF DATA AND FINDINGS

a. Sources and Quantities of Contamination

The possibility of contamination of the Landfill Area located on DOE-optioned property prompted the sinking of a well, designated RD-7, in late 1985 (see Figure 5). Well water samples from RD-7 were monitored for the presence of volatile organic compounds. These results are summarized in Table 1.

Table 1. Volatile Organic Compounds Found in Landfill RD-7 Well Water (concentrations in parts per billion)

Compound	1-23-86	7-2-86	7-3-86	8-6-86	8-6-86	12-12-86	3-9-87	3-9-87
Trichloroethylene	16	130	21	24	27	26	53	25
Toluene	13	8	<1	<1	<1	<1	<1	<1
Freon 113 (TF)	--	--	3.6	--	13	<1	<1	<1
trans 1,2-dichloroethylene	<1	3	1.2	<1	<1	<1	<1	1
Trichlorofluoromethane	--	--	<1	--	<1	<1	<1	13
Laboratory	(1)	(1)	(2)	(1)	(2)	(3)	(2)	(3)
Method	EPA 624	EPA 624	SW-846 (8240)	EPA 624	SW-846 (8240)	EPA 601	SW-846 (8240)	EPA 624

(1) McKesson
(2) SSFL
(3) Clayton

A comparison of these results with action levels for contaminants of drinking water (Table 2) indicates that, during the period from January 1986 to March 1987, the concentrations of trichloroethylene have been greater than the action level for this compound. Rocketdyne will implement remedial action to purify the ground water at the Landfill; funding has been requested from DOE.

Complete analytical reports are appended (see Appendix B).

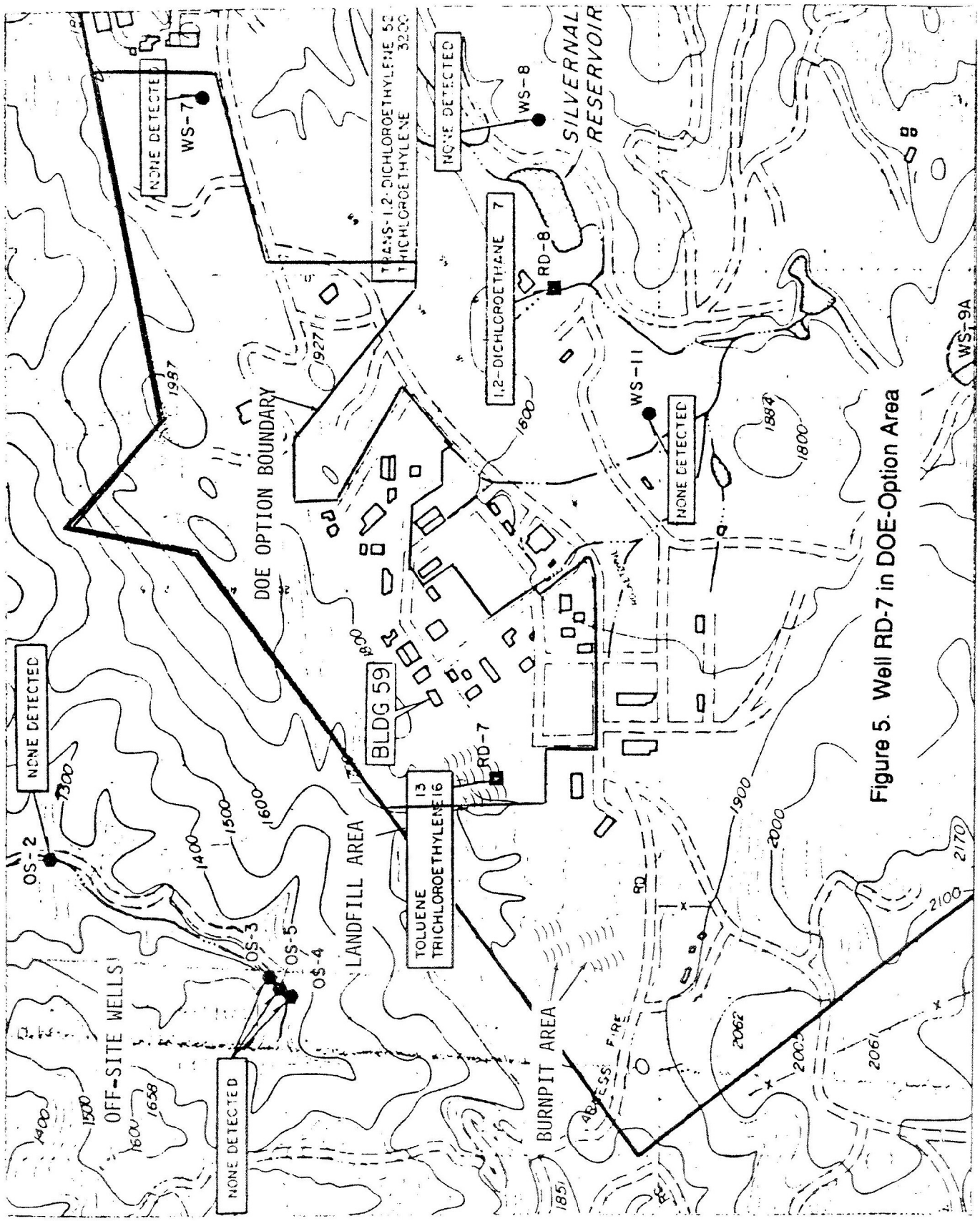


Figure 5. Well RD-7 in DOE-Option Area

Table 2. Action Levels for Contaminants of Drinking Water
Department of Health Services, State of California — Health and Welfare Agency

Trichloroethylene	5 ppb
Toluene	100 ppb
Freon 113 (TF)	18,000 ppb
1,2-dichloroethylene	16 ppb
Trichlorofluoromethane	3,400 ppb

In March and April of 1987, soil samples were taken at various locations and depths in both the Landfill and Burn Pit Areas. Although not an ETEC facility and not within the DOE-optioned boundary, the Burn Pit Area was also considered to be an area of concern. Results of the analyses of these soil samples for volatile organic compounds are summarized in Table 3. Copies of the complete analytical reports are included in Appendix B. It should be noted that the Landfill soil samples appear to be essentially free of contamination.

Soil samples were also analyzed for the presence of extractable metals and for the presence of metals released by acid digestion. These results are summarized in Table 4. The complete analytical reports are included in Appendix B.

The soil samples were also characterized for pH, the presence of oil and grease, diesel fuel, PCB's, terphenyls, biphenyl, and polychlorinated terphenyls. These results are summarized in Table 5, and the analytical chemistry reports are included in Appendix B. With the exception of minor amounts of oil and grease, the DOE-optioned Landfill Area appears to be relatively free of contamination.

Table 3. VOC Soil Sample Chemical Analysis For Selected Sample Locations and Depth from Surface (Gas Chromatograph — Mass Spectrometer)

(VOC in mg/kg — Depth from Surface)

Volatile Organic Compound	LF-6 (6.0 ft)	LFR-1 (8 in.)	LFR-2 (8 in.)	LFR-3 (8 in.)	BPW-3 (0.5 to 1.0 ft)	BPW-3 (4.5 ft)	BPW-5 (3.0 ft)	BPL-1 (0.5 to 1.0 ft)	BPL-2 (1.5 ft)	BPL-2 (3.5 to 4.0 ft)	BPL-2 (5.5 to 6.0 ft)	BPL-8 (3.0 to 3.5 ft)
Carbon tetrachloride	nd	nd	nd	nd	nd	nd	nd	nd	nd	500	nd	nd
1,1-Dichloroethane	nd	nd	nd	nd	nd	nd	nd	nd	nd	430	8.4	1.2
1,1-Dichloroethene	nd	nd	nd	nd	nd	nd	nd	nd	nd	90	nd	nd
trans 1,2-Dichloroethene	nd	nd	nd	nd	nd	nd	nd	nd	nd	22	1.8	nd
Ethyl benzene	nd	nd	nd	nd	nd	nd	nd	nd	nd	44	nd	nd
Freon-TF	nd	nd	nd	nd	nd	nd	nd	nd	6.3	3100	nd	nd
Tetrachloroethene	nd	nd	nd	nd	nd	nd	nd	nd	1.7	1200	nd	0.6
Toluene	nd	nd	nd	nd	nd	nd	nd	nd	nd	800	11	nd
1,1,1-Trichloroethane	nd	nd	nd	nd	nd	nd	36	nd	nd	1840	nd	nd
Trichloroethene	nd	nd	nd	nd	nd	nd	22	nd	nd	740	34	0.3
Trichlorofluoromethane	nd	0.9	nd	nd	nd	nd	nd	nd	nd	nd	7.8	nd

nd — none detected

Table 4. Soil Sample Analyses for Metals For Selected Sample Locations and Depth from Surface (Gas Chromatograph — Mass Spectrometer)

Metals	LF-6 (6.0 ft)	LFR-1 (8 in.)	LFR-2 (8 in.)	LFR-3 (8 in.)	BPW-3 (0.5 to 1.0 ft)	BPW-3 (4.5 ft)	BPW-5 (3.0 ft)	BPL-1 (0.5 to 1.0 ft)	BPL-2 (1.5 ft)	BPL-2 (3.5 to 4.0 ft)	BPL-2 (5.5 to 6.0 ft)	BPL-8 (3.0 to 3.5 ft)
					(Depth from Surface)							
Waste Extraction Test (WET) Title 22-66600, mg/l												
Copper (SW846-7210)	0.1	0.4	0.1	0.2	0.3	nd	0.5	0.7	0.2	nd	nd	nd
Nickel (SW846-7420)	0.05	0.1	0.05	nd	1.1	nd	0.2	nd	0.2	0.3	0.8	0.3
Chromium (SW846-7190)	nd	nd	nd	nd	1.5	nd	0.05	nd	0.2	3.1	nd	0.15
Cadmium (SW-846-7130)	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.15	nd	nd
Lead (SW846-7420)	nd	0.2	0.1	0.3	6.9	0.1	0.1	0.1	0.4	2.1	0.4	0.1
Mercury (SW846-7470)	nd	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd	nd
Acid Digestion for Metals SW-846-3050, mg/kg												
Copper (SW846-7210)	34	73	20	93	159	24	43	16	60	39	149	58
Nickel (SW846-7420)	16	nd	27	12	129	19	24	13	29	23	21	17
Chromium (SW846-7190)	8	nd	12	7	320	13	34	14	34	710	12	10
Cadmium (SW-846-7130)	1	nd	2	1	6	1	2	2	2	2	2	1
Lead (SW846-7420)	8	TR	10	13	864	10	17	18	14	153	19	13
Mercury (SW846-7470)	nd	nd	nd	nd	3.0	nd	nd	nd	0.4	nd	nd	nd

nd — none detected

Table 5. Other Soil Sample Analyses For Selected Sample Locations and Depth from Surface (Gas Chromatograph — Mass Spectrometer)

Analysis	LF-6 (6.0 ft)	LFR-1 (8 in.)	LFR-2 (8 in.)	LFR-3 (8 in.)	BPW-3 (0.5 to 1.0 ft)	BPW-3 (4.5 ft)	BPW-5 (3.0 ft)	BPL-1 (0.5 to 1.0 ft)	BPL-2 (1.5 ft)	BPL-2 (3.5 to 4.0 ft)	BPL-2 (5.5 to 6.0 ft)	BPL-8 (3.0 to 3.5 ft)
	(Depth from Surface)											
pH (SW846-9040 1:1, Extract)	7.3	7.4	8.1	7.8	10.1	9.7	8.9	9.8	7.1	9.5	10.4	9.5
Oil and grease, mg/kg (EPA 503B, modified)	500	76	42	1100	2600	105	24	492	89	3600	144	34
Diesel fuel, mg/kg (SW846-3350, modified)	nd	nd	nd	nd	202	50	nd	nd	nd	375	160	20
Polychlorinated biphenyls, mg/kg PCB's (SW840-8080 + 3550)	nd	nd	nd	nd	2.0*	12*	0.2*	2.4*	1.0*	2.6*	1.1*	nd
Terphenyls, mg/kg (Ortho, Meta, Para)	nd	nd	nd	nd	nd	TR	nd	nd	nd	nd	48	nd
Biphenyl, mg/kg (SW846-3550, modified)	nd	nd	nd	nd	nd	TR	nd	nd	nd	nd	35	nd
Polychlorinated terphenyls, mg/kg PCT's (SW846-8080 + 3550 modified)	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.4†	nd	nd

nd — none detected
*PCB 1254
†Arochlor 4465

b. Extent and Pathways for Migration

While the terrain at SSFL directs 90% of the surface water runoff south into Bell Canyon and then on to the Los Angeles River Basin, the 10% directed north through Runkle and Meier Canyons and on to the Simi Valley includes surface drainage from the Landfill and the Burn Pit discussed in this report. The general drainage pattern is shown in Figure 6, with drainage detail in Figure 7. Surface water runoff in the immediate area of the Landfill and Burn Pit is generally north toward the Simi Valley via ephemeral ravines. Routine environmental monitoring and sampling programs conducted by Rocketdyne have shown no offsite mobility of chemical or radioactive materials from SSFL. To confirm that there is no contamination, comprehensive surveys are performed periodically including selected surface drainage pathways.

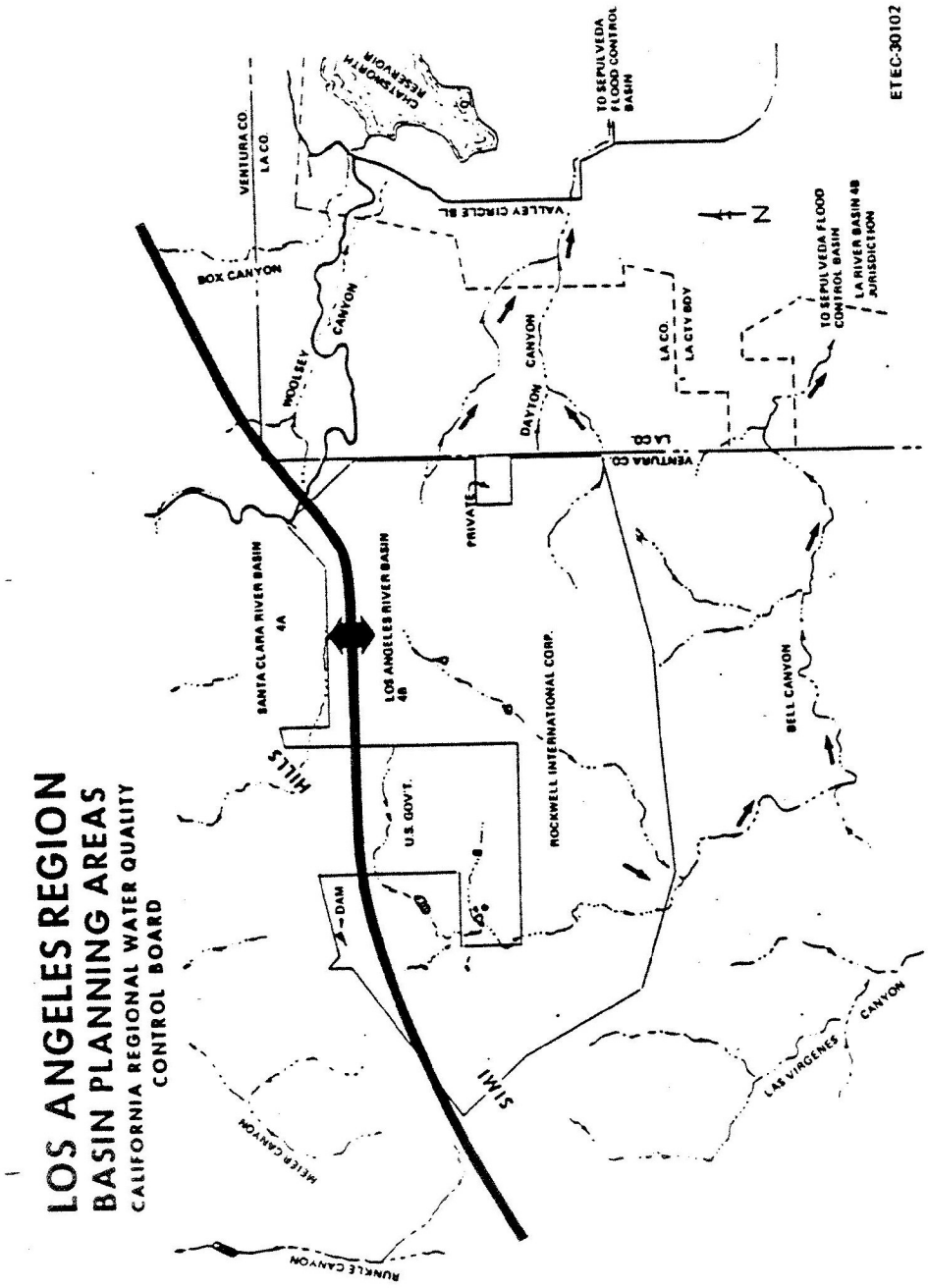


Figure 6. Surface Water — SSFL and Vicinity

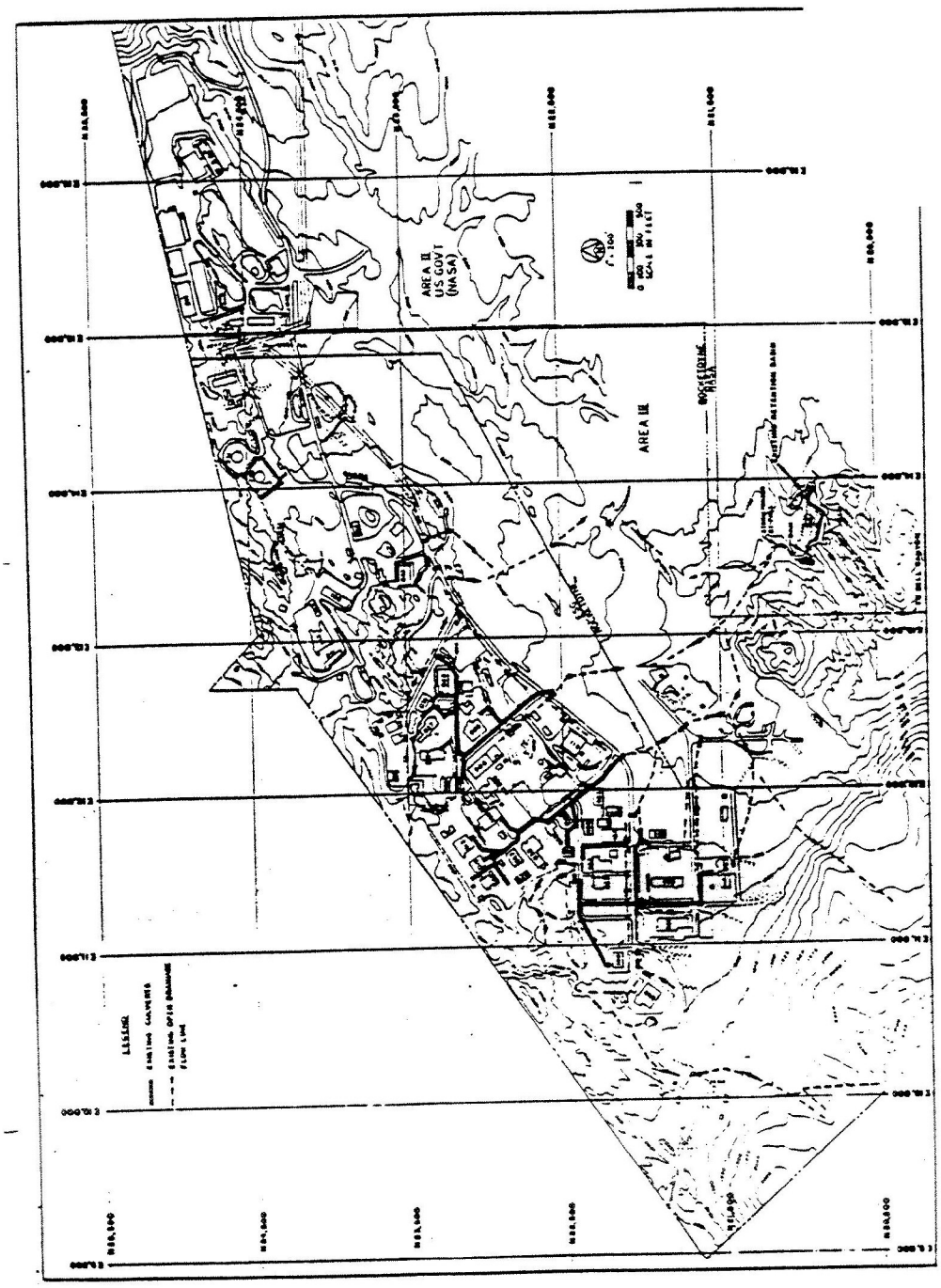


Figure 7. Storm Drainage System

4. INTERPRETATION AND ANALYSIS

a. Existing Conditions

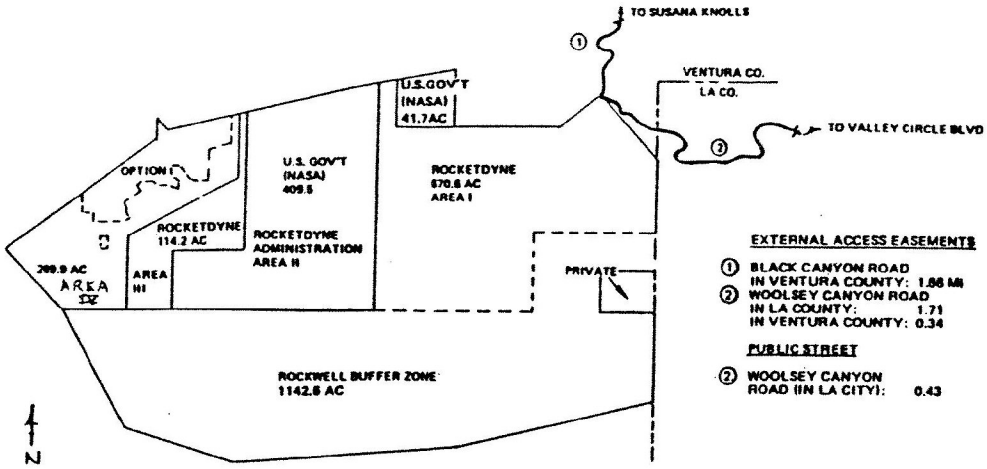
The SSFL site is located in the southeasterly region of Ventura County, State of California, being a portion of Tracts A and P of the Rancho Simi and portions of Sections 19, 20, 21, 28, 29, 30, 31, 32, and 33, Township 2 North, Range 17 West, San Bernardino Base Line and Meridian; and portions of Sections 25 and 36, T2N, R18W, SBM. Regional perspective of the location is shown by Figures 8, 9, and 10. Facilities are identified in Figure 11.

The location is approximately 7 miles west of Rocketdyne Headquarters at Canoga Park, California, and approximately 30 miles northwest of downtown Los Angeles. The SSFL is situated on an elevated plateau (~1,800 ft at Landfill and Burn Pit of Area IV) within the Simi Hills, and is isolated by distance and rugged terrain from densely populated areas. In regions surrounding SSFL, the greatest population density occurs to the east in the San Fernando Valley. According to 1980 data, the population of this region was about 1,600,000. The nearest valley communities of Chatsworth and Canoga Park have a combined population of about 175,000. Nearby Ventura County communities of Simi Valley and Thousand Oaks have populations of about 80,000 and 100,000, respectively.

The SSFL facility is located in the Simi Hills of eastern Ventura County, California. The Simi Hills are in the central portion of the Transverse Range geomorphic province and separate the Simi Valley from the western part of the San Fernando Valley. The Simi Valley is a broad synclinal depression, and the Simi Hills form the southern flank of the syncline. The Simi Hills are composed primarily of exposures of the Upper Cretaceous Chatsworth Formation. This formation is a marine turbidite sequence composed of turbidite sandstone with interbedded shales and minor conglomeratic lenses. The exposure of the Chatsworth Formation in the Simi Hills is characterized by massive, cliff-forming sandstone beds.

The Chatsworth beds dip steeply to the northwest where they are overlain by the Paleocene "Martinez" Formation, and possibly the Simi Conglomerate.

The initial porosity and permeability of the Chatsworth Formation have been affected by poor sorting, early compaction, carbonate cementation, and diagenetic alternation of framework grains and matrix material. The present porosity and permeability are secondary and result from the dissolution of detrital feldspars and carbonate cement in the rock matrix and from fracture permeability. Rocks from Chatsworth exposures in the Simi Hills generally have porosities less than 5% as measured in thin section, but some samples have secondary porosities as high as 14%. The permeability of the Chatsworth Formation is considered to be low except along fractures. From an historical



SUBDIVISIONS				
OWNER	JURISDICTION	ACRES		OPTION
ROCKWELL	ES ROCKETDYNE ROCKWELL (BUFFER)	289.9 784.8 1142.6	2217.3	90.26
GOVERNMENT	NASA (FORMER AFP 57) NASA (FORMER AFP 64)	409.5 41.7	451.2	
TOTAL ACRES			2668.5	

ETEC-30108

Figure 8. Land Ownership, Options, Access Easements

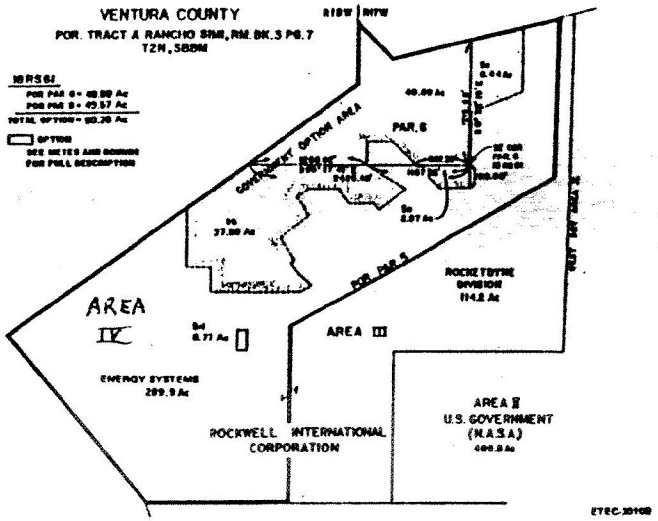


Figure 9. Area IV Property

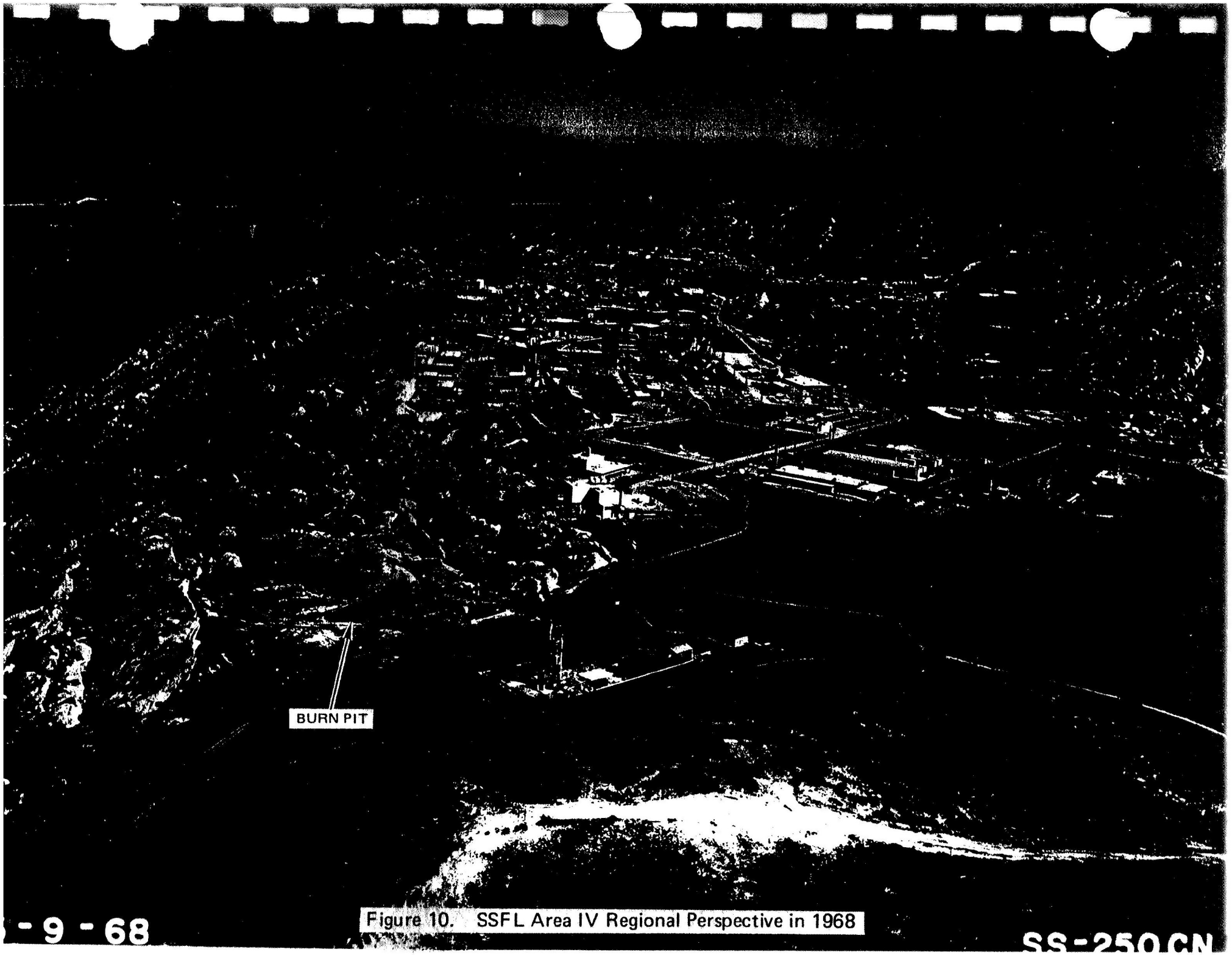


Figure 10. SSFL Area IV Regional Perspective in 1968

viewpoint, oil has been produced from correlative Upper Cretaceous sands in the Horse Meadows oil field located 7 miles northeast of the SSFL. Prior analyses of cores from drilling at the Horse Meadows field indicate porosities averaging approximately 20% and permeabilities averaging 60 to 65 md (millidarcys). While these permeabilities are very low, permeabilities could be several orders of magnitude greater if the rock is fractured.

Well developed joint patterns are evident in the Chatsworth Formation outcrops in the Simi Hills. Joints are fractures along which no movement has occurred. These joints may result from the structural activity which formed the Simi Valley syncline. There are several major faults in the area which offset Paleocene and Upper Cretaceous rock units. One of these faults, the Burro Flats Fault, trends northwest-southwest and passes through the southwestern portion of the SSFL facility. The southwestern block of this fault appears to be down-thrown relative to the northeastern block. It is not known if there has been strikeslip movement along this fault.

There appears to have been movement along a "shear zone" which trends northeast-southwest through the SSFL facility. The "shear zone" is character - ized by contorted bedding and breccia. The direction of movement along this "shear zone" is not known.

In this semiarid region, the low altitude and the influence of the ocean result in a relatively mild climate throughout the year. Precipitation is extremely variable, with an average rainfall of 17.75 in. received principally during the winter months of November through April. Mean temperature is 62°F. The mean maximum is 71°F, and the mean minimum is 53°F.

b. Future Implications

The principal geologic units in Area IV of the SSFL are the Chatsworth Forma - tion and the shallow alluvium which overlies it in some parts of the facility. In the southwestern portion of Area IV, the Burro Flats Fault offsets the upper Cretaceous Chatsworth Formation and the "Martinez Formation" of Tertiary age.

The upper Cretaceous Chatsworth Formation, formerly designated the "Chico Formation," is composed primarily of well consolidated, massively bedded sandstone with interbeds of siltstone and claystone. It may be as thick as 6,000 ft. Chatsworth Formation beds dip to the northwest at approximately 20 to 30°. Well developed fracture and joint systems may be seen in some Chatsworth Formation outcrops.

The Tertiary "Martinez Formation" is exposed to the north of Area IV and to the southwest of Burro Flats. The "Martinez Formation" is younger than the Chats - worth Formation and is composed of bedded marine sandstones and shales. No ground water wells penetrate the "Martinez Formation" at the facility.

The Chatsworth Formation is overlain in some places by a discontinuous layer of Quaternary alluvium, notably in the Burro Flats area. Where present, the alluvium is generally less than 20 ft thick. The alluvium consists of mixtures of unconsolidated sand, silt, and clay.

The hydrogeologic environment at the SSFL may be separated into two ground water systems — the Chatsworth Formation and the Shallow Zone. The Chats - worth Formation ground water system consists of the saturated portion of the Chatsworth Formation. The Shallow Zone, where present, is composed of the saturated portion of the surficial alluvium and the underlying zones of weathered sandstones and siltstone. The Shallow Zone may be "perched" in some areas.

Ground water flow in the Chatsworth Formation is probably fracture-dominated in most parts of the facility. Analyses of aquifer test data from Chatsworth Formation wells at the SSFL facility indicate that permeabilities may range from approximately 10^{-2} gpd/ft^2 (gallons per day per square foot) to approximately 10^3 gpd/ft^2.

The Chatsworth Formation is recharged in Area IV by the infiltration of precipi - tation and by infiltration from surface water drainage. The Shallow Zone may store and transmit surface water to the underlying Chatsworth Formation.

Water level contour maps indicate that the direction of ground water movement along the northwestern boundary of Area IV is to the northwest. Elsewhere in Area IV the direction of ground water movement is toward the south and south - east. The depth of water below land surface in Chatsworth Formation wells in Area IV ranges from approximately 60 ft at well RD-7 west of Building 059 to approximately 45 ft at well WS-7 northeast of Building 114. A water level hydrograph compiled from water level data collected at well WS-7 indicates that annual water level changes may be on the order of 10 to 15 ft.

c. Hazard Assessment

There is no evidence to conclude that an imminent hazard exists, but due to the presence of TCE in the RD-7 well at the Landfill and identification of contami - nated soil at the Burn Pit, a prudent course of action requires cleanup of the RD–7 water and further engineering assessments of the Burn Pit soil contamination.

As discussed above, hydrogeolgic studies at SSFL describe two groundwater systems at the site that can be considered applicable in the Landfill and Burn Pit Area IV of SSFL. One is the shallow, unconfined system in the alluvial surface mantle of the Burro Flats area and along the major ephemeral drainage channels, and the other a deeper groundwater system in the fractured Chats - worth sandstone. Alluvium along the major surface drainage systems may store and transmit groundwater to the underlying Chatsworth Formation through fractures. Water levels in the alluvium respond to recharge resulting from

surface flows and may vary considerably between wet and dry periods. The alluvium, composed of a heterogeneous mixture of gravel, sand, silt, and clay, has estimated hydraulic conductivities ranging from 0.1 to 1,000 gal/day/ft^2. Wells RD-16 and RD-18 were drilled to 30 ft in the area of the Landfill and Burn Pit, and these areas were found to be dry, indicating that the alluvial surface mantle is not saturated in this area.

On the basis that the occurrence and movement of groundwater in the Chatsworth Formation is controlled by fractures, water levels in unfractured portions of the Chatsworth Formation would differ considerably from water levels in nearby fractured zones. Water levels measured in onsite wells are not considered adequate to define fully the potentiometric surface of the Chatsworth aquifer at the SSFL. In general, water levels on site are highest in wells in the western portion of the SSFL. The direction of groundwater flow in the Chatsworth Formation could be radially offsite toward the surrounding lowlands, controlled by fracture zones and bedding planes.

The difference in permeability between unfractured and fractured portions of the aquifer may be large. This is illustrated by the range of production capabilities of the SSFL wells completed in the Chatsworth Formation. Producing wells on the SSFL site had original discharge rates ranging from 60 to 450 gpm. Of the 17 wells drilled, three were abandoned as "dry holes." The geophysical logs indicate that a large number of fractures may be encountered at depth in some wells. Large fractures which intersect the well bore probably account for most of the groundwater production. Because of the meager rainfall in the area and the relatively large variability in annual precipitation, any groundwater recharge may vary greatly from year to year. Potential deleterious pathways of possible contaminant transport are difficult to postulate on the basis of onsite well data. In the area of the Burn Pit and Landfill, offsite well sampling has not revealed any contaminants. Based upon the topography in the area of the Landfill and Burn Pit, dilution by rainfall inundation would most likely lead to contaminant levels below detection capabilities.

The amount of precipitation which enters the groundwater system depends on the volume and intensity of rainfall and antecedent moisture conditions. A precipitation station has been maintained at the SSFL facility since 1959. The mean annual precipitation as measured at the SSFL station has been 18 in., with a standard deviation of 9 in. Because of the relatively high variability in annual precipitation, groundwater recharge may vary significantly from year to year. Precipitation is not evenly distributed throughout the year. The dry season normally extends from May through October. During the dry season, it is not uncommon for there to be several successive months with no measurable precipitation. The wet season commonly extends from December through March.

Part of the annual precipitation is lost to evapotranspiration from plants and soils and to evaporation from ponded water surfaces. Runoff from precipitation events flows in canyon bottoms and channels eroded into alluvium. Canyons

on the Chatsworth Formation have been eroded along zones of rock weakness such as fractures and faults. Infiltration of runoff may occur along these ephemeral drainages (ravines) which coincide with faults or fractures.

Specific pathways of possible contaminant transport are difficult to predict on the basis of the sparse water level data from any existing onsite wells in the general location around RD-7. However, there is a hydraulic gradient from the SSFL facility toward the Simi Valley to the northwest. The most likely pathways would be along fracture zones which might trend offsite. Additional data would be needed to validate this and to characterize the direction and velocity of groundwater movement offsite.

Groundwater is pumped from the Chatsworth Formation at the SSFL facility from wells which are capable of producing a total of 390 gpm. They currently produce approximately 166 acre feet per year for sanitary, industrial, and cooling purposes.

The Chatsworth Formation may utlimately discharge to other consolidated formations such as the Simi Conglomerate to the north, or it may discharge to unconsolidated alluvial aquifers in the Simi Valley, but there is no evidence to show any contaminants moving off the SSFL site at this time.

5. RECOMMENDATIONS

a. Need for Corrective Action

As shown in Figure 8, SSFL comprises 2668.5 acres. The southern portion, consisting of 1142.6 acres, serves as an undeveloped buffer zone. Of the remaining 1525.4 acres of developed laboratory facilities, 451.2 acres is government owned (NASA), with all remaining land owned by Rockwell. Included in the Rockwell-owned land is 90.26 acres optioned to DOE. NASA, in Area II of SSFL has recognized a need for corrective action and is taking action at the present time to clean up chemical agents (notably trichloroethylene, TCE), from 8,000 large engine tests (1948 to 1961). Need for cleanup of radio - active contamination in DOE-owned facilities at SSFL has been recognized by DOE and is being currently conducted under the DOE Surplus Facilities Management Program.

The Landfill and Burn Pit areas represent the first defined need for cleanup of chemical agents resulting from prior DOE programs conducted at the SSFL.

It should be noted that ETEC and the Atomics International group of Rocketdyne for the most part operate in a 289.9-acre parcel, shown in Figures 9 and 10. Under the terms and conditions of the contract between Rockwell and the government (DE-AM03-SF00700), the government has acquired an unrecorded option to purchase the specific portion of Rockwell's property currently defined as the 90.26 acres shown in Figure 4 as the "option" area.

b. Priorities

Located entirely within Ventura County, SSFL operates under the public jurisdiction of various regulatory bodies of that county. Although not within city limits, it is designated to be within the "sphere of influence" of the City of Simi Valley. The Ventura County Planning Commission administers zoning laws and ordinances that regulate the use of buildings, structures, and land. To assure conformance, all plans and specifications are subject to review before permits are issued. California's Government Code requires the legislative body of each city and county to establish a planning agency to develop a General Plan in such a manner that all or individual "elements" may be adopted by the legislative body. Ventura County's Planning Department has developed a General Plan and makes recommendations to the Planning Commission and Board of Supervisors for putting the plan into effect.

In conformance with Ventura County's regional "open space" plan, neighboring lands to the north and west of SSFL have been zoned rural-agricultural five acres (R-A-5Ac.) or, under a 10-year contract between Ventura County and the landowner, agricultural exclusive (A-E). The area to the north and northwest of SSFL is defined by a steep gradient with the overburden covered by a variety of native Southern California vegetation.

On March 8, 1954, North American Aviation, Inc. (which became North American Rockwell and then Rockwell International), filed an application with the Ventura County Planning Commission for a Special Use Permit covering planned operations at the site. A favorable finding by the commission resulted in the issue of a Special Use Permit by Ventura County in April 1954. Public restrictions, as they relate to these operations, do not address exceptions for federal improvements on its optioned land or the subject of federal immunity from state and county laws, regulations, ordinances, rules, and codes in its sovereign capacity. Federal policy has been to abide by state and local ordinances and codes relating to environmental protection.

Many environmental, safety and health criteria apply to the planning and perfor - mance of projects at SSFL. The primary local criteria pertinent to standards and controls are found in the Rocketdyne health, safety, and environmental proce - dures manual and the Rocketdyne environmental control manual. The manual incorporates requirements from DOE Order 5480.1B, "Environmental Protection, Safety and Health Protection Program for DOE Operations"; from the California Occupational Safety and Health Act; from the Code of Federal Regulations Title 10, Part 20; from the California Administrative Code Title 17; and from the NRC Special Nuclear Materials License and State of California Radioactive Material License issued to Rockwell. In addition, the manual incorporates guidance from nationally recognized professional organizations and standard-setting groups.

Major requirements pertinent to ES&H planning and performance relate to environmental protection considerations. Of primary importance are requirements from the National Environmental Policy Act (NEPA) and those from local and state jurisdictions. Guidance and requirements applicable to compliance with the NEPA process are found in DOE Order 5440.1C, "National Environmental Policy Act."

For each proposed action, consideration will be given to the NEPA require - ments before detailed planning would proceed. The need for environmental reports, agency interactions, or for higher level environmental analysis documentation would be determined in conjunction with the DOE-SAN office.

Control of air and water pollution is required and is accomplished through a comprehensive monitoring, evaluation, and control system. The Federal Water Pollution Control Act (WPCA) requires federal agencies and facilities operated for federal agencies to comply with state and local laws. Water quality objec - tives for surface waters, groundwaters, solid waste, and solid-liquid waste, as specified by the Los Angeles Regional Board, are adhered to. Discharges from site facilities are performed in accordance with limitations established in NPDES permit CA 0001309 for SSFL operations. Air pollution emission is controlled in accordance with the rules of Ventura County Air Pollution Control District (VCAPCD) for SSFL operations.

c. Constraints

There are no technical restraints that inhibit further definition of the extent of contamination or cleanup of the soil in the Burn Pit nor cleanup of the Landfill well water at RD-7. However, disposal of contaminated soil removed from the Burn Pit may pose a problem since, at present, there are no available disposal sites for mixed radioactive and hazardous wastes.

Appendix A

Sampling Locations

Appendix A1

Trench Digging Procedure for Sodium Burn Pit and Landfill (Construction Materials Storage) Site

Trenches or holes are to be dug at two previous sites — the Construction Materials Storage Site and the Sodium Burn Pit. Soil samples will be taken, and any loose materials that are unearthed will be collected. The samples are to be analyzed and the data used in the planning of the environmental cleanup of the two areas.

A variety of materials classified as hazardous may be buried at these sites. The fill at the construction materials storage site is primarily dirt and rubble; the presence of hazardous material is suspected but not verified. The Construction Materials Storage Site may have some chemical and hazardous materials buried, such as PCB's, toluene, asbestos, or mercury, which are nonuniformly distributed. Volatile organic liquids may also be present in the soil, e.g., trichloroethylene or toluene. The Sodium Burn Pit may have any of these same materials in addition to possibly having radioactive materials and/or unreacted reactive metals. Both sites have nonhazardous materials buried at these sites as well.

To provide for situations that may be caused by these hazardous materials, a variety of health and safety equipment will be on hand, stored in a safe container. This equipment includes:

- Hard hats with face shields (polycarbonate)
- Radioactive monitoring devices
- Red-line coveralls, plastic gloves, and booties
- HEPA-filtered respirators
- Dust respirators
- Oxygen content monitors for confined space entries
- Gloves
- Barrier ropes
- Stanchions
- Safety signs
- Hudson sprayer.

Personnel involved in this operation should be aware that there have been rattlesnakes reported in the area, usually during hot weather. Another thing to watch for is poison oak. Personnel should also be aware of common potential hazards such as bee stings and bramble bushes.

Operating Procedure

A health physicist will be on call during work at the Construction Materials Storage Site and present at all times during work at the Sodium Burn Pit. A hydrologist and a representative from safety will also be present during operations at both sites. The crew consists of two mechanics, an experienced backhoe operator, and a crew chief.

1. Prior to starting work, crew personnel will suit up in green coveralls and work boots as required by the Health, Safety and Environment (HS&E) Department. Hard hats with face shields (polycarbonate) may also be necessary.

2. On the first day of work in the area, the crew chief will point out the safety hazards, place the barricades, and place the caution signs. He will instruct crew personnel to observe the safety requirements. The location of safety related and emergency equipment and operating equipment will be pointed out. The crew chief will then conduct a familiarization tour of the area, pointing out the work to be done.

3. A representative from the Environmental group or a hydrologist will have developed a grid plan for placement of the holes or trenches. The trenches are to be dug where directed for optimum soil sampling.

4. The trenches or holes are to be dug with the backhoe by an experienced backhoe operator. They will be dug to a depth specified by the hydrologist and then a soil sample will be taken for analysis.

5. If, while digging, any gas is emitted or any odor is detected by the crew, the crew is to immediately get away from the site and report the incident to both Health and Safety and Environment personnel.

6. If a hazardous situation develops due to or during the digging operations, all operations will be suspended, and the situation will be evaluated.

7. If foreign matter is unearthed but does not create a hazardous situation, the matter needs to be identified and disposed of as follows.

   a. If the matter contains an unreacted reactive metal (e.g., NaK, Na), place the matter in a sealed 55-gal drum until the metal can be reacted and the matter disposed of properly.

   b. If the matter contains radioactive materials, place the material in a 55-gal drum obtained from the Radioactive Materials Disposal Facility (RMDF). Request the material be removed and disposed of by RMDF personnel.

   c. If the matter is suspected to contain asbestos, place the matter in a drum and set aside for confirmatory analysis and disposal.

d. If the matter contains any other suspected material that may be classified as a hazardous material (e.g., lead, PCB's), place the matter in a 55-gal drum or other type of container as specified by Environmental. Request the material be picked up, analyzed, and disposed of by Environmental group personnel.

e. If the matter is not classified as hazardous, place the material in a dumpster for common disposal.

f. After taking the proper action, identify all drums or other containers and their contents.

8. If a manned entry into a hole needs to be made, the situation is to be treated as a Confined Space Entry (Hazard Class A) and is to be carried out according to HS&E procedure E-10.

Appendix A2

Sample Collection and Laboratory Protocols (Water Samples From Wells)

Collection of Water Samples

Samples from wells have been analyzed for common ions, selected trace metals, cyanide, and EPA priority volatile base/neutrals and acid extractables.

Samples were collected from all WS and RD wells except RD-8 by means of dedicated submersible pumps. RD-8 was sampled initially with a bailer. Subsequently, RD-8 has been sampled using a "Tri-Lock" hand-operated reciprocating pump. Samples were obtained after at least three to five bore hole volumes had been pumped.

Samples were bailed from shallow zone monitor wells (SH and RS series). At least three casing volumes were bailed before samples were collected. Disposable PVC bailers were used to collect samples.

The methods of sample collection for offsite wells and springs (OS series) are summarized as follows.

Sampling Site	Description	Sampling Location
OS-2	Flowing artesian well	Sampled from discharge pipe
OS-3	Flowing artesian well	Sampled from break in discharge pipe
OS-4	Flowing artesian well	Sampled at well head
OS-5	Flowing artesian well	Sampled from discharge pipe

Vertical Interval Sampling — Chatsworth Formation

Chatsworth Formation wells were sampled using a single packer arrangement in order to determine the vertical extent of volatile organic constituents. Depending on the interval to be sampled, a sampling pump was installed either on the top or bottom of the packer.

A Tigre-Tierra sliding end packer was used. In order to separate vertical intervals, the packer was inflated to 400 to 600 psi (pounds per square inch) with pressurized nitrogen. Water levels were measured above the packer using an electric sounder. Hydraulic pressure below the packer was measured using a Slope Indicator 500-psi digital pressure transducer. Three to five bore hole volumes were removed from the vertical interval before a ground water sample was collected. Samples were analyzed for TCE and *trans*-1,2-dichloroethylene by the SSFL Analytical Chemistry Unit.

Storage of Water Samples

Water samples for analysis of common ions and selected trace metals were collected and stored in 1-liter polyethylene containers. Containers were rinsed with bailed or pumped water prior to sample collection. Trace metal samples were filtered by the contract laboratory through 0.45-micron millipore filters and acidified using nitric acid.

Water samples for volatile organic analyses were collected in 40-milliliter glass vials. The vials were sealed with threaded plastic caps with Teflon septa. Each "sample" was composed of two duplicate 40-milliliter vials. The vials were sealed in such a manner that residual air was expelled. All samples were refrigerated until extracted at the laboratory.

Shipment of Samples

Water samples for analysis of common ions and trace metals were shipped to BC Laboratories, Bakersfield, California, within 3 days of sample collection in the field. Water samples for analysis of EPA priority organic compounds were shipped to Brown & Caldwell Analytical Laboratories, Pasadena, California, and McKesson Environmental Services, Pleasanton, California, within 1 to 3 days of sample collection. Water samples analyzed by the SSFL Analytical Chemistry Unit were delivered within 24 hours of sample collection. All samples for analysis of organic compounds were shipped on ice.

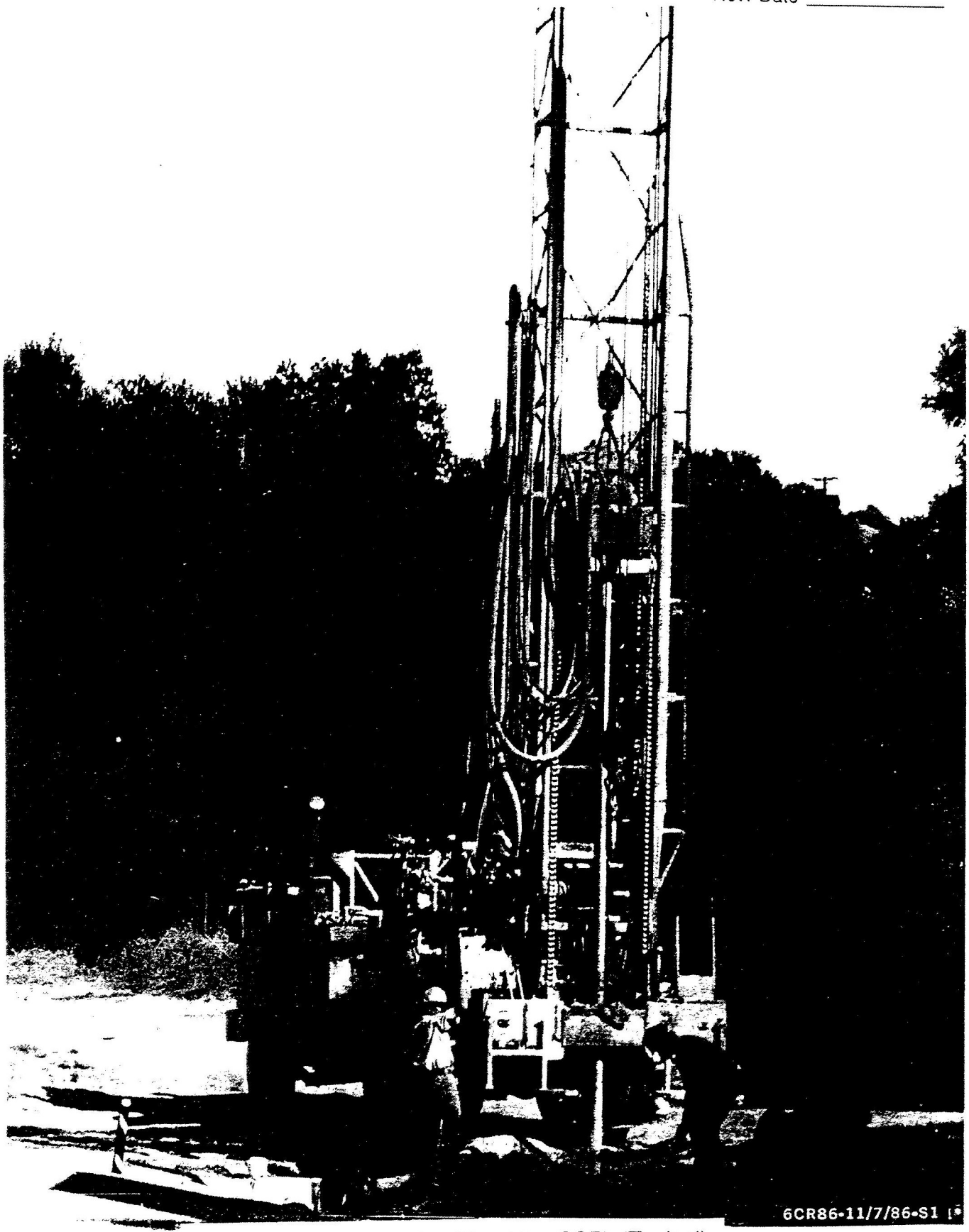


Figure A2.1. Well Drilling Rig at the SSFL (Typical)

Appendix A3

Soil Sampling — Landfill and Burn Pit

LANDFILL SAMPLING

Notes on Sampling

Samples were collected in either 4- or 16-oz glass jars. Samples for analysis of volatile organic constituents (VOC) were collected with a slide hammer in 2-in. x 6-in. brass cylinders. The ends were capped with Teflon sheets and plastic caps and sealed with clear plastic tape. Because a limited number of samples were to be analyzed for volatile organic constituents, samples were, in general, taken from zones which were judged to have the potential for containing those constituents. These judgments were based on the presence of soil mottling, staining, discoloration, or odor. In the Burn Pit cells, samples were taken from trenches because the trench was located in an area which generally was disturbed.

Trench LF-1 **03/30/87** **12:50 — 13:30**

The trench was approximately 35 ft long and 4 to 6 ft deep. The top 2 ft of soil was composed of light brown silty sand with some sandstone cobbles. There was one small zone, 1 ft thick, of dark brown silty sand. From 2 ft to total depth, the soil was medium brown silty sand. Three 4-oz samples were collected from the bottom of the trench at 15:10 (LF-11, LF-12, LF-13). No VOA sample was taken. There were no suspicious materials found. There were no odors and no positive readings from the "Miran" sniffer.

Trench LF-2 **03/30/87** **13:30 — 13:50**

The trench was approximately 25 ft long and 6 to 10 ft deep. At the west end of the trench, asphalt chunks and charred wood were found on the surface. The soil was composed of light brown silty sand with Chatsworth Formation sandstone cobbles. The soil beneath the surface appeared to be undisturbed. Three 4-oz samples were collected at 8 ft in from the stake, 10 ft deep (LF-21, LF-22, LF-23). No unusual odors were noted.

Trench LF-3 **03/30/87** **13:50 — 14:15**

The trench was 15 ft long and 10 to 12 ft deep. The soil was composed of light brown silty sand with sandstone cobbles. A 1-ft-thick zone of flaky material was observed at the surface. Four-oz glass sample LB-34 was taken 3 ft in from the stake at the surface. Three 4-oz samples were collected 6 ft in from the stake, 12 ft down, at 14:15 (LF-31, LF-32, LF-33). No unusual odors were noted.

Trench LF-4 **03/30/87** **14:15 — 14:30**

The trench was 15 ft long and 10 ft deep. The top 2 to 3 ft of material was composed of medium brown silty sand with construction debris (metal, concrete, asphalt, etc.). From 3 ft to total depth, the soil was light brown silty sand with

sandstone cobbles. Three 4-oz samples were collected 6 ft in from the stake 6 ft down, at 14:30 (LF-41, LF-42, LF-43). No unusual odors were noted.

Trench LF-5 03/30/87 — Completed 03/31/87 15:20 —

The trench was approximately 15 ft long and 12 ft deep. The top 3.5 ft of soil was composed of medium brown clayey sand with some silt. Pieces of wood and concrete were observed. From 3.5 to 5 ft, soil was dark brown mottled stiff clay with building debris (concrete, rebar, etc.) present. From 5 ft to total depth, the soil was yellowish brown clayey sand, probably weathered Chatsworth Formation. Four 4-oz samples and one ziplock bag were collected 12 ft in from the stake, 12.5 ft deep (LB-5-1, 2, 3, 4, and 5). No unusual odor was noted.

Trench LF-6 03/31/87 9:40 — 10:05

The trench was approximately 15 ft long and 9 ft deep. Soil was light brown clayey silt with no building debris. Collected one VOA sample (LF-6), 6 ft in from stake and 9 ft down. Five 4-oz samples were collected 6 ft in from the stake, 9 ft down (LF-6-1, 2, 3, 4, and 5). No unusual odor was noted. A VOA sample was taken from this location because a VOA sample was needed from the central region of the Landfill.

SAMPLES COLLECTED FROM RAVINE NORTHWEST OF LANDFILL (DENOTED LFR-)

All samples were collected for volatile organic analysis with a slide hammer ~8 in. below surface at bottom of drainage. The samples were collected in order to determine if any volatile organic constituents had leached from the Landfill into the soils of the small ephemeral drainage which runs along the northwest of the Landfill.

LFR-1

Sample was collected at 14:27 at upstream edge of Landfill, west of well RD-7.

LFR-2

Sample was collected approximately 100 ft downstream of LFR-1, adjacent to area where 55-gal drums were visible in the side of the slope. Metal trash and construction debris were present in immediate vicinity.

LFR-3

Sample was collected approximately 300 ft downstream of LFR-2. LFR-3 was at the edge of Landfill furthest downstream.